2013
Department of Agricultural Biotechnology Periodic Program Review

Submitted December 2013

Unit Self-Study Report Checklist		
	Academic Department (Educational) Unit Overview:	**Page Number or NA**
1	Provide the Department Mission, Vision, and Goals	**1**
2	Describe centrality to the institution's mission and consistency with state's goals: A program should adhere to the role and scope of the institution as set forth in its mission statement and as complemented by the institutions' strategic plan. There should be a clear connection between the program and the institutions, college's and department's missions and the state's goals where applicable.	**1-2**
3	Describe any consortial relations: The SACS accreditation process mandates that we "ensure the quality of educational programs/courses offered through consortial relationships or contractual agreements and that the institution evaluates the consortial relationship and/or agreement against the purpose of the institution." List any consortium or contractual relationships your department has with other institutions as well as the mechanism for evaluating the effectiveness of these relationships.	**N/A**
4	Articulate primary departmental/unit strategic initiatives for the past three years and the department's progress towards achieving the university and college/school initiatives (be sure to reference Unit Strategic Plan, Annual Progress Report, and most recent Implementation Plan)	**2-3**
5	Department or unit benchmarking activities: Summary of benchmarking activities including institutions benchmarked against and comparison results: • number of faculty • number of students • etc.	**N/A**
	Faculty and Graduate Students:	
6	Number of faculty and FTE breakdown by DOE, faculty list, brief bios or CVs	**3-5**
7	Overview of current research program and plans. Describe primary faculty contributions to the three-four strongest research and creative areas in the department.	**N/A**
8	Describe primary faculty contribution to teaching and service at the department level that have enhanced college and university strategic initiatives.	**5**
9	Describe attrition (cumulative number not tenured, resigned, retired, or other) of the program faculty over the past three years. Discuss the expected effect on program under review and other issues related to ability to retain qualified faculty during the past three years.	**5**
10	List current number of unfilled lines and discuss current actions or plans to fill line. Include general description of "start-up" packages.	**N/A**
11	Number of graduate students and departmental-level TAs and RAs. List the salary range for TAs and RAs and estimate the number on fellowship for the current or most recent fall semester.	**5**
12	Describe the reasons students reject fellowships or assistantship offered from the university, college, or department/unit**.**	**N/A**
13	Number of postdocs	**N/A**
14	List of grants and contracts for the period of review, including funding amounts	**N/A**
15	Faculty fellowships	**N/A**
16	Faculty honors & recognition	**6**
17	Publication list for period of review, including graduate and undergraduate publications	**6**
18	Undergraduate research activities & initiatives (if applicable)	**6**

	Documentation of Implementation of Policies & Procedures: Identify the educational policies and procedures established through faculty governance and responsible parties for implementation. Explain dissemination and transparency.	**Page Number or NA**
19	Evidence of adherence to educational policies and procedures established through the faculty governance process, including consistency in applying policies related to grading, probation, admissions, termination	**6-7**
20	Evidence of consistent review and monitoring of course substitution, course equivalency credits, course substitutions, course transfers toward degree completion, and vetting of exceptions, degree requirements	**6-7**
21	Evidence of adherence to unit procedures on faculty personnel actions (e.g., appointment, promotion and tenure) and budget request preparation	**N/A**
22	Evidence of course scheduling and teaching assignment	**6-7**
	Academic (Degree) Program Description:	
23	Program demand/unnecessary duplication: • Number of UG and G students enrolled and credit hour production • Number of UG and G degrees conferred • Explanation of how curriculum is different from existing programs at other state institutions or that access to these programs is limited • Explanation of pursuit of collaborative opportunities with similar programs at other institutions and how collaboration will increase effectiveness and efficiency	**7-9**
24	Program history and background/organizational structure: Critical events/background information which will help in understanding the program currently.	**9**
25	Program uniqueness: Unique components, distinctive innovations. Is the program a response to changes in the discipline or other academic necessities?	**9-11**
26	Describe how the program is administered (e.g., is there a program coordinator and/or program committee? What is his or her role or function? How do the administrators of the program operate?)	**11-15**
27	Describe the recruitment and development plan for the program (include attention to faculty, staff, and students).	**15-16**
28	Program delivery: Review of distance learning course offerings, services and outcomes to ensure compliance with best practices, SACS policies, and federal rules, University Senate and college curriculum committees. Describe flexibility of program delivery. Are classes available at convenient times and in convenient formats for non-traditional students, etc.	**16**
29	Program contributions to undergraduate general education or UK General Education Core	**16**
	Program Quality and Student Success: The curriculum should be structured to meet the stated objectives and student learning outcomes of the program.	
30	Student Learning Outcomes Assessment • Evidence of attainment of student learning outcomes for all program delivery, as applicable (e.g., traditional, online, distance education, etc.) • Program assessment of Student Learning Outcomes for graduate programs and undergraduate programs • Assessment results reports and findings for improvement (include evidence) • Evaluation of students' post-graduate success	**16-17**
31	External awards or other recognition of the students and/or program	**17**
32	Six-year graduation rate	**17**
33	Employer satisfaction with graduates as measured by surveys and/or alumni satisfaction	**17-18**
34	Job placement for undergraduate and graduate students or graduate school admission	**17-18**
35	Pass rates on licensure/certification	**N/A**
36	Describe processes used to ensure currency of curriculum (industry advisory boards, pass rates on licensure, standardized tests, etc.)	**18**

		Page Number or NA
37	Describe quality of orientation, advising, other student services/developmental programs, effectiveness of advising, innovations in advising and efforts to improve	**18-20**
38	Instruction: Overview of current instructional program(s) and plans; describe measures of teaching effectiveness and efforts to improve (e.g., faculty development initiatives for instruction, teacher mentor programs) • Class sizes and faculty nucleus for program instruction • Instructional equipment • Faculty credentialing to support core/elective course offering • Internship/independent studies/ co-curricular	**20**
39	Program qualifications/standards for incoming students, program admission	**20**
	Program Resources:	
40	Cost and funding of program. Please show detail. • Student credit hour per instructional faculty FTE • Budget summary information and adequacy. Include external funding.	**20-21**
41	Facilities (description and adequacy)	**21**
42	Equipment (including IT capacity) description and adequacy	**21**
43	Personnel summary and adequacy (faculty and staff numbers, demographics)	**21**
45	Support from other university units such as college, research, administration, human resources, development and alumni affairs	**21**
	Input from Affected Constituents:	
46	Evaluation data from staff, faculty, students, (e.g., surveys, focus groups, interviews, etc.) Information gathered from accreditation visit/external reviewers and progress updates since last program review (append external review comments for accredited reviews).	**22**
	Operations:	
47	Quality of faculty & staff communications and interactions, such as awards/recognitions, opportunities for input, unit meeting schedule, unit retreat schedule, opportunities for faculty and staff to interact, organizational chart	**22**
	Service, Extension and Non-Extension Programs:	
48	Summary of quantity and quality of outreach and community service; interrelationship of public service with research and other aspects of the program; nature and quality of service to the university and discipline	**N/A**
49	Summary of extension programs by topic	**N/A**
50	Summary of county-level programs	**N/A**
51	Summary of youth programs	**N/A**
52	Summary of community-based programs and training	**N/A**
53	Extension publications, videos, etc.	**N/A**
54	Evidence of public service activities such as congressional testimony, service on boards	**N/A**
55	Number of FTE extension faculty and extension specialists	**N/A**
56	Description and evaluation of outreach, service, and engagement activities	**N/A**
57	Number of clientele served, programs, and training opportunities	**N/A**

	Other Areas:	Page Number or NA
58	Quality Enhancement Plan (Multimodal Communications Across the Discipline): Please indicate program contribution to the goals of the QEP. See http://www.uky.edu/presentationu/	**22**
59	University Diversity Plan: Please indicate ways in which the program contributes to the University's Diversity Plan. See http://www.uky.edu/DiversityPlan/diversity_plan.html	**22-23**

Self Study

Agricultural Biotechnology Bachelor of Science Degree Program

College of Agriculture, Food, and Environment

Self-study (2008-2013)

Submitted by: Daniel K. Howe, ABT Steering Committee Chair

Submitted to: Dean M.S. Smith, College of Agriculture, Food, and Environment

Date submitted: December 13, 2013 (updated December 23, 2013)

Executive Summary

Self-study process:
The Agricultural Biotechnology (ABT) undergraduate degree program self-study was conducted by the ABT Steering Committee Chair (Dan Howe, Veterinary Science), the Co-Directors of Undergraduate Studies for ABT (Sharyn Perry, Plant and Soil Sciences; Michael Goodin, Plant Pathology), and the ABT Academic Coordinator (Esther Fleming). Data for the self-study was obtained primarily from 1) University of Kentucky and ABT records; 2) an online survey of ABT alumni; 3) information and comments solicited from affected constituents (e.g., Chairs, affiliated faculty members, professional school admissions faculty/personnel).

Progress since prior self-study and external review:
The previous self-study and external review of the ABT program was conducted in 2007-2008. Shortly after that external review was completed, the ABT program administration was changed with the appointment of a new Steering Committee Chair (D. Howe) and new Co-Directors of Undergraduate Studies (S. Perry and M. Goodin). Consequently, there was some disconnect between the new ABT program administrators and the external review recommendations, and a formal Program Review Implementation Plan was not drafted to respond to the recommendations. Despite the absence of an approved and executed plan, several of the recommendations have been addressed.

Recruitment of faculty with a commitment to instruction in ABT and keeping vibrant the current ABT faculty were two key recommendations from the 2008 external review. Typically, faculty members generally participate in ABT instruction (with support from the Chair of their department) on a voluntary basis. Recently, this has included Dr. Joe Chappell, who developed and is teaching ABT120, Genetics and Society. As well, Dr. Olga Tsyuko and Dr. Chuck Fox will pilot a population genetics lab and a lecture-based course on evolution in agriculture and medicine, respectively, in Spring 2014. The ABT program has also been fortunate that junior faculty in Plant and Soil Sciences (Dr. Luke Moe) and in Entomology (Dr. Xuguo "Joe" Zhou) were hired with instructional responsibilities tied to ABT. Dr. Moe teaches ABT495 each Fall and ABT460 every other Spring, and is a member of the ABT Steering Committee. Dr. Zhou teaches ABT360, Genetics, and is also a member of the ABT Steering Committee. The three courses taught by Drs. Moe and Zhou are part of the major requirements for ABT students.

Other recommendations from the external review committee concerned increasing enrollment and diversity within the ABT program, and possibly implementing an ABT Master of Science degree. Other comments from the external review panel included mitigating the impact of the difficulty of the program, allowing more flexibility in specialty support courses, and better communication of research mentor responsibilities.

The ABT program has grown in recent years, with approximately 170 students currently enrolled (Fall 2013). At this level of enrollment, several ABT courses are near capacity and further growth will necessitate additional offerings of these core courses. The consensus of the ABT Steering Committee is that increasing the program enrollment would likely impact quality, unless additional resources and faculty participation are obtained. The ABT program has been successful at recruiting a diverse student body. From 2004 to 2010, 65.5% of ABT students were female and 19.7% self-identified as members of groups other than "White, non-Hispanic."

An ABT Master's degree is an item that has been considered periodically by the ABT Steering Committee. A new member of the Steering Committee (B. Houtz) has been a major proponent of a fast-track MS degree, and he is now investigating the feasibility of offering this via the University Scholar's Program.

Curricular changes that address external review concerns about degree difficulty include reduction in the total credit hours required for the degree (to 128 from 132) and increased latitude in the courses accepted for the Specialty Support category. From the perspective of the ABT Steering Committee, these changes have not reduced the rigor of the ABT curriculum.

Challenges and Recommendations:

This ABT self-study process has revealed several challenges that are tied primarily to the ever-present concern about availability of resources to support the program. This concern is especially relevant and timely given the University of Kentucky's current process to implement a new value-based budget model. Specifically, it is a concern that a relatively small and interdepartmental degree program such as ABT might be negatively affected by this new financial model for allocating funds. Despite this principal concern, we are encouraged by the past support that has been provided to ABT by affiliated Faculty, Departments, and the College, and we believe that any negative impacts from the new budget model can be alleviated by attentive and active coordination with the CAFE Administration.

<u>The following recommendations and actions address the current and impending challenges facing the ABT program and will help the program prosper moving forward:</u>

1) Voluntary faculty participation has been a central characteristic of the ABT program. However, the University's new budget model may strain the willingness and ability of Departments and faculty members to continue their involvement in ABT, particularly in the area of classroom instruction. Funds allocated in the new financial system will be controlled at the level of the College. Therefore, we recommend that the CAFE Administration establish tangible incentives to Departments that have faculty members serving as instructors for ABT courses.

2) The ABT program has benefited from the financial support provided by the College. However, there are several areas in which program requirements currently surpass, or may soon surpass, the available resources. The following recommendations address two keys issues:

i) **Establish a recurring 0.5 Teaching Assistantship to support ABT 495** - ABT 495 is a lab-intensive course that requires significant time and effort from the instructor, Dr. Luke Moe. Assistance with teaching the course has been provided previously by graduate students funded as Research Assistants by Dr. Moe. Graduate students who volunteered as TAs received a $1000 stipend supplement that was provided by the Department of Plant and Soil Sciences. Currently, the course is offered in the Fall only, with a maximum enrollment of 21 students. This does not accommodate all of the students in the ABT program, so BIO 510 is the alternative for students not able to enroll in ABT 495. Dr. Moe recognizes the need for offering a Spring semester section of ABT 495, thus accommodating most, if not all, students in the program. However, adding a Spring offering of this course would require significant extra time and effort, so a 50% TA line committed to ABT 495 would greatly facilitate this initiative by Dr. Moe.

ii) **If needed, increase the Academic Coordinator position beyond the current 50% appointment** - Currently, Esther Fleming is supported 50% by the College to serve as the Academic Coordinator for ABT. Ms. Fleming also holds a 50% appointment as a Research Analyst in the lab of Dr. Bruce Webb, the previous Director of ABT. As described in detail in the ABT Program Description section, the Academic Coordinator has numerous responsibilities and duties that have gradually accumulated since the position was formed in 2006. Although a discussion between the relevant individuals is needed before any action is proposed, it is conceivable that the Academic Coordinator position will need to be expanded beyond a 50% appointment. This would put the ABT Academic Coordinator position more in line with other interdepartmental program Academic Coordinators who hold 100% appointments.

3) It has become apparent that we need to increase awareness of the ABT degree program. Students who have transferred to ABT have stated that they had been initially unaware of the program and how it can help them achieve their career goals. Therefore, it is our intent to enhance our recruitment efforts to better inform prospective students about the ABT program. Increased enrollment is a likely consequence of these efforts, and program growth in the absence of additional support will certainly erode the quality of the training experience. Consequently, we encourage the CAFE administration to establish mechanisms to assure that added resources will be available to support growth of the ABT program (see items #1 and #2 above).

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54	Evidence of public service activities such as congressional testimony, service on boards	**N/A**
55	Number of FTE extension faculty and extension specialists	**N/A**
56	Description and evaluation of outreach, service, and engagement activities	**N/A**
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	indicate program contribution to the goals of the QEP. See http://www.uky.edu/presentationu/	
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Agricultural Biotechnology Program Overview:

Program Mission

Agricultural Biotechnology (ABT) is an interdepartmental undergraduate degree program established in 1995. The primary mission of the ABT program is to recruit and train students in modern methods and principles of biotechnology research including cellular and molecular biology, genetic engineering, and protein science, and to graduate students who will contribute to the economic development of Kentucky through enhancement of a knowledge-based research and technology-driven economy. Students are provided a firm foundation in the principles of genetics and molecular biology of both prokaryotic and eukaryotic organisms. Each student then specializes in an area appropriate to his or her interests and career objectives. Opportunities for specialization span across the Colleges at the University of Kentucky and include agricultural and biomedical technology pertaining to microbes, plants, invertebrates, and vertebrates. Central to the ABT curriculum is a research or internship experience that is developed (ABT 301) and conducted (ABT 395 or 399) by the student under the supervision of a faculty mentor. Students completing the ABT Bachelor of Science degree program will be prepared to assume government, university, and industry positions with research and technology applications to agriculture and food production. Graduates will also be well prepared to continue their training towards advanced degrees in graduate or professional school.

The basic tenets on which the ABT program was founded are described in the Program Manifesto (Appendix A), which is a living document that provides guidelines for faculty and students involved in the program.

Connection with the mission and goals of the University of Kentucky

The mission of the ABT program is tied directly to the first of the five goals outlined in the University of Kentucky's 2009-2014 Strategic Plan; **Goal 1: Prepare Students for Leading Roles in an Innovation-driven Economy and Global Society.** The ABT program accomplishes its primary mission by addressing the following Goals/Learning Outcomes:

1. Agricultural Biotechnology graduates will acquire knowledge about the range of approaches to manipulate and improve plants, animals and microorganisms.

2. Agricultural Biotechnology graduates will demonstrate the ability to interpret, evaluate and communicate their assessment of modern biotechnology approaches for the purposes cited in Learning Outcome 1.

3. Agricultural Biotechnology graduates will evaluate how their experience in the Agricultural Biotechnology program has influenced their outlook on the relationship between society and biotechnology, and how their personal philosophies and values have been influenced as a consequence of the program.

4. Agricultural Biotechnology students will participate in research projects including the requirements of the independent study course ABT 395, or experiential learning course ABT 399. Presentation (oral and written) is an integral part of their research program and they will demonstrate their ability to communicate about science through these presentations. ABT students will have the opportunity to become authors and co-authors on suitable outlets for communication of their research results including abstracts presented at professional meetings, and where possible peer-reviewed scientific research publications.

Program initiatives and progress on implementing recommendations from last review
Several of the ABT program's initiatives over the past three years have been in response to alteration of the University of Kentucky's general education curriculum and changes to the Biology degree program curriculum.

Beginning in Fall 2011, the University of Kentucky's general education requirements changed from the University Studies Program (USP) to the UK Core. The UK Core curriculum is based on four comprehensive learning outcomes that are addressed by 30 credit-hours of coursework in 10 course categories. This change necessitated evaluation of ABT coursework and revision of the program curriculum to mesh with the new UK Core requirements. Despite the reduction in credit hours required by UK Core relative to the old USP requirements, the change resulted in a loss of 2 credits of free electives for ABT students due to fewer pre-major courses matching UK core categories.

In 2011, the University of Kentucky's Department of Biology altered their curriculum for the Biology undergraduate degree by phasing out the traditional Introductory Biology labs (BIO 151 and BIO 153) and adding lab sessions to the upper-level Biology courses. In place of the introductory labs, a 1-credit computer-based "lab" was offered by Biology. In addition to being requirements in the ABT curriculum, the BIO 151/153 courses were considered important since they provided students with an early laboratory experience. Moreover, the loss of these two labs was a concern for ABT pre-professional students since some schools require introductory biology labs as prerequisites for admission to their professional degree programs. In response to these changes in Biology, the ABT course requirements were modified to accept the BIO 155 computer-based lab. As well, a new course developed by Dr. Joe Chappell, ABT 120, Genetics and Society, was added to the ABT core curriculum to provide an early lab experience for the students and to help the pre-professional students satisfy admission prerequisites.

As related in the Executive Summary, the ABT program administration was changed shortly after the prior external review was conducted (2008). An unintended result of this change was that a formal Program Review Implementation Plan was not drafted to respond to the external review recommendations. Despite the absence of an approved and executed plan, several of the recommendations have been addressed.

The main recommendations from the 2008 external review were to recruit faculty members with a commitment to instruction in ABT and to keep vibrant the current ABT faculty. Other recommendations concerned expanding the program, increasing diversity within the program, and possibly implementing an ABT Master of Science degree. Other comments included mitigating the impact of the difficulty of the program, allowing more flexibility in specialty support courses, and better communication of research mentor responsibilities.

Typically, faculty members self-nominate to participate in ABT instruction (with support from the Chair of their department). Recently, this has included Dr. Joe Chappell, who developed and is teaching ABT120, Genetics and Society. As well, Dr. Olga Tsyuko and Dr. Chuck Fox will pilot a population genetics lab and a lecture-based course on evolution in agriculture and medicine, respectively, in Spring 2014. The ABT program has also been fortunate that junior faculty in Plant and Soil Sciences (Dr. Luke Moe) and in Entomology (Dr. Xuguo "Joe" Zhou) were hired with their instructional responsibilities tied to ABT. Dr. Moe teaches ABT495 each Fall and ABT460 every other Spring. Dr. Zhou teaches ABT360, Genetics. These three courses are part of the major requirements for ABT students.

The ABT program has grown substantially in recent years, with approximately 170 students currently enrolled (Fall 2013). At the current enrollment, several ABT courses are near capacity, and one course (ABT 495) is not able to accommodate all students in the program. Therefore, further growth will necessitate additional offerings of these core courses. The ABT Steering Committee believes that efforts to increase the program enrollment would likely erode the quality of the program unless additional resources are procured. Even with added resources, there is some concern about increased enrollment in the program given that the majority of ABT-associated faculty members participate in the program voluntarily. Therefore, there are currently no plans to actively seek expansion of the ABT program, unless it is via offering a Master's degree in ABT. An ABT Master's degree is an item for ongoing consideration. A new member of the ABT Steering Committee (B. Houtz) has been a major proponent of a fast-track MS degree, and he is now investigating the feasibility of offering this via the University Scholar's Program.

Additional curricular changes that address external review recommendations include reduction to 128 in the total credit hours required for the degree (from 132) and increased latitude in the courses accepted for the Specialty Support category.

ABT-associated Faculty

The ABT degree program is an interdepartmental program housed in CAFE, but benefits from faculty participation from across the University of Kentucky campus. There are 26 University of Kentucky faculty members representing nine Departments in three Colleges who participate directly in ABT as Steering Committee members, core course instructors, and/or academic

advisors (Table 1; Appendix A). With the exception of two junior faculty members who have teaching obligations to ABT (Moe, Plant and Soil Sciences; Zhou, Entomology), faculty participation in the ABT program is voluntary and done largely out of personal commitment to the program's mission of training students in Agricultural and Biomedical sciences. Biosketches/curricula vitae for key ABT faculty members are provided in Appendix B.

Table 1. Agricultural Biotechnology-associated faculty members

ABT Steering Committee	Roles	Home Department
Daniel K. Howe	Steering Committee Chair, ABT 301 instructor, Advisor	Veterinary Science, CAFE
Sharyn Perry	Co-Director of Undergraduate Studies, ABT 201 instructor, Advisor	Plant and Soil Sciences, CAFE
Michael Goodin	Co-Director of Undergraduate Studies, ABT 101 instructor, Advisor	Plant Pathology, CAFE
James Harwood	Steering Committee, ABT 301 instructor, Advisor	Entomology, CAFE
Luke Moe	Steering Committee, ABT 495 and ABT 460 instructor, Advisor	Plant and Soil Sciences, CAFE
Craig Vander Kooi	Steering Committee	Molecular and Cellular Biochemistry, College of Medicine
Robert Houtz	Steering Committee, Advisor	Horticulture, CAFE
Xuguo "Joe" Zhou	Steering Committee, ABT 360 instructor, Advisor	Entomology, CAFE
Joe Chappell	ABT 120 instructor, Advisor	Pharmaceutical Sciences, College of Pharmacy
Ling Yuan	ABT 301 instructor, Advisor	Plant and Soil Sciences, CAFE
Bruce Webb	ABT 395/399 instructor, Advisor	Entomology, CAFE
Reddy Palli	ABT 460 instructor, Advisor	Entomology, CAFE
David Wagner	ABT 461 instructor	Forestry, CAFE
Ernie Bailey	Advisor	Veterinary Science, CAFE
Seth DeBolt	Advisor	Horticulture, CAFE
Stephen Dobson	Advisor	Entomology, CAFE
Bruce Downie	Advisor	Horticulture, CAFE
Rebecca Dutch	Advisor	Molecular and Cellular Biochemistry, College of Medicine
Mark Farman	Advisor	Plant Pathology, CAFE
Charles Fox	Advisor	Entomology, CAFE
David Horohov	Advisor	Veterinary Science, CAFE
Aardra Kachroo	Advisor	Plant Pathology, CAFE
James Matthews	Advisor	Animal and Food Sciences, CAFE
Chris Schardl	Advisor	Plant Pathology, CAFE
Lisa Vaillancourt	Advisor	Plant Pathology, CAFE
Mark Williams	Advisor	Horticulture, CAFE

A much larger and diverse group of faculty members affiliated with multiple departments in CAFE and the Colleges of Medicine, Dentistry, Pharmacy, and Arts and Sciences have served as research mentors for the required student research projects (ABT 395). Although not comprehensive, an extensive list of previous research mentors is provided in Appendix C. Similar to faculty members who serve as instructors and academic advisors, research mentors who supervise ABT students participate on a voluntary basis.

In general, the ABT core courses were designed to serve students pursuing the Ag Biotechnology degree. The ABT 461 Population Genetics course taught by Dr. Dave Wagner (Forestry) is cross-listed as ENT 461 and FOR 461, so this course serves a broader spectrum of UK students. The new ABT core course, ABT 120 Genetics and Society, was designed by Dr. Joe Chappell with the intention that it would satisfy the UK Core Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences requirement (course area IV). While ABT students already complete this UK Core requirement with General Chemistry (CHE 105), students in other majors across the UK campus have ABT 120 as an option to satisfy this intellectual inquiry course requirement.

Since most ABT-associated faculty members are not obligated to teach in the program, there is a persistent concern about loss of faculty participation due to retirement, relocation, realignment of priorities, and/or loss of interest. Since the last external review, the prior ABT program Director, Dr. Bruce Webb, stepped down from an administrative role. However, Dr. Webb remains very actively involved in ABT, serving as an instructor (ABT 360, ABT 395/399), academic advisor, and research mentor. Dr. Chris Schardl vacated his role as an instructor for ABT 460 due to appointment as the Chair of Plant Pathology. Dr. Schardl continues to serve as an academic advisor to students in the ABT program. Dr. Joe Chappell, who developed ABT 120 and has served as an academic advisor and research mentor since the ABT program's inception, was recently appointed as Chair of Pharmaceutical Sciences in the College of Pharmacy (May 2013). Although Dr. Chappell has stated an interest in remaining affiliated with ABT, which we welcome, it seems possible that he will soon need to request a replacement instructor for ABT 120. If (when?) this occurs, we believe that the gap can be filled with existing ABT-associate faculty; for example, Dr. Joe Zhou (Entomology) has indicated that he would like to increase his involvement in course instruction for ABT. Nevertheless, maintaining and/or increasing faculty involvement in the program will remain a challenge, especially if enrollment in the ABT program continues to grow.

As an undergraduate degree program, there are no graduate students in ABT. In 2012, the Dean of CAFE applied a recurring 50% stipend ($9000) to support a graduate teaching assistant for ABT 120 (secondarily for ABT 495 if unutilized). In the past, graduate students have assisted with ABT courses (e.g., ABT 301, ABT 495) on an unpaid, voluntary basis.

Four faculty members affiliated with the ABT program have been recognized for their contributions to student training and mentorship. Dr. Luke Moe was named the 2013 University of Kentucky Office Work-Life Supervisor of the Year. Dr. Bruce Webb received the 2011 Provost's Distinguished Service Professor Award. Dr. Luke Bradley was a 2011 Honorable Mention for the Outstanding Undergraduate Research Faculty Mentor, while Dr. Bruce Downie received this recognition in 2010.

An undergraduate research experience (ABT 395) or an internship (ABT 399) is an integral component of the ABT curriculum. A majority of ABT students satisfy this requirement by conducting an ABT 395 research project under the supervision of a University of Kentucky faculty research mentor. A small proportion of ABT students satisfy the requirement via an ABT 399 internship; past internship sites include Alltech, Paratechs Corporation, DuPont Pioneer, and Disney World. The grade for ABT 395/399 is based on a written report and a public presentation of the research findings or internship experience. Importantly, the ABT 395/399 experience provides opportunities for ABT students to co-author peer-reviewed publications and to present their findings at assorted scientific conferences (Appendix D). Based on information provided to us by students or research mentors, ABT students have co-authored 15 peer-reviewed publications since 2007 (one additional manuscript in preparation). Two ABT students had articles published in Kaleidoscope: University of Kentucky Journal of Undergraduate Research. Thirty oral or poster presentations were given by ABT students at scientific conferences, with nine students presenting their research at Posters at the Capital, an annual event that educates Kentucky State Legislators of the importance of undergraduate research.

Implementation of Policies and Procedures

The ABT program follows the CAFE policies and procedures for approving curriculum changes, student advising and orientation, course equivalencies, and course substitutions.

Approval of curriculum changes, for both courses and of programs, is a faculty-driven process. Proposals for course changes and new courses are initiated by an ABT faculty member. Proposals for program changes are submitted by the Chair of the ABT Steering Committee after consultation and approval by the committee. Proposals are reviewed by a CAFE Undergraduate Curriculum Committee (UCC). Courses at the 400G or 500 levels are reviewed by both the UCC and a College Graduate Curriculum Committee.

Academic advising is done by ABT-associated faculty members, with coordination by one Co-DUS (S. Perry) and the Academic Coordinator for ABT (E. Fleming). Prior to the start of a major advising window (summer, fall, spring) the College coordinates an advising meeting for all active College advisors to address any changes since the last advising round, as well as to address any areas of particular concern. For summer advising, each advisor receives a binder with color-coded pages containing advising information. During the two primary advising windows in the fall and spring, students sign up for appointments with their ABT advisors to

discuss class schedules, program progress, and professional plans. As needed, the ABT Co-DUSs and the Academic Coordinator provide guidance to the ABT academic advisors.

Course equivalencies are typically automated through decisions that have been carefully evaluated by content experts in the past. As a result, when a new student enters the University, most transfer credits are automatically recognized to be equivalent to particular courses at the University of Kentucky. In cases where a course does not equate to an existing course, or in which a student believes that a course which he/she has taken previously should count for a given UK course, it is the student's responsibility to procure a copy of the course syllabus and any other pertinent materials and provide them for evaluation by the College.

Course substitutions are handled similarly. Circumstances under which course substitutions are permitted are limited and specific. For example, if a course is taught only once per year and conflicts with another course that a student needs to graduate, it would be normal procedure for the student to have a substitution request honored. Course substitution requests require submission of a form by the student's advisor, signed by both the student and the advisor, indicating what course would be substituted for which other course, and providing the rationale for the substitution. Appropriate substitutions would include: course of similar or greater depth, course of same or higher rigor, course more closely related to a student's specialty support interests. Likely reasons for rejection would include a course substitution lacking a rationale, lacking an advisor's signature, or asking for a lower-level course to substitute for a higher-level and/or more rigorous course.

Degree audits are accomplished by degree audit personnel and via the online software program APEX. APEX software allows students and academic advisors to check current coursework status. The Director of the Advising Resource Center (S. Skees) also conducts detailed degree audits to confirm that students are on track to complete degree requirements.

The ABT core courses (ABT 101, 120, 201, 301, 360, 460, 461, and 495) are taught at regular intervals and typically by the same instructor each year/semester. The exceptions are ABT 301 (Howe and Yuan during fall; Harwood during spring) and ABT 460 (Moe and Palli in alternating years).

ABT Program Description

Program demand

Over this review period, ABT has averaged 159 students enrolled (numbers are from the Office of Institutional Effectiveness webpage: http://www.uky.edu/IRPE/colleges/agriculture.html) with a range of 131 to 174. Presently, 174 students are enrolled in the ABT program. Over the past 5 years, an average of 27 degrees per year have been awarded (range is 15 to 32 degrees per year). Student credit hours per year for ABT prefixed courses averaged 517 per year over the past five years for which data is available.

The ABT program has an excellent reputation at UK both within the College and across campus. There are several identifiable reasons for this success. First, many of the program faculty are genuinely committed to the excellence of the program and provide outstanding instruction and in-depth academic and career counseling. Second, the program attracts exceptional students who are highly motivated and fosters productive networking among students and faculty that enhances their performance. Third, the program has at least 3 clear and integral elements that differentiate it from other undergraduate programs. 1) A sequence of courses emphasizes the applicability and significance of the degree and the field. This 'experiential track' includes ABT 101, 120, 201, 301, 395/399 and 495. The experiential track provides continuing rationale for the program and each course builds upon prior experiences in the track. 2) Biotechnology is a diverse and rapidly changing field and our students have diverse interests and career goals. However, ABT has a programmatic emphasis on genetics as the common thread linking all biotechnological fields, thus providing a thematic coherence to the degree and ready explanation for its rigor. Courses in the 'genetics track' include ABT120 (Genetics and Society), ABT 360/BIO 304 (Genetics), 460 (Molecular Genetics), ABT 461 (Population Genetics), ABT 495 (Experimental Methods in Biotechnology), BIO 148/152/155 (Introductory biology series), BIO 308/209 (Microbiology lecture and lab) and BCH 401G (Biochemistry). Advisors in the program also encourage students to take courses in cell biology (e.g. BIO 315) and physiology (e.g. BIO 350) that strengthen aspects of their training in genetics. 3) The program provides for significant flexibility within the curriculum that allows students to pursue and develop their independent interests in support of their career goals. These 'specialty support' courses provide 21 credit hours that give students significant freedom to concentrate on their respective areas of interest or explore the diversity of the field.

At least two other elements are important in the success of the ABT degree, neither of which is readily quantifiable. In keeping with the College of Agriculture's emphasis on building an inclusive community that feels like a family, the ABT program provides students with an unusual level of access to faculty. This leads to better interaction between students and faculty and improved academic and professional advising and career counseling, which are undoubtedly important factors in the success of the program. Finally, and perhaps most importantly, the undergraduate research experience is a central and defining element of the program. Several required courses in the degree, ABT 101, 201 and 301, are clearly directed towards preparing students for their experiential research course (ABT 395/399). The ABT faculty also encourages students to do far more than meet the minimum requirements for this experiential course. It is common for students to work multiple years on their project and become valued members of their research mentor's laboratories. This encouragement leads directly to superior student performance in research fellowships, publications, and continued education in professional and graduate schools. The overwhelming success of the independent research projects, and the substantial positive feed-back from research mentors, strongly supports the emphasis that has been placed on this component of the Agricultural Biotechnology degree program. The success of these projects and the commitment of the individual students suggest that an opportunity for

the uninterrupted continuation of these research projects will serve the interest of our students and also allow for additional and more significant involvement by research mentors.

Currently, Dr. Robert Houtz (member of the ABT Steering Committee) has been spearheading discussion with faculty in the Medical School to develop a University Scholars option for ABT students that would give them a Masters in Medical Science as well as their ABT B.S. degree. This would be a mechanism for some students to build upon the success of their research component of the ABT degree. Moreover, such an opportunity would fit well with the generally high standards and performance that are already associated with the ABT program.

Program history

The Agricultural Biotechnology is an interdisciplinary degree program originally operated as an individualized degree option under a B.S. degree in Agriculture from 1989 to 1994. With significant efforts and planning by Drs. Joseph Chappell and Glenn Collins, a formulated plan to institute a new degree program in Agricultural Biotechnology was put forth to the Council on Higher Education early in 1994. In 1995 approval was received for the B.S. degree in Agricultural Biotechnology. From this original proposal a concise manifesto was developed (Appendix A) that summarizes the original goals and objectives for this program and outlines its structure and workings. Through periodic updates, this manifesto continues to define the rationale for the program and its principal elements. Without exception, the goals and objectives identified in the proposal for this degree program have been met, and indeed substantially exceeded by the current status of this undergraduate program. The initial program had 9 courses developed to support this program (ABT 101, 201, 360, 395, 399, 401, 460, 461, and 495) each with one section. ABT 360 was not offered for several years with our students enrolling in BIO304 instead and College of Agriculture faculty being involved in teaching in BIO304 in Fall semesters. However ABT360 is now being offered again and currently the program retains all of the original classes, with ABT401 now being ABT301 (3 sections). A new course, ABT120, that is also a UK General Education Core course has recently been added to the curriculum (Fall 2012) becoming a required course for ABT freshmen in Fall 2013.

Program uniqueness

As briefly outlined above, the ABT program attempts to provide an atmosphere that feels like family to our students and as part of this we work hard to mentor and engage our students. One facet is helping entering freshmen make the transition to the University. Another, interconnected part is helping them develop their independent study project. A third part involves the flexibility in the specialty support courses to allow best preparation for their individual career goals.

Transition to the University – ABT 101 provides an academic orientation as well as introducing a variety of possible careers for which ABT will prepare students. Co-director Dr. Michael Goodin and Academic Coordinator Esther Fleming teach this course, which also involves many guest speakers. Thus, the first semester students have contacts they met during summer advising that they continue to see each week in class and to whom they can address questions or concerns

as they acclimate to University life. ABT 101 also provides a mechanism for students to meet others in their cohorts, providing further support as they transition to the University. In the past, upperclassmen have met with ABT 101 students immediately following class to provide tutoring with CHE 105, a course that is challenging for many students. Early in the semester, other faculty who teach and advise in ABT attend a "meet and greet" during ABT 101. Attendance by the faculty has been very good and generally instructors for nearly all of the ABT courses always attend, as well as other faculty on the Steering Committee and who serve as permanent advisors. This meet and greet is immediately followed by a meeting of the Biotech Club to make the new students aware of this opportunity. Often, there is a cookout in the Fall semester, and the ABT 101 students in particular are encouraged to attend to meet upperclassmen and faculty. Other activities have included movie nights (at the Agricultural Living Learning Community) as well as trips (to the Primate Rescue Center). There is an ABT Club Facebook page maintained by Dr. Goodin where these and other activities are advertised.

ABT101 is purposefully designed to demonstrate connectedness between seemingly unrelated aspects of science and society. More importantly, students are challenged to confront how technological innovations lead to societal perturbations and transformations. The class environment is strongly supportive and encouraging of students' opinions, which in many cases is expressed for the first time. The class develops analytical thinking and provides a meaningful opportunity to reveal deficiencies in college preparation that were not provided in high school. With this knowledge students are in a better position to be directed to the plethora of remedial, support and peer-tutoring resources available on the UK Campus. In summary, ABT101 provides students with a supportive atmosphere where they are afforded the intellectual freedom required to develop out-of-the-box thinking needed to drive innovation in their future chosen careers. A typical response to the ABT 101 experience is provided here, "thank you for challenging my thoughts and beliefs. It honestly made me a better person. I see the world with different eyes and many things said in class will always stay with me. It has honestly impacted me in so many ways that I never before imagined."

The addition of the new ABT core requirement ABT 120, Genetics and Society that most ABT Freshmen take in their second semester allows the cohort to continue to interact in Spring of their first year. Additionally ABT 120 provides a lab experience that was lost when Biology stopped running the traditional "wet" labs BIO 151 and 153. This introductory lab experience is particularly important for certain professional programs (e.g. veterinary school).

Most students will then take ABT 201 in the Fall of their Sophomore year, and can continue to interact in this course. ABT 201 is a one credit seminar based course that introduces students to research programs on and off campus to help them find a research area or lab of interest for their independent research project. Invited speakers also talk about their career paths and some interesting discussions have included comparison of careers in industry versus academia and what it means to be an MD/PhD. ABT 201 has also had presenters share other opportunities with the students such as leadership programs, internship opportunities, and how to apply for

prestigious external scholarships to support the student's research efforts. The ABT 201 students are encouraged to attend the ABT 395/399 presentations to help them see what results from the independent study projects.

Development of the ABT 395/399 project - Development of an independent research project can be daunting for students so support is provided throughout the program. Students learn about research areas in ABT 101 and this continues in ABT 201. They must identify a lab in which they will perform their research project prior to taking ABT 301 where they will write a research proposal. The ABT webpage, the student's faculty advisor, and the program administration are all resources to help students find lab homes if they are having difficulties. They receive guidance on writing the research proposal from their faculty mentors and from the instructors of ABT 301. After the research, they must prepare a final written and oral presentation of their work and again receive guidance from their faculty mentor and from the coordinator of ABT 395/399. An ABT 399 internship also requires a learning contract to be developed prior to the internship opportunity.

Specialty support courses – Students take 21 credits in specialty support coursework. Generally these courses are 300-level and above, but must be at least 200-level. While the pre-major and major requirements prepare student for many career paths, the specialty support courses allow them to focus a group of courses to meet their particular career goals and meet prerequisites for continued education at professional or graduate schools. For instance, a pre-medical school student could take courses on human anatomy, physiology, immunobiology, health care ethics, as well as sociology and psychology courses to help them prepare for the new section of the MCAT. Students interested in plant molecular biology could take courses in plant taxonomy, plant pathology, plant physiology, and bioinformatics, as well as specialized topics such as biofuels. The list of approved specialty supports is extensive. If a particular course has not been approved for Specialty Support, a student can develop a proposal describing how the course meets their career goals for consideration by the ABT Steering Committee.

Program administration

Administration of this program is through a team of two co-Directors of Undergraduate Studies, a Steering Committee Chair, a Steering Committee and an Academic Coordinator. The Agricultural Biotechnology Steering Committee represents the breadth of the College of Agriculture, Food, and Environment (CAFE) and other participating colleges in the University of Kentucky. The committee consists of five faculty members, the Chair and the Co-DUS's (eight members total) appointed to serve three-year terms (renewable) by the CAFE Associate Dean of Instruction. Department Chairs from ABT-associated departments are ex officio members of the committee. The Chair of the Steering Committee and the Directors of Undergraduate Studies were appointed for a term of three years in 2009, which were renewed for an additional three years in 2012. The ABT Steering Committee is responsible for ensuring that the curriculum is current and relevant, for responding to degree program reviews, for facilitating cooperation with the College's Advising Resource Center to ensure that students are receiving quality academic

advising, for overseeing student internship/research participation projects, and for providing input to the Advising Resource Center for course scheduling.

Ms. Esther Fleming has served as Academic Coordinator for the program since approximately 2006 with a 50% appointment in this role. She is very active in recruitment, advising and helping students transition to the university. She assists the ABT administration in all aspects of running the program.

> Advising: The Academic Coordinator (AC) has a large role in freshmen advising beginning with merit advising in the spring and then advising over the summer for incoming freshmen. Generally, the AC attends every merit advising session and every summer advising session to meet each freshmen student. The AC reviews incoming freshmen files to ensure that their AP courses, dual credit courses, etc. are credited to their records during the fall semester. In the fall, the AC arranges the freshmen into groups according to their placement in math and chemistry, organizes the faculty and the students for our in-class, small group advising. Recently, during K-Week, the AC met with 27 incoming freshmen after they arrived on campus. For each individual appointment, the AC worked with the student to review their transfer credits, demonstrated APEX, reviewed the example curricula of the degree, reviewed freshmen study helps including chemistry learning center location and hours, math learning center location and hours, writing center hours and location and The Study location and hours.
>
> The AC works with the co-DUSs to assign freshmen students to permanent academic advisors in the spring semester and transfer students during in the spring and/or fall semester. The AC is responsible for maintaining the advisee/advisor list for the ABT program. In the past, once the assignment list was completed, the AC forwarded the list to the CAFE student advising office. Recently, the AC has completed training to enter advisor changes in the SAP system. The AC works with the faculty and students (particularly freshmen) to ensure that the freshmen actually make contact and schedule the first advising appointment with their permanent advisor during the spring semester.
>
> The AC is readily available to talk with students about ABT courses, planning their course work and planning their research project.
>
> Recently, the AC has advised students during transfer sessions.
>
> Classroom support: The AC serves as the course coordinator for ABT 101, working with Dr. Bruce Webb from 2005 to 2009, Dr. Robert Houtz in 2010 and Dr. Goodin from 2011 to 2013. The AC assists the course instructor by attend class meeting every week, reviewing the syllabus, suggesting speakers, suggesting topics for student success, maintaining class attendance, explaining course

sequencing to freshmen, explaining example curriculum to freshmen, engaging freshmen, providing assistance to freshmen students as they adjust to college life and providing information for career choices to freshmen.

The AC has attends ABT 201 periodically to provide continued support for sophomore students and our transfer students. Occasionally, the AC will introduce the speaker if the instructor is sick.

As needed, the AC has proctored an exam and introduced guest speakers.

The AC supports ABT 395, the independent research course. In the last year, the AC completed training in SAP to enroll approved students in ABT 395.

The AC administers course evaluations each semester, as needed.

Website Maintenance: In July of 2005, the administrative assistant was tasked to redesign the website. By attending various workshops and meeting with a web developer in Ag communications, the AC completed the task in early 2006. General maintenance of the website, including updates, is the responsibility of the AC. The AC attends a monthly web publishers meeting on campus.

Data Collection: The AC collects and maintains enrollment list of students in ABT program and maintains student records which including welcome letters, advising notes, scholarships, awards, dean's list, study aboard, etc.

The AC collects data on the number of freshman and transfer students transferring in and out of the program. Course enrollment, freshmen retention data, transfer retention data, GPA info, program size, graduates/semester etc. for the Ag biotech program are collected by the AC since IR does not collect these numbers for ABT.

The AC attends the coordinating committee meetings, records minutes, and provides input on the status of the program.

Recruitment: The AC have been involved in student recruitment via emailing and meeting with prospective students, attending yearly reoccurring events such as Ag Roundup lunch, IFAL lunch, Collegian Day dinner, attending State FFA convention and a Healthcare career fair in Somerset.

Current UK students who are considering changing their major to Ag biotech will often meet initially with the AC.

Training: The AC completes SAP training as needed and attends workshops offered through the advising network and also conferences for regarding professional schools for Ag biotech students.

The AC participates in the monthly meetings of the Academic Coordinators for the CAFE.

Miscellaneous: The AC helps officials of the ABT club to plan meetings and events for the ABT student body and maintaining the listserv for the Ag Biotech community.

The AC is involved with engaging the Education Abroad office to open opportunities for Ag Biotech students who are interested in studying aboard.

Impacts of the Academic Coordinator for the Ag Biotechnology program:

- Improved academic advising particularly during the critical early semesters.
- Improved academic advising in regards to requirements for various career paths of interest to our students
- Improved organization and awareness of program needs
- Improved awareness of student progress, activities, needs and achievements
- Improved "small community" within the program while attending a large university which likely results in better student retention
- Improved participation in recruitment activities
- Provided a personal interface for students to assist them in negotiating the university's administration system
- Improved interaction with freshmen students
- Improved personalized mentoring
- Provides coordination of the "whole ABT picture" since the managing of the program is a shared responsibility among faculty
- Provided critical assistance to faculty and students during the university's transition from USP to UK Core
- Improved insight and administration of the student's independent research projects due to the AC personal background in research

Freshmen and transfer students meet with one of the administrators of ABT (a Co-Director of Undergraduate Studies or the Steering Committee Chair) or the program's Academic Coordinator to be advised for course enrollment, career planning, and part-time job opportunities. A permanent Academic Advisor will be assigned to students by their second

semester. During their second year, students are expected to develop a plan of study with the help of their advisors, and to submit that plan of study to the Associate Dean for Instruction (N-6, Agricultural Science Center North). Also during the second year, students should begin seeking a research mentor. Third and fourth year students are expected to meet regularly with their advisor to discuss coursework and career goals. During the third year, students should select a research project and write a research proposal in ABT 301, Writing and Presentation in the Life Sciences. The independent research project proposal is reviewed and approved by the ABT 301 course instructor. Students should enroll in ABT 395, Independent Study in Biotechnology, for 2 to 4 credit hours (pending approval) during the semester that they expect to complete their independent research project. Students can repeat the course for a maximum of 6 credit hours (pending approval by the ABT 395/399 instructor). Students choosing to substitute an internship for the research experience should enroll in ABT 399, Experiential Learning in Biotechnology, for a maximum of 6 credit hours. A learning contract must be completed and approved prior to the internship. Both a written and oral report will be required upon completion of the ABT 399 internship or the ABT 395 research project and before any grade evaluation can be made. The members of the ABT Steering Committee will evaluate the oral reports during dead week each semester. Final grade assignment will be made by the course instructor of ABT 395/399, as outlined in the ABT 395/399 Class Information.

Recruitment and development plan

New faculty members, advisors and research mentors are recruited into the program by the Directors and program faculty. All faculty members of the University of Kentucky are eligible to participate in the Agricultural Biotechnology program, and are especially encouraged to serve as Research Mentors for students in this program. Two recent hires at UK have their teaching assignments tied to ABT: Dr. Luke Moe (Plant and Soil Sciences) who teaches ABT 495 and ABT 460 in even years, and Dr. Xuguo "Joe" Zhou (Entomology) who teaches ABT 360. In addition, other faculty have self-nominated to design new courses that are either now part of the core curriculum (Dr. Joe Chappell and ABT 120), or that are suitable specialty support courses (a new populations genetics lab piloting as PLS 597 by Dr. Olga Tsyusko, and a course in evolution in agriculture and medicine piloting at GEN 300-001 by Dr. Chuck Fox). The ABT administration is often contacted by University of Kentucky faculty seeking to recruit ABT students to their labs. These faculty members are subsequently invited to present their research programs to the students in ABT 101 or ABT 201.

Numerous faculty members are voluntary permanent academic advisors for ABT. The DUSs train the new and existing advisors to keep them informed about changes that impact their advising duties. This is done by organizing workshops to share information as well as circulating information by email updates. The ABT administration and excellent personnel in the CAFE Advising Resource Center (N8 ASCN) are also available to answer questions from advisors, research mentors, or students.

Students are ultimately responsible for ensuring that they have satisfied all University and CAFE requirements for graduation. The ABT program website (http://www.uky.edu/Ag/Biotechnology/) was revised and updated extensively in 2006 and is designed to acquaint students with the general design and purpose of the program.

Selected informational sheets for students, advisors and research mentors are included in the ABT Program Manifesto (Appendix A).

Program delivery

A number of courses in the ABT curriculum from other departments have multiple offerings, including evening and online sections and this allows some flexibility for student scheduling. However, the core ABT courses generally have only one or two sections per semester or year. The limited section offerings are unavoidable due to the size of the program and resources available. In addition, a single yet reasonably-sized class allows for a more cohesive community among the students. The academic advising that students receive, including generation of a plan of study, helps ensure that a student's progress is not impeded by missing a particular course. In the event of an unavoidable course conflict, the ABT administration and College advising services identify options to allow the student to graduate on time.

Program contributions to UK Core

A new course was developed by Dr. Joe Chappell, ABT120, Genetics and Society, that meets the Intellectual Inquiry in Natural, Physical and Mathematical Sciences UK Core requirement. The course first ran in Fall 2012 and is currently offered in the Fall (one section) and Spring (two sections) semesters.

Program Quality and Student Success

The ABT curriculum is designed to address 4 Student Learning Outcomes, which are evaluated for program assessment:

1. Agricultural Biotechnology graduates will acquire knowledge about the range of approaches to manipulate and improve plants, animals and microorganisms.

2. Agricultural Biotechnology graduates will demonstrate the ability to interpret, evaluate and communicate their assessment of modern biotechnology approaches for the purposes cited in Learning Outcome 1.

3. Agricultural Biotechnology graduates will evaluate how their experience in the Agricultural Biotechnology program has influenced their outlook on the relationship between society and biotechnology, and how their personal philosophies and values have been influenced as a consequence of the program.

4. Agricultural Biotechnology students will participate in research projects including the requirements of the independent study course ABT 395, or experiential learning course ABT

399. Presentation (oral and written) is an integral part of their research program and they will demonstrate their ability to communicate about science through these presentations. ABT students will have the opportunity to become authors and co-authors on suitable outlets for communication of their research results including abstracts presented at professional meetings, and where possible peer-reviewed scientific research publications.

The process and tools used for program assessment are provided in Appendix E. Based on the assessment data generated over the past three years, the ABT curriculum is providing students with the training needed to achieve the Learning Outcomes (Appendix F). It should be noted that the program assessment system was implemented recently (2010) by the University of Kentucky's Office of Assessment, and the ABT program administration believes that the current assessment process can be improved. Once the program external review is completed in 2014, it is our plan to reexamine and revise the ABT assessment procedures and tools to provide us with more useful information to guide our curricular changes.

Student Awards

The ABT program faculty and staff are exceedingly proud of ABT student success in garnering awards and fellowships/scholarships. Among the numerous achievements of ABT students or graduates since 2008 (Appendix G), there have been four Beckman Scholars (Philip Houtz, Jessica Houtz, Laura Crawford, Lesley Mann), three Chellgren Scholars (Philip Houtz, Zachary Willard, Jessica Gambrel), and a Gates Cambridge Scholar (Lesley Mann). Additionally, ABT students have been awarded the Barry M. Goldwater Scholarship (Philip Houtz, Taylor Lloyd, Lesley Mann), and Astronaut Scholarship Foundation Award (Taylor Lloyd), and a Wethington Fellowship (Laura Crawford).

Six-year graduation rates

Graduation rates are collected for individual Departments, but not for interdepartmental programs like ABT. Therefore, this information was not readily available for our self-study.

Employer and alumni satisfaction, and post-graduate success

There is a lengthy and diverse list of employers or schools (graduate and professional) that employ or train graduates of the ABT program. Consequently, it is difficult to evaluate "Employer satisfaction" of our graduates. However, we solicited comments from faculty involved in admissions to University of Kentucky Professional and Graduate programs. Although the response was limited, the comments implied that the ABT program is highly regarded and our graduates are well prepared for professional school (Appendix H).

To determine the satisfaction and success of students who have graduated with a B.S. in ABT, we generated an online survey of 12 questions, which was circulated by email to ABT alumni by the CAFE Alumni Office for Advancement. The survey questions and responses are provided in Appendix I. The survey elicited 35 responses from ABT alumni who graduated between 2000 and 2013. In response to a question about satisfaction with the experience as an Ag

Biotechnology major, 25 respondents (71.4%) said they were extremely satisfied, while another seven (20%) stated that they were moderately satisfied with their experience. Two respondents indicated they were slightly satisfied, and one respondent indicated moderate dissatisfaction with the ABT experience. Four survey questions asked for comments regarding favorite experience, least favorite experience, changes to improve ABT, and general comments about the program (Appendix I). While these comments were generally positive, concerns about academic advisors and increased exposure to career opportunities have provided us with some guidance for improving the ABT program.

It is difficult to get an accurate assessment of post-graduate placement and success once students graduate from the program and leave the University of Kentucky. Although it does not provide comprehensive results, we have used the information obtained from the ABT alumni survey to gain some insights into student status after graduation (Appendix I). Based on the 35 responses to the survey, only eight (22.9%) of these ABT graduates were employed full-time upon graduation. However, 28 (80%) of the respondents indicated that they attended graduate or professional school immediately following graduation. The current educational/employment status of the respondents was diverse, and included students in graduate or professional school, research scientists, practicing physician/dentist/pharmacists, and teacher/university faculty members.

Maintenance of program quality and currency

It is the purview of the ABT Steering Committee to ensure the currency and quality of the ABT curriculum. The breadth of expertise represented by the Steering Committee membership allows for informed and timely decisions to alter ABT course offerings to keep the degree requirements aligned with contemporary Agricultural and Biomedical disciplines.

Orientation and advising

Entering freshmen are advised during Merit weekends and the Summer Advising Conferences by ABT faculty and the ABT Academic Coordinator (E. Fleming). At least one of the Co-DUSs and/or the Steering Committee Chair attends each advising session. Additional faculty experienced in advising for ABT attend as needed to allow a ratio of 1-2 students per advisor during these sessions. Students are provided with an overview of the program and assisted in developing their first semester schedules and registering for courses. Often, and in particular for merit students, AP scores are not available during advising. To ensure that students are placed in correct courses, the Academic Coordinator rechecks schedules later in the summer but before the beginning of the Fall semester. In 2013, the Academic Coordinator also started scheduling individual meetings with entering freshmen during the first part of the Fall semester.

All entering ABT Freshmen are initially assigned Drs. Goodin, Howe or Perry as their academic advisor. Group advising for the second semester occurs during one of the ABT 101 classes. This process is facilitated by grouping students with similar needs (e.g. Honors students are advised in one group; other students are generally grouped by Math placement).

In the early spring of the freshman year, students are assigned to a permanent faculty advisor. Currently, ABT has 24 faculty advisors allowing ~6:1 ratio of advisee to advisor. Students with similar career goals are assigned to specific advisors, allowing advisors to become more familiar with specialty support courses for specific career paths. Students often change career goals, but the initial advisor-student link is maintained unless a change is requested. Students meet with their advisor each semester to discuss coursework, career goals, educational opportunities (e.g. internships, study abroad, awards), and any other concerns the student may have. Advisors help students develop a Plan of Study that is submitted to the CAFE Office of Academic Programs for their Junior and Senior years. Students must deliver a registration worksheet signed by their advisor to the CAFE Advising Resource Center. The sheet is carbonized such that a copy is retained by the permanent advisor and by the Advising Center, providing a permanent record of coursework planning in case questions arise at a later time. Prior to assignment to a permanent faculty advisor, students are encouraged to meet with Drs. Goodin, Howe or Perry to discuss any questions or concerns.

The ABT Alumni survey (Appendix I) indicated that a majority of the respondents felt that their academic advisor was extremely helpful (54.3%) or quite helpful (22.9%). However, five of the respondents (14.3%) stated that their advisor was only slightly helpful (3) or not at all helpful (2). These results were supported by several comments provided in response to questions about least favorite experience and what could be improved with ABT. Although these opinions were a minority, these responses indicate that the ABT program administrators need to be more vigilant and proactive if students express concern about the quality of advising that they are receiving from their academic advisor.

Orientation and advising for students who transfer to ABT:

Most transfer students initially meet with Co-DUS Dr. Sharyn Perry to discuss career goals, the ABT program, and for initial assistance selecting coursework. Transfer students then are assigned a permanent faculty advisor who has experience with transfers. Transfer students are exempt from ABT101 and ABT120; their entry into the program is through ABT201.

Other opportunities for student development:

The Biotech Listserv notifies ABT students of opportunities such as pre-professional meetings, new courses, student hourly jobs, and research opportunities. Students with particular professional school goals are encouraged to join the appropriate listserv. Dr. Bruce Webb has been instrumental in identifying industry internship opportunities for students who seek this experience. The ABT administration nominates suitable students for opportunities such as service as an Agricultural Ambassador, or for various external award applications that become available. The Biotech Club and activities listed on the Facebook page allow an outlet for social and scholarly interactions.

Support for ABT advisors:

Tools such as Degree Progression sheets and example curricula have been developed by the Academic Coordinator and are available on the ABT webpage to aid faculty advisors. The co-DUSs and Academic Coordinator attend meetings to keep up to date on advising issues. The information is disseminated to the faculty advisors by email and meetings. Faculty advisors are encouraged to contact the ABT administrators with questions about student needs.

Instructional quality

Smaller class sizes and ready access to ABT instructors, advisors, and administrators has been an enduring strength of the ABT program. A survey of ABT alumni (Appendix I) yielded multiple comments that highlighted the appeal and benefits of the ABT program's small size. ABT 101 and ABT 201 accommodate all of the students in the program as freshmen or sophomores, respectively, and these classes rarely exceed 50 students. Enrollment for Fall 2013 is 47 students in ABT 101 and 46 students in ABT 201. All other ABT core courses have smaller class sizes.

Of the 35 respondents to the ABT alumni survey, 17 (48.6%) of the responses stated that the teaching within the ABT major was extremely effective, while 17 (48.6%) stated that the teaching was very effective. One respondent (2.9%) felt that the teaching in the ABT major was moderately effective. In contrast, only 3 (8.8%) of 34 respondents to a question about teaching outside the ABT major believed that the teaching was extremely effective. Fourteen (41.2%) responses said that the teaching outside the major was very effective, and 17 (50%) said that the teaching outside the major was moderately effective.

Although teacher/course evaluations (TCE) by students are not completely reliable for assessing instruction quality, these evaluations are one measure used at the University of Kentucky for evaluating teaching effectiveness. In general since 2008, the overall TCE scores for ABT courses and instructors have equaled or exceeded the scores for CAFE and the University of Kentucky (Provost Area) (Appendix J). Occurrences when the ABT course and/or instructor have received substandard scores have typically been when a course was offered for the first time or a first-time instructor taught the course.

Program qualifications

The ABT program does not restrict enrollment. The program standards are equivalent to the University of Kentucky's admission requirements. While the ABT program attracts students who have excelled in high school and have strong ACT scores and grade-point averages, the program is inclusive and strives to assist any students who wish to pursue the ABT degree.

Program Resources

Since approximately 2006, the College has provided partial support for an ABT Academic Coordinator (Esther Fleming). Currently, the Academic Coordinator position is a 50% appointment; Ms. Fleming also holds a 50% appointment as a Research Analyst in the lab of Dr. Bruce Webb, previous Director of ABT. As described in the ABT Program Description section, the Academic Coordinator carries numerous and significant responsibilities. These duties have

gradually accumulated since the position was formed in 2006, and it is conceivable that the Academic Coordinator position will need to be expanded beyond a 50% appointment.

Starting in 2012, the Dean of CAFE specified a recurring allocation of $5000 to the ABT program cost center account for general operating expenses. The Dean also committed $9000 recurring for a 50%-time graduate Teaching Assistant to support ABT 120, a new course developed to serve UK Core needs and the early laboratory experience of ABT majors. It should be noted that ABT 495 is also a lab-intensive course that requires significant time and effort from the instructor (Dr. Luke Moe). A graduate student funded as a Research Assistant by Dr. Moe has served informally as a Teaching Assistant for ABT 495. The graduate student who volunteered as a TA was provided a $1000 stipend supplement by the Department of Plant and Soil Sciences. A 0.5 TA line committed to ABT 495 would be more appropriate and beneficial, particularly since Dr. Moe has indicated a desire to offer a Spring semester section of ABT 495 (currently offered only in the Fall) to accommodate more students in the ABT.

A laboratory in the Plant Sciences Building (room 109) serves as the teaching laboratory for ABT 495, Experimental Methods in Biotechnology (L. Moe, instructor). The room was originally designed as a research lab, but was co-opted as a teaching facility for ABT 495 by Dr. Joe Chappell, who developed this lab-intensive course. The room is ~800-900 sq. ft. with 10 kneeholes, gas lines, vacuum lines, air lines, laminar flow hood, fume hood, 4 microcentrifuges, 4 vortex machines, 10 apparatuses for agarose gels, 10 apparatuses for SDS-PAGE, 5 power supplies, 2 UV boxes for gels, solvent storage cabinet, lab microwave, 2 rotary evaporators, 2 large sinks with drying racks, 4C fridge with -20C freezer, large whiteboard, and shelving/coat racks for non-lab materials (backpacks, jackets, etc.). The laboratory was outfitted primarily via the resourcefulness of Dr. Chappell. Most of the instrumentation in obtained to outfit this teaching lab was surplus equipment, acquired by donations, or appropriated from Dr. Chappell's lab (a practice that continues with the current instructor, Dr. Luke Moe). The establishment of a recurring budget for ABT operating expenses has allowed us to secure several small pieces of equipment that were needed to replace worn out instruments. Purchase or replacement of larger, more costly instruments in the facility will require procurement of funds from the College or other sources.

When ABT 120 was developed in 2012, a one-time allocation of $9700 was provided by CAFE to cover the start-up costs of this course. Both ABT 120 and ABT 495 collect lab fees from enrolled students. These fees ($50/student for ABT 120; $100/student for ABT 495) appear to provide sufficient funds to cover the costs of the consumable lab reagents used in the instruction of these courses. As mentioned, purchase/replacement of lower-cost equipment is likely feasible using the ABT operating expenses and/or any surplus funds from lab fees. However, additional funds from the College or other sources will be needed for purchase or replacement of costlier instrumentation for these labs.

As detailed in more extensively in the "**ABT-associated Faculty**" section of this self-review document, the faculty members who participate in training students are a primary resource for the ABT program. Currently, there are 26 University of Kentucky faculty members representing nine Departments in three Colleges who participate directly in ABT as Steering Committee members, core course instructors, and/or academic advisors (Table 1; Appendix A). A much larger and diverse group of faculty members across the University of Kentucky Campus have served as research mentors for the student research projects (ABT 395). A partial listing of previous research mentors is provided in Appendix C. Importantly, faculty participation in the ABT program is voluntary and done principally out of personal commitment to training students in Agricultural and Biomedical sciences. The ABT program has benefited tremendously from the willingness of UK faculty to contribute, along with the support from their Departments and Department Chairs. However, there is always concern about keeping current ABT-associated faculty engaged and recruiting new faculty to participate, particularly with the changing budget allocation model that the University will implement over the next several years.

Input from Affected Constituents

Input was solicited from Chairs of Departments that are affiliated with the ABT program. Responses were obtained from five Department Chairs, and their comments were almost universally positive. As stated by one of the Chairs, the ABT program is valued "for the quality of its students and the contributions they make to our research programs." In particular, this Chair noted that the research projects conducted by the ABT undergraduates contribute to the "Broader Impacts" criterion for securing extramural funding from the NSF. As well, two of the Departments do not have undergraduate degree programs, so these Chairs were enthusiastic about the teaching opportunities that the ABT program provides to their faculty members.

The uncertain financial support for the ABT program was a concern raised by the Chair of a Department that contributes significantly to the program (T. Pfeiffer, Plant and Soil Sciences). Plant and Soil Sciences has subsidized the ABT program by providing TA stipend supplements as well as equipment and supplies for ABT 495. Rightfully, these costs should be covered by funds allocated to the ABT program. As well, a concern was expressed about accounting for administrative time given by ABT-associated faculty members (e.g., Luke Moe's role as the ABT Club Faculty Advisor). As recommended by Dr. Pfeiffer, a more timely and consistent link between the ABT program and departmental administration will help to alleviate this disconnect.

Operations

Semiannual meetings of the ABT Steering Committee are convened by the Chair to discuss program status, curriculum issues and changes, and any other items that need consideration by the committee. Chairs of ABT-affiliated Departments are normally copied on meeting notifications and itineraries to allow them the opportunity to give input. Issues that require immediate attention or are of relatively minor importance may be discussed and approved (as

appropriate) by the Steering Committee by email. As needed to discuss program issues and carry out administrative tasks, meetings are held between the Steering Committee Chair, the Co-DUSs, and/or the Academic Coordinator.

Quality Enhancement Plan and University Diversity Plan

The University of Kentucky's Quality Enhancement Plan (QEP) has a primary emphasis on improving student communication skills (e.g., writing, public speaking, etc.). To accomplish this major goal, the University has implemented a new Graduation Composition and Communication Requirement (GCCR), which replaces the former Graduation Writing Requirement (GWR). In addition to attaining proficiency in written communication (i.e., the old GWR), students will also be required to show competence in oral communication and information literacy in their discipline. The ABT program will contribute to the major goal of the University's QEP via ABT 201 and ABT 301, which together satisfied the previous GWR. Both courses have a major writing assignment that is drafted, reviewed, and revised prior to final submission to the instructor. Both the ABT 201 and 301 papers require literature searches and reference citations, thereby demonstrating student information literacy. The oral communication component for the GCCR will be fulfilled by the research proposal presentations in ABT 301 (20 minute time limit) that include instructor and peer feedback to the student. Moreover, ABT students will further hone and demonstrate their communication skills by writing a research report and presenting their research findings at the public ABT395/399 presentations.

The ABT program has been successful at recruiting a diverse student body. From 2004 to 2010, 65.5% of ABT students were female and 19.7% self-identified as members of groups other than "White, non-Hispanic." The most recent and complete data (2011-2012) indicates that of the 158 students enrolled in the ABT program, 96 students were female and 19 students were listed as Minority. Of the 25 ABT degrees conferred in 2011-2012, 16 students were female and 4 were Minority. Although the ethnicity of the ABT program historically compares well with the overall student enrollment in CAFE and estimates for the Commonwealth of Kentucky population (U.S. Bureau of the Census, 2009 estimates), we believe it will be beneficial to consult with the CAFE Office of Diversity to develop recruitment efforts that will ensure we attract a diverse student population.

List of Appendices:

A) ABT Program Manifesto
B) Faculty biosketches/curricula vitae
C) Research mentors
D) Student publications/presentations
E) ABT program assessment materials
F) Annual assessment results
G) Student awards
H) Comments from professional school admissions personnel
I) ABT alumni survey
J) Teacher/course evaluations

Agricultural Biotechnology Bachelor of Science Degree Program

Appendices:

A) ABT Program Manifesto
B) Faculty biosketches/curricula vitae
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B.S. Degree in Agricultural Biotechnology
(Program Manifesto)

Biotechnology encompasses cellular and molecular approaches to the manipulation and improvement of agricultural plants, animals and microorganisms, and the control of agricultural pests and diseases. The primary purpose of the baccalaureate degree program in Agricultural Biotechnology is to train students in modern cellular and molecular biology and genetic engineering. Students are provided a firm foundation in the principles of genetics and molecular biology of both prokaryotic and eukaryotic organisms. Each student then specializes in an area appropriate to his or her interest and career objectives. Opportunities for specialization span across the Colleges at the University of Kentucky and include agricultural and biomedical technology pertaining to microbes, plants, invertebrates, and vertebrates. Central to the ABT curriculum is a research or internship experience that is developed (ABT 301) and conducted (ABT 395 or 399) by the student under the supervision of a faculty mentor. Students completing the ABT Bachelor of Science degree program will be prepared to assume government, university, and industry positions with research and technology applications to agriculture and food production. Graduates will also be well prepared to continue their training towards advanced degrees in graduate or professional school.

Administration of Program

Freshmen and transfer students will meet with one of the Administrators of the Agricultural Biotechnology Program (a Co-Director of Undergraduate Studies or the Steering Committee Chair) or the program's Academic Coordinator to be advised for course enrollment, career planning, part-time job opportunities. A permanent Academic Advisor will be assigned to students by their second semester. During their second year, students are expected to develop a plan of study with the help of their advisors, and to submit that plan of study to the Associate Dean for Instruction (N-6, Agricultural Science Center North). Also during the second year, students should begin seeking a research mentor. Third and fourth year students are expected to meet regularly with their advisor to discuss coursework and career goals. During the third year, students should select a research project and write a research proposal in ABT 301, Writing and Presentation in the Life Sciences. The independent research project proposal is reviewed and approved by the ABT 301 course instructor. Students should enroll in ABT 395, Independent Study in Biotechnology, for 2 to 4 credit hours (pending approval) during the semester that they expect to complete their independent research project. Students can repeat the course for a maximum of 6 credit hours (pending approval by the ABT 395/399 instructor). Students choosing to substitute an internship for the research experience should enroll in ABT 399, Experiential Learning in Biotechnology, for a maximum of 6 credit hours. A learning contract must be completed and approved prior to the internship. Both a written and oral report will be required upon completion of the ABT 399 internship or the ABT 395 research project and before any grade evaluation can be made. The members of the ABT Steering Committee will evaluate the oral reports during dead week each semester. Final grade assignment will be made by the course instructor of ABT 395/399, as outlined in the ABT 395/399 Class Information.

The Agricultural Biotechnology Steering Committee represents the breadth of the College of Agriculture, Food, and Environment (CAFE) and other participating colleges in the University of Kentucky. The committee consists of eight faculty members appointed to serve three-year terms (renewable) by the CAFE Associate Dean of Instruction. The ABT Steering Committee is responsible for ensuring that the curriculum is current and relevant, for responding to degree program reviews, for facilitating cooperation with the College's Advising Resource Center to ensure that students are receiving quality academic advising, for overseeing student internship/research participation projects, and for providing input to the Advising Resource Center for course scheduling.

All faculty members of the University of Kentucky are eligible to participate in the Agricultural Biotechnology program, and are especially encouraged to serve as Research Mentors for students in this program. Students are ultimately responsible for ensuring that they have satisfied all University and CAFE requirements for graduation. The Steering Committee will conduct periodic informational meetings for students and advisors to keep them appraised of their responsibilities and any policy/program changes, and will provide advising materials as needed.

Career Opportunities

Employment opportunities include research scientists, laboratory technicians or managers in university, government, industrial, or clinical laboratories using biotechnological tools for research and production. Examples of research areas include construction of novel pest and disease resistance genes, development of new immunological and nucleic acid-based diagnostic probes for plant and animal diseases, genetic engineering of microorganisms for the production of important pharmaceutical agents, and development of new bioengineered strains of microorganisms for fermentation and food production services. Students will also be prepared to enter graduate programs in many disciplines as well as professional programs such as Veterinary Medicine, Medicine, Dentistry and Law.

Agricultural Biotechnology Undergraduate Degree Program

Faculty

All faculty members of the University of Kentucky are eligible to participate in the Agricultural Biotechnology program and are especially encouraged to serve as Research Mentors for students in this program. The Agricultural Biotechnology Steering Committee represents the breadth of CAFE and other participating colleges in the University of Kentucky. The committee consists of eight faculty members appointed to serve three-year terms (renewable) by the CAFE Associate Dean of Instruction. The ABT Steering Committee is responsible for ensuring that the curriculum is current and relevant, for responding to degree program reviews, for facilitating cooperation with the College's Advising Resource Center to ensure that students are receiving quality academic advising, for overseeing student internship/research participation projects, and for providing input to the Advising Resource Center for course scheduling. The Academic Advisor serves as a guide for undergraduate students as they develop their plan of study and helps the student develop a program that is specific to his/her interests.

Administration:

Steering Committee Chair: Dr. Daniel Howe Email: dkhowe2@uky.edu Phone: (859) 257-4757 ext. 81113
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Agricultural Biotechnology Undergraduate Degree Program

Course Requirements

Students must satisfy the University and College requirements, and must complete the major, specialty support and elective course requirements outlined in the Program in Agricultural Biotechnology, including an independent research project relevant to the student's interest in biotechnology. A minimum of 128 credit hours is required.

UK CORE REQUIREMENTS

I.	Intellectual Inquiry in Creativity & the Arts	3
II.	Intellectual Inquiry in Humanities	3
III.	Intellectual Inquiry in Social Sciences	3-4
IV.	Intellectual Inquiry in Natural, Physical and Mathematical Sciences: CHE 105 and CHE 111	5
V.	Composition and Communication I: CIS110 or WRD110 (Or ENG ACT $\geq$ 32 or SAT I Writing Score $\geq$ 720, then complete CIS/WRD112)	3
VI.	Composition and Communication II : CIS111 or WRD111 (Or ENG ACT $\geq$ 32 or SAT I Writing Score $\geq$ 720, then complete CIS/WRD112)	3
VII.	Quantitative Foundations : MA123 or MA113/193 or MA137 (Or AP Calculus AB or BC score of 3, 4 or 5)	3-5
VIII.	Statistical Inferential Reasoning: STA210	3
IX.	Community, Culture and Citizenship in the USA: GEN100	3
X.	Global Dynamics	3

GRADUATION REQUIREMENT

Two years of the same foreign language in high school or two-semester sequence of one foreign language in college

COLLEGE REQUIREMENTS

A. GEN 100 (Fall semester) for first semester freshman

or

B. GEN 100 (Spring semester) for transfer students, upperclassmen who have not completed UK Core IX: Community, Culture and Citizenship in the USA 3

PRE-MAJOR REQUIREMENTS

BIO 148, BIO 152, BIO155	7
CHE 105, CHE 111	5
CHE 107, CHE 113	5
CHE 230, CHE 231	4
CHE 232, CHE 233	4
MA 113/193 OR MA 137 OR MA 123	4-5
PHY 211	5
PHY 213	5

MAJOR REQUIREMENTS

ABT 101 (transfers are exempt)	1
ABT 120 (transfers who are not freshmen are exempt)	3
ABT 201	1
ABT 301	2
BIO 308 or BIO 208	3
BIO 209	2
ABT 360 or BIO 304	3-4
ABT 460	3
ABT 461	3
STA 291 or STA 570 or STA580	3-4

BCH 401G	3
ABT 495 or BIO 510	4
ABT 395 or ABT 399	3

Note:
All students are expected to undertake an independent study project in an area of their interest for a minimum of 3 and a maximum of 6 credit hours. This requirement can be met by a research project or an internship that is agreed upon by a student's Research Mentor and approved by the instructors of ABT 301 and ABT 395/399. Both written and oral reports will be required upon completion of the project.

SPECIALTY SUPPORT REQUIREMENTS

(Students must take a minimum of 21 credit hours of specialty support courses and at least one course from category 1. A number of the courses listed here may have additional prerequisites. Courses not on this list may be used to meet this specific requirement if approved by the Coordinating Committee.)

1. CELL BIOLOGY AND PHYSIOLOGY

ASC 364 Reproductive Physiology of Farm Animals	4
BIO 315 Introduction to Cell Biology	4
BIO 350 Animal Physiology	4
BIO 430G Plant Physiology	4
BIO/PGY 502 Principles of Physiology	5

2. EXAMPLES OF OTHER SPECIALTY SUPPORT COURSES (This is not a complete list. Students may select other support courses that meet their specific needs and that provide instruction in biotechnology-related areas. Students are advised to check for course availability and new course offerings.)

PLANT & SOIL SCIENCE AND HORTICULTURE

PLS 404 Integrated Weed Science	4
PLS 502 Ecology of Economic Plants	3
PLS 470G Soil Nutrient Management	3
PLS 657 Seed Biology	3
PLS 566 Soil Microbiology	3
PLS 440 Plant Propagation	3

ANIMAL SCIENCES, VETERINARY SCIENCES, AND PHYSIOLOGY

ASC 362 Animal Genetics	4
ASC 378 Animal Nutrition/Feeding	4
ASC 410G Equine Sciences	3
VS 350 Introductory Anatomy, Physiology, and Animal Hygiene	3
VS 351 Principles of Animal Hygiene and Disease Control	3
PGY 412G Principles of Human Physiology	4
PGY417 Genomics and Epigenetics	2

BIOLOGY

BIO 303 Evolution	4
BIO 325 Ecology	4
BIO 351 Plant Kingdom	3
BIO 420G Taxonomy of Vascular Plants	4
BIO 425 Biology Seminar (various topics)	1
BIO 494G Immunobiology	3
BIO 520 Bioinformatics	3
BIO 529 Developmental Biology	3

CHEMISTRY

CHE 440G Intro Physical Chemistry	4
CHE 522 Instrumental Analysis	4
CHE 532 Spectrometric Identification of Organic Compounds	2
CHE 533 Qualitative Organic Analysis Laboratory	2

CHE 550 Biological Chemistry I	3
CHE 552 Biological Chemistry II	3
CHE 554 Biological Chemistry Lab	2
CHE 565 Environmental Chemistry	3

ENTOMOLOGY

ENT 300 General Entomology	3
ENT 320 Horticultural Entomology	3
ENT 340 Livestock Entomology	3
ENT/FOR 402 Forest Entomology	3
ENT/BIO 561 Insects Affecting Human & Animal Health	3
ENT/BIO 564 Insect Taxonomy	4

FOOD SCIENCE

FSC 434 Food Chemistry	4
FSC 530 Food Microbiology I	5
FSC 536 Advanced Food Technology	4
FSC 538 Food Fermentation and Thermal Processing	4
FSC 540 Food Sanitation	3

FORESTRY AND PLANT PATHOLOGY

PPA 400G Principles of Plant Pathology	3
PPA 500 Physiology of Plant Health and Disease	3
FOR 425 Forest Management	3
FOR 470 Interdependent Natural Resource Issues	3

PHARMACOLOGY

PHA 422G Pharmacology of Treating Human Disease	3

COMMUNICATIONS, SOCIOLOGY AND PHILOSOPHY

COM311 Patient-Provider Communication	3
PHI 305 Health Care Ethics	3
PHI 380 Death, Dying and Quality of Life	3
SOC 350, sections on Sociology of Health and Illness	3

ADDITIONAL ELECTIVES: to 128 credits 6-10

Special notes for satisfying the degree requirements:

1. Full time status is 12 hours.
2. You must complete Composition and Communication I and II and 30 credit hours before enrolling in ABT201.
3. A Plan of Study must be completed and submitted to the Office of Academic Programs for the Junior and Senior years.
4. You must complete 128 credit hours of approved course work with at least a 2.0 grade-point standing.
5. You must complete 45 credit hours of approved upper division (>300) course work.
6. 30 of the last 36 hours must be completed at UK.

Agricultural Biotechnology

Example Curriculum for Students starting Fall 2013

MA 109 in their first year

Fall year 1			Spring Year 1		
MA 109	College Algebra	3	CHE 107	General College Chemistry II	3
ABT 101	Intro to Biotechnology	1	CHE 113	General College Chemistry II Lab	2
GEN 100[1]	Issues in Ag -UK Core IX-	3	ABT 120	Genetics and Society	3
CIS 110[1]	Composition and Communication I -UK Core V-	3	MA 123[1]	Elementary Calculus and its Applications -UK Core VII-	4
CHE 105[1]	General College Chemistry I -UK Core IV-	4	CIS 111[1]	Composition and Communication II -UK Core VI-	3
CHE 111[1]	General College Chemistry I Lab 1 -UK Core IV-		UK Core[1]	I	3
Total		15	Total		18
Fall Year 2			Spring Year 2		
CHE 230	Organic Chemistry I	3	CHE 232	Organic Chemistry II	3
CHE 231	Organic Chemistry I Lab	2	CHE 233	Organic Chemistry II Lab	2
CHE 295	Organic Chemistry Workshop I	1	BIO 152	Principles of Biology II	3
BIO 148	Introductory Biology	3	UK Core[1]	III	3
BIO 155	Lab for Introductory Biology I	1	STA 291	Statistical Methods	3
STA 210[1]	Making Sense of Uncertainty: Intro to Stats -UK Core VIII-	3			
ABT 201	Scientific Method in Biotechnology (only after 30 hrs)	1			
UK Core[1]	II	3			
Total		17	Total		14
Fall Year 3			Spring Year 3		
PHY 211	General Physics I	5	PHY 213	General Physics II	5
ABT 360[3]	Genetics	3	BIO 308	General Microbiology	3
ABT 301	Writing & Presentation in the Life Sci	2	BIO 209	Introductory Microbiology Lab	2
UK Core[1]	X	3	ABT 461	Introduction to Population Genetics	3
SS[2] – 1	Specialty Support Course	3	SS[2] – 2	Specialty Support Course	3
Total		16	Total		16
Fall Year 4			Spring Year 4		
BCH 401	Fundamentals of Biochemistry	3	ABT 460	Introduction to Molecular Genetics	3
ABT 395	Independent Study in Biotechnology	3	SS[2] – 4	Specialty Support Course	3
ABT 495	Experimental Methods in Biotechnology	4	SS[2] – 5	Specialty Support Course	3
SS[2] - 3	Specialty Support Course	3	SS[2] - 6	Specialty Support Course	3
	Elective	2-3	SS[2] – 7	Specialty Support Course	3
Total		15-16	Total		15

MINIMUM TOTAL NEEDED = 128 credit hours

[1]UK Core—for list of acceptable courses, check the UK 2013-2014 Bulletin pgs 90-94
[2]Specialty Support course—for list of acceptable courses, check the UK Bulletin pg 97 and check with your advisor
[3]BIO 304 (4hrs) can substitute for ABT 360 (3hrs)

Math 123 in their first year

Fall year 1			Spring Year 1		
MA 123	Elementary Calculus and its Applications -UK Core VII-	4	CHE 107	General College Chemistry II	3
ABT 101	Intro to Biotechnology	1	CHE 113	General College Chemistry II Lab	2
GEN 100	Issues in Ag -UK Core IX-	3	ABT 120	Genetics and Society	3
CHE 105	General College Chemistry I -UK Core IV-	4	BIO 148	Introductory Biology I	3
CHE 111	General College Chemistry I Lab -UK Core IV-	1	BIO 155	Lab for Introductory Biology I	3
CIS 110	Composition and Communication I -UK Core V-	3	CIS 111	Composition and Communication II -UK Core VI-	3
Total		16	Total		15

Fall year 2			Spring Year 2		
CHE 230	Organic Chemistry I	3	CHE 232	Organic Chemistry II	3
CHE 231	Organic Chemistry I Lab	1	CHE 233	Organic Chemistry II Lab	1
CHE 295	Organic Chemistry I Workshop	1	(Optional Organic Chemistry II Workshop)		
BIO 152	Principles of Biology II	3	UK Core[1]	II	3
BIO 155	Lab for Introductory Biology I	1	UK Core[1]	III	3
STA 210	Making Sense of Uncertainty: Intro to Statistical Reasoning -UK Core VIII-	3	STA 291	Statistical Methods	3
			OR		
ABT 201	Scientific Method in Biotechnology (only after 30 hrs)	1	STA 570	Basic Statistical Analysis	4
			OR		
UK Core[1]	I	3	STA 580	Biostatistics I	3
Total		17	Total		13-14

Fall year 3			Spring Year 3		
PHY 211	General Physics I	5	PHY 213	General Physics II	5
BCH 401G	Fundamentals of Biochemistry	3	BIO 308	General Microbiology	3
ABT 360[3]	Genetics	3	BIO 209	Introductory Microbiology Lab	2
ABT 301	Writing & Presentation in the Life Sci	2	SS[2] – 1	Specialty Support Course	3
UK Core	X	3	SS[2] – 2	Specialty Support Course	3
Total		16	Total		16

Fall year 4			Spring Year 4		
ABT 495	Experimental Methods in Biotechnology	4	ABT 460	Introduction to Molecular Genetics	3
ABT 395	Independent Study in Biotechnology	3-4	ABT 461	Introduction to Population Genetics	3
SS[2] – 3	Specialty Support Course	3	SS[2] - 5	Specialty Support Course	3
SS[2] – 4	Specialty Support Course	3	SS[2] – 6	Specialty Support Course	3
	Elective 1	3	SS[2] – 7	Specialty Support Course	3-4
Total		16-17	Total		15-16

MINIMUM TOTAL NEEDED = 128 credit hours

[1]UK Core—for list of acceptable courses, check the UK 2011-2012 Bulletin pgs 90-94
[2]Specialty Support course—for list of acceptable courses, check the UK Bulletin pg 97 and check with your advisor
[3]BIO 304 (4hrs) can substitute for ABT 360 (3hrs)

MA 113 or MA 137 in their first year

Fall year 1		Spring Year 1	
MA 113 Calculus I -UK Core VII-	4	CHE 107 General College Chemistry II	3
MA 193 Calculus I Workshop	1	CHE 113 General College Chemistry II Lab	2
OR		CHE 197 General Chemistry II Workshop	1
MA 137 Calculus for the Life Sciences -UK Core VII-	4	ABT 120 Genetics an Society	3
		BIO 148 Introductory Biology I	3
ABT 101 Intro to Biotechnology	1	BIO 155 Lab for Introductory Biology I	1
GEN 100 Issues in Ag -UK Core IX-	3	CIS 111 Composition and Communication II -UK Core VI-	3
CHE 105 General College Chemistry I -UK Core IV-	4		
CHE 111 General College Chemistry I Lab -UK Core IV-	1		
CIS 110 Composition and Communication I -UK Core V-	3		
Total	15-16	Total	16

Fall year 2		Spring Year 2	
CHE 230 Organic Chemistry I	3	CHE 232 Organic Chemistry II	3
CHE 231 Organic Chemistry I Lab	2	CHE 233 Organic Chemistry II Lab	2
CHE 295 Organic Chemistry I Workshop	1	(Optional CHE 297 Organic Chemistry II Workshop)	
BIO 152 Principles of Biology II	3	UK Core[1] II	3
		UK Core[1] III	3
STA 210 Making Sense of Uncertainty: Intro to Statistical Reasoning - UK Core VIII-	3	STA 291 Statistical Methods	3
		OR	
		STA 570 Basic Statistical Analysis	4
ABT 201 Scientific Method in Biotechnology (only after 30 hrs)	1	OR	
		STA 580 Biostatistics I	3
UK Core[1] I	3		
Total	16	Total	14-15

Fall year 3		Spring Year 3	
PHY 211 General Physics I	5	PHY 213 General Physics II	5
BCH 401G Fundamentals of Biochemistry	3	BIO 308 General Microbiology	3
ABT 360[3] Genetics	3	BIO 209 Introductory Microbiology Lab	2
ABT 301 Writing & Presentation in the Life Sci	2	SS[2] – 1 Specialty Support Course	3
UK Core[1] X	3	SS[2] – 2 Specialty Support Course	3
Total	16	Total	16

Fall year 4		Spring Year 4	
ABT 495 Experimental Methods in Biotechnology	3	ABT 460 Introduction to Molecular Genetics	3
ABT 395 Independent Study in Biotechnology	3-4	ABT 461 Introduction to Population Genetics	3
SS[2] – 3 Specialty Support Course	3	SS[2] - 5 Specialty Support Course	3
SS[2] – 4 Specialty Support Course	3	SS[2] – 6 Specialty Support Course	3
Elective 1	3	SS[2] – 6 Specialty Support Course	3
		Elective 2 (if necessary)	3
Total	15-16	Total	15-18

MINIMUM TOTAL NEEDED = 128 credit hours

[1]UK Core—for list of acceptable courses, check the UK 2011-2012 Bulletin pgs 91-94
[2]Specialty Support course—for list of acceptable courses, check the UK Bulletin pg 97 and check with your advisor
[3]BIO 304 (4hrs) can substitute for ABT 360 (3hrs)

updated 6/3/13

Agricultural Biotechnology Undergraduate Degree Program

Information Sheet for Academic Advisors

The Academic Advisor serves as a guide for undergraduate students as they develop their plan of study and helps the student develop a program which is specific to his/her interests.

Incoming freshmen students will be advised by a member of the ABT program (Chair, Director of Undergraduate Studies, Academic Advisor, or the program Academic Coordinator) during the summer and fall advising conferences. Each student will meet with a member of the ABT program on a one-to-one basis or in a small group setting. The student is free to request an individual advising session. During the Spring semester, Academic Advisors are generally assigned before advising and registration conferences. Transfer students will meet with the Director of Undergraduate Studies for the program for their first semester in the ABT program and will then be assigned to a permanent Academic Advisor the next semester. The student should meet with their Academic Advisor at least once a semester; however, some students may need more assistance than others. Sophomore Students are also required to submit to the Associate Dean for Instruction an official **Plan of Study** (http://www.uky.edu/Ag/Biotechnology/UK_Core_check_2013_14.doc) for their Junior and Senior years. Upper division transfer students can submit their **Plan of Study** during the first semester they are enrolled in the ABT program. Advisors and students are encouraged to use the online APEX system to track degree progress. The ABT administration will continue to help all students with finding part-time and summer jobs, career planning and general support for the degree.

Each student is required to perform an independent research project or internship. During the second or third year, the student should select a Faculty Research Mentor. It is crucial that the student selects a Research Mentor prior to enrollment in ABT 301. It is the student's responsibility to contact potential Research Mentors about project opportunities. The Academic Advisor and the ABT 301 course instructor can work closely with the student to ensure that they find a Research Mentor. The Research Mentor may or may not be the same as the Academic Advisor. The student, working closely with the Research Mentor, must write a research proposal for ABT 301, which will be reviewed and approved by the ABT 301 instructor. The approved research project will be verified the ABT 395/399 instructor. The student will conduct an independent research project or internship, prepare a written report, and make an oral presentation summarizing the project. Students should enroll for 2 to 4 hours of credit for ABT 395 or ABT 399 (pending approval) during the semester that they expect to complete their research project or internship. ABT 395 or ABT 399 can be taken for a maximum of 6 credits (pending approval).

ABT 301 Independent Research Proposal: Each student must complete an independent research proposal for ABT 301. With assistance from the Research Mentor, the student will write, revise and then present their research proposal during the semester. The ABT 301 syllabus is available at: http://www.uky.edu/Ag/Biotechnology/ABT301/ABT%20301%20syllabus_2013_revised.pdf. It is the responsibility of each student to identify a Research Mentor before enrolling in ABT 301. The ABT 301 course instructor will approve the research project and maintain records that the student's research proposal was approved.

ABT 395 Independent Research Project: Students can begin working on their project as soon as they have the consent of their research mentor. The research mentor should carefully monitor the student's activities to ensure that an appropriate level of effort is directed toward the completion of the project. Students should sign up for 2 to 4 hours of credit for ABT 395/399 during the semester that they expect to complete their research project. They may repeat the course so that a maximum of 6 hours of credit is earned for the project (pending approval by the ABT 395/399 instructor). The ABT 395/399 instructor will verify that the independent research project was approved by the ABT 301 course instructor.

Written Report: Written reports will be used to evaluate students' performance and for assignment of grades. The research mentor is required to send his/her approval of the written report to the ABT 395/399 course instructor. The written report will be graded as outlined in the ABT 395/399 Class Information. The ABT 395/399 Class Information is available at: http://www.uky.edu/Ag/Biotechnology/Classinfo395_399.htm.

Oral Report: At the end of the semester that the independent study is completed, an oral report summarizing the project will be presented at a meeting of ABT students and faculty. The oral report should last about 12 minutes. Oral reports are given on the last Tuesday or Thursday of the semester at 1:00 p.m. as outlined by in the ABT 395/399 Class Information. Oral reports will be used to evaluate student performance and for assignment of grades.

Grades: Grade assignment will be made by the instructor of ABT 395/399 as outlined in the ABT 395/399 Class Information.

Agricultural Biotechnology Undergraduate Degree Program

Information Sheet for Research Mentors

Each student in the Agricultural Biotechnology Program is required to perform an independent research project or internship. This project will be carried out under the direction of a Research Mentor. The Research Mentor can be any university faculty member who agrees to serve in this role and who has an active research program. The Mentor is selected by the individual student after consultation with their Academic Advisor and may or may not be the same as the Academic Advisor. Working closely with the Research Mentor, the student must write a research proposal, perform an independent research project or internship, prepare a written report, and make an oral presentation summarizing the research project. The Research Mentor is encouraged to inform students of available stipends for doing research projects, e.g., HHMI, NSF, etc.

The purpose of the project is to allow the student to gain experience in developing, performing and reporting an independent research project. This means that the student should be actively involved in the design and execution of the project and not simply an observer of laboratory activities. Emphasis should be on careful development of a research plan and a literature review, creating and testing hypotheses, and analyzing and reporting results. The student should have a project, or part of an ongoing project, that he/she can perform thoroughly and independently and is not just an extra set of hands on a graduate student's project. The project should teach the student how to design and set up an experiment, analyze the data, troubleshoot if necessary, and end up with a thorough understanding of why the experiment worked and what the results suggest. It is better for the student to understand a narrow area or technique thoroughly than to be involved in a broad area with less depth of knowledge.

ABT 301 Independent Research Proposal: Each student must complete an independent research proposal for ABT 301. With assistance from the Research Mentor, the student will write, revise and then present their research proposal during the semester. The ABT 301 syllabus is available at: http://www.uky.edu/Ag/Biotechnology/ABT301/ABT%20301%20syllabus_2013_revised.pdf. It is the responsibility of each student to select a Research Mentor before enrolling in ABT 301. The ABT 301 course instructor will approve the research project and maintain records that the student's research proposal was approved.

ABT 395 Independent Research Project: Students can begin working on their project as soon as they have the consent of their Research Mentor. The Research Mentor should carefully monitor the student's activities to ensure that an appropriate level of effort is directed toward the completion of the project. Students should sign up for 2 to 4 hours of credit for ABT 395/399 during the semester that they expect to complete their research project. They may repeat the course for a maximum of 6 hours of credit is earned for the project (pending approval by the ABT 395/399 instructor). The ABT 395/399 instructor will verify that the independent research project was approved by the ABT 301 course instructor.

Written Report: Written reports will be used to evaluate student performance and for assignment of grades. The Research Mentor must approve the written report submitted to the ABT 395/399 course instructor. The written report will be graded as outlined in the ABT 395/399 Class Information. The ABT 395/399 Class Information is available at: http://www.uky.edu/Ag/Biotechnology/Classinfo395_399.htm.

Oral Report: At the end of the semester during which the independent study is completed, an oral report summarizing the project will be presented at a meeting of ABT students and faculty. The oral report should last about 12 minutes. Oral reports are given on the last Tuesday or Thursday of the semester at 1:00 p.m. as outlined by in the ABT 395/399 Class Information. Oral reports will be used to evaluate student performance and for assignment of grades.

Grades: Grade assignment will be made by the instructor of ABT 395/399 as outlined in the ABT 395/399 Class Information.

Agricultural Biotechnology Undergraduate Degree Program

Information Sheet for Students

First Year:

Incoming freshmen students will be advised by a member of the ABT program (Chair, Director of Undergraduate Studies, Academic Advisor, or the program Academic Coordinator) during the summer and fall advising conferences. Each student will meet with a member of the ABT program on a one-to-one basis or in a small group setting. The student is free to request an individual advising session. During the Spring semester, Academic Advisors are generally assigned before advising and registration conferences. Transfer students will meet with the Director of Undergraduate Studies for the program for their first semester in the ABT program and will then be assigned to a permanent Academic Advisor the next semester. The student should meet with their Academic Advisor at least once a semester; however, some students may need more assistance than others. Sophomore Students are also required to submit to the Associate Dean for Instruction an official **Plan of Study** (http://www.uky.edu/Ag/Biotechnology/UK_Core_check_2013_14.doc) for their Junior and Senior years. Upper division transfer students can submit their **Plan of Study** during the first semester they are enrolled in the ABT program. Advisors and students are encouraged to use the online APEX system to track degree progress. The ABT administration will continue to help all students with finding part-time and summer jobs, career planning and general support for the degree.

Communications:

Communication between the faculty and students in the Agricultural Biotechnology program are usually transmitted through e-mail. Students are required to establish an e-mail address as soon as possible and subscribe to the Biotechnology Listserv. For more information, contact the Academic Coordinator, Esther Fleming at (859) 257-3263, (efleming@uky.edu) or in room S-227 Agricultural Science Ctr. North.

Second Year:

With the help of your permanent Academic Advisor, formulate your **Plan of Study** during your Sophomore year. Your plan will need to satisfy all UK Core, College and Program requirements. Students are also required to submit an official plan of study to the Associate Dean for Instruction by the end of the advising period of their second year. It is the student's responsibility to deliver the plan of study to the Associate Dean for Instruction. The Plan of Study is a graduation requirement for CAFE.

During your second year, identify an area of interest in which you would like to do your independent research project or internship.

Third and Fourth Year:

Independent Research Project or Internship: During your third year and before you enroll in ABT 301, identify a Research Mentor and an independent research project. Your Research Mentor may or may not be the same as your Academic Advisor. Your Academic Advisor and the course instructor of ABT 301 may work with you to help you find a Research Mentor. Enroll in ABT 395 or ABT 399, 2-4 credit hours, for the semester(s) in which you plan to complete your research project or internship.

Students enrolled in ABT 399, (internship option) will be required to complete a learning contract (http://www.uky.edu/careercenter/themes/happy/pdf/ukcc-internship-blank-contract.doc), which must be approved by the Academic Advisor, the Chair of the Steering Committee, a counselor from the career center and a representative of the sponsoring agency. The learning contract must be completed and approved before the internship is started.

ABT 301 Independent Research Proposal: Each student must complete an independent research proposal for ABT 301. With assistance from the Research Mentor, the student will write, revise and then present their research proposal during the semester. The ABT 301 syllabus is available at: http://www.uky.edu/Ag/Biotechnology/ABT301/ABT%20301%20syllabus_2013_revised.pdf. It is the responsibility of each student to identify a Research Mentor before enrolling in ABT 301. The ABT 301 course instructor will review the research project and maintain records that the student's research proposal was approved.

ABT 395 Independent Research Project: Students can begin working on their project as soon as they have the consent of their Research Mentor. The Research Mentor should carefully monitor the student's activities to ensure that an appropriate level of effort is directed toward the completion of the project. Students should sign up for 2 to 4 hours of credit for ABT 395/399 during the semester that they expect to complete their research project. They may repeat the course for a maximum of 6 hours of credit is earned for the project (pending approval by the ABT 395/399 instructor). The ABT 395/399 instructor will verify that the independent research project was approved by the ABT

301 course instructor. Information regarding ABT 395/399 can be found at: http://www.uky.edu/Ag/Biotechnology/Classinfo395_399.htm

Written Report: Written reports will be used to evaluate student performance and for assignment of grades. The Research Mentor must approve the written report submitted to the ABT 395/399 course instructor. The written report will be graded as outlined in the ABT 395/399 Class Information.

Oral Report: At the end of the semester during which the independent study is completed, an oral report summarizing the project must be presented at a meeting of ABT students and faculty. The oral report should last about 12 minutes. Oral reports are given on the last Tuesday or Thursday of the semester at 1:00 p.m. as outlined by in the ABT 395/399 Class Information. Oral reports will be used to evaluate student performance and for assignment of grades. Details for the oral report are given in the ABT 395/399 Class Information.

Grades: Grade assignment of the independent research project will be made by the instructor of ABT 395/399 as outlined in the ABT 395/399 Class Information. Grades will be determined by the faculty Research Mentor's evaluation of the student's research performance, the written report, the oral presentation and the student's compliance with course instructions.

Graduation:

The student should continue to work with his/her academic advisor to ensure a timely completion of their degree. The semester before you intend to graduate, you must schedule an appointment with Susan Skees, the director of Academic Services, to complete a degree audit and apply for graduation. The dates for these appointments are located at: http://www.ca.uky.edu/students/current/graduation_info.asp or by contacting the College of Agriculture Office of Academic Programs, N-8 Agricultural Science Center North, phone 257-3468 or 257-3469.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Howe, Daniel Keith	Professor
eRA COMMONS USER NAME (credential, e.g., agency login) DANIEL.HOWE	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Western Illinois University	B.S.	05/88	Biology
Western Illinois University	M.S.	05/90	Parasitology
Purdue University	Ph.D.	12/92	Molecular Parasitology
Washington University School of Medicine	Postdoc	01/93-06/99	Microbial Pathogenesis

A. Personal Statement

My research interests have focused on the genetics and molecular biology of apicomplexan parasites, with a particular emphasis on the two-host coccidian (i.e., *Sarcocystis neurona, Toxoplasma gondii,* and *Neospora* spp.). My research program over the past decade has been focused heavily on gaining genetic information for *S. neurona* and developing molecular tools to investigate this parasite. To that end, we have conducted a project to sequence and annotate the genome for *S. neurona*, and to generate transcriptome information for different developmental stages of the parasite.

B. Positions and Honors

Professional Appointments:

1993-1999 Postdoctoral Fellow, Department of Molecular Microbiology, Washington University School of Medicine, Laboratory of Dr. David Sibley

1999–2005 Assistant Professor, Department of Veterinary Science, M.H. Gluck Equine Research Center, University of Kentucky

2005-2012 Associate Professor, Department of Veterinary Science, M.H. Gluck Equine Research Center, University of Kentucky

2009-present Director of Graduate Studies, Department of Veterinary Science, M.H. Gluck Equine Research Center, University of Kentucky

2012-present Professor, Department of Veterinary Science, M.H. Gluck Equine Research Center, University of Kentucky

Other Professional Activities and Honors:

1999-2001 Ad hoc reviews (3), The Wellcome Trust

2001 Ad hoc review, NIH/NIAID Parasitology and Vector Biology Training Grant

2001-2003 Editorial Board, Journal of Eukaryotic Microbiology

2004-present Amerman Family Equine Research Endowment

2004 Invited Speaker, Meeting of the Am. College of Veterinary Internal Med., Minneapolis, MN

2004 Faculty Futures Award, University of Kentucky

2005 Ad hoc review, Maryland Sea Grant NSI, Oyster Disease Research Program

2006-2010 Editorial Board, Veterinary Parasitology

2007 Invited Speaker, 4th Annual Workshop of the European COST, Porticcio, France

2008	Invited Speaker, Meeting of the Am. College of Veterinary Internal Med., San Antionio, TX
2009	Presiding Officer, Annual Midwestern Conference of Parasitologists, Delaware, OH
2010-2012	Wethington Award, University of Kentucky
2010-present	Co-Editor-in-Chief, Veterinary Parasitology
2011	Ad hoc review, Maryland Industrial Partnerships Program
2012	Invited Speaker, Advances in Equine Neurological Diseases Symposium, Lexington, KY
2012	Invited Speaker, International Conference on Equine Infectious Diseases, Lexington, KY
2012-present	Editorial Board, Infection and Immunity
2013	Invited Speaker, International Meeting on Apicomplexan Parasites in Farm Animals, Kusadasi, Turkey

C. Peer-reviewed Publications (past 3 years):

1. Gautam, A.*, J.P. Dubey, W.J. Saville, and **D.K. Howe**. 2011. The SnSAG merozoite surface antigens of *Sarcocystis neurona* are expressed differentially during the bradyzoite and sporozoite life cycle stages. Veterinary Parasitology 183:37-42.

2. Dangoudoubiyam, S.*, J. B. Oliveira, C. Víquez, A. Gómez-García, O. González, J. J. Romero, O. C. H. Kwok, J. P. Dubey, and **D.K. Howe.** 2011. Detection of antibodies against *Sarcocystis neurona, Neospora* spp., and *Toxoplasma gondii* in horses from Costa Rica. Journal of Parasitology 97(3):522-524.

3. Yeargan, M.R.*, and **D.K. Howe.** 2011. Improved detection of equine antibodies against *Sarcocystis neurona* using polyvalent ELISAs based on the parasite SnSAG surface antigens. Veterinary Parasitology 176:16-22.

4. Furr, M., **Howe, D.,** Reed, S., and Yeargan, M*. 2011. Antibody coefficients for the diagnosis of Equine Protozoal Myeloencephalitis. Journal of Veterinary Internal Medicine 25:138-142.

5. Andrews, E.S., P.R. Crain, Y. Fu, **D.K. Howe**, and S.L. Dobson. 2012. Reactive Oxygen Species Production and *Brugia pahangi* Survivorship in *Aedes polynesiensis* with Artificial *Wolbachia* Infection Types. PLoS Pathogens 8(12): e1003075. doi:10.1371/journal.ppat.1003075.

6. Arias, M., M. Yeargan*, I. Francisco, S. Dangoudoubiyam*, P. Becerra, R. Sánchez-Andrade, A. Paz-Silva and **D.K. Howe.** 2012. Exposure to *Sarcocystis* spp. in horses from Spain determined by Western blot analysis using *Sarcocystis neurona* merozoites as heterologous antigen. Veterinary Parasitology 185:301-304.

7. Yeargan, M.R.*, C. Alvarado-Esquivel, J.P. Dubey, and **D.K. Howe.** 2013. Prevalence of antibodies to *Sarcocystis neurona* and *Neospora hughesi* in horses from Mexico. Parasite 20: doi:10.1051/parasite/2013029.

8. Reed, S.M., **D.K. Howe**, J.K Morrow, A. Graves, M.R. Yeargan*, A.L. Johnson, R.J. MacKay, W.J.A. Saville, and N.M. Williams. 2013. Accurate antemortem diagnosis of equine protozoal myeloencephalitis (EPM) based on detecting intrathecal antibodies against *Sarcocystis neurona* using the SnSAG2 and SnSAG4/3 ELISAs. Journal of Veterinary Internal Medicine 27:1193-1200. doi:10.1111/jvim.12158.

9. Andersen, U.V., **D.K. Howe**, S. Dangoudoubiyam*, N. Toft, C.R. Reinemeyer, E.T. Lyons, S.N. Olsen, J. Monrad, P. Nejsum, and M.K. Nielsen. 2013. SvSXP: A *Strongylus vulgaris* antigen with potential for prepatent diagnosis. Parasites and Vectors 6:84. doi:10.1186/1756-3305-6-84.

10. Awinda, P.O., R.H. Mealey, L.B.A. Williams, P.A. Conrad, A.E. Packham, K.E. Reif, J.F. Grause, A.M. Pelzel-McCluskey, C. Chung, R.G. Bastos, L.S. Kappmeyer, **D.K. Howe**, S.L. Ness, D.P. Knowles, and M.W. Ueti. Serum antibodies from a subset of horses positive for *Babesia caballi* by competitive ELISA demonstrate a protein recognition pattern not consistent with infection. Clinical and Vaccine Immunology 20(11):1752-1757. doi:10.1128/CVI.00479-13.

D. Research Support

Research Support (past 3 years):

USDA/CSREES #2009-65109-05918 Howe (PI) 2009-2013
Genome Sequence for the Apicomplexan *Sarcocystis neurona*
This project will sequence, annotate, and conducted phyogenomic analyses of the genome from *Sarcocystis neurona*, an apicomplexan parasite and the primary cause of equine protozoal myeloencephalitis.
Role: PI

Bill and Melinda Gates Foundation Grant Dobson (PI) 2007-2012
Supplemental Lymphatic Filariasis Vector Intervention in the South Pacific
The goal of this study is to develop and deliver tools based on *Wolbachia* to accomplish population suppression and/or replacement of *Aedes polynesiensis*, a major vector of filarial worms in large regions of the South Pacific
Role: Co-Investigator

USDA/CSREES Award Schardl (PI) 2008-2011
Advanced Genetics Technologies
This grant provided funds for pilot projects utilizing genomic technologies in the University of Kentucky's College of Agriculture.
Role: Co-Investigator

BIOGRAPHICAL SKETCH

Sharyn Elaine Perry
Department of Plant and Soil Sciences, University of Kentucky, 1405 Veterans Dr., 307 Plant Science Bldg., Lexington, KY 40546-0312
Tel.: 859-257-5020 ext. 80732; FAX: 859-257-7125; e-mail: sperr2@uky.edu

a. Professional Preparation

Institution	Major/Area	Degree	Year
Univ. of Michigan-Dearborn	Biochemistry	B.S.	1983-1987
Univ. of Wisconsin-Madison	Cell and Molec. Biol.	Ph.D.	1987-1993
Univ. of Wisconsin-Madison	Molecular Biology	Postdoc.	1993-1998

b. Appointments

2009-present	Co-director of Undergraduate Studies for the Agricultural Biotechnology Program
2004-present	Associate Professor, Dept. of Plant and Soil Sciences, University of Kentucky
1998-2004	Assistant Professor, Dept. of Plant and Soil Sciences, University of Kentucky
1997-98	Research Associate, Department of Botany, University of Wisconsin-Madison
1994-97	National Science Foundation Postdoctoral Research Fellow in Plant Biology, University of Wisconsin-Madison
1993-94	Postdoctoral Fellow, training program in *Arabidopsis* signal transduction, DOE/NSF/USDA Collaborative Research in Plant Biology, University of Wisconsin-Madison
1987-93	Graduate Research Assistant, Program in Cell and Molecular Biology, University of Wisconsin-Madison
1989	Teaching Assistant, Cellular Biology, University of Wisconsin-Madison
1987-90	National Institutes of Health pre-doctoral training fellowship, Program in Cell and Molecular Biology, University of Wisconsin-Madison
1985-87	Undergraduate Research Assistant, Univ. of Michigan-Dearborn.

c. Products (publications) – Partial list of most current and relevant to current work.

1. Zheng, Q., Y. Zheng and S.E. Perry (2013). AGAMOUS-Like15 Promotes Somatic Embryogenesis in Arabidopsis and Soybean in Part by Control of Ethylene Biosynthesis and Response. *Plant Physiology* **161**, 2113-2127.
2. Zheng, Q., Y. Zheng, and S.E. Perry (2013). Decreased *GmAGL15* Expression and Reduced Ethylene Synthesis may Contribute to Reduced Somatic Embryogenesis in a Poorly Embryogenic Cultivar of *Glycine max. Plant Signaling & Behavoir* **8**, e25422.
3. Wang, F. and S.E. Perry (2013). Identification of Direct Targets of FUSCA3, a Key Regulator of Arabidopsis Seed Development. *Plant Physiology* **161**, 1251-1264.
4. Nayak, N.R., A.A. Putnam, B. Addepalli, J.D. Lowenson, T.S. Chen, E. Jankowsky, S.E. Perry, R.D. Dinkins, P.A. Limbach, S.G. Clarke, and A.B. Downie (2013). An Arabidopsis ATP-Dependent, DEAD-Box RNA Helicase Loses Activity upon IsoAsp Formation but Is Restored by PROTEIN ISOASPARTYL METHYLTRANSFERASE. *The Plant Cell* **25**, 2573-2586.
5. Zheng, Y., and S.E. Perry. (2011). Chapter 16: Chromatin Immunoprecipitation to Verify or to Identify in Vivo Protein-DNA Interactions. In MIMB volume **754**, 277-291.
6. T.S. Chen, N. Nayak, S.M. Majee, J. Lowenson, K.R. Schäfermeyer, A.C. Eliopoulos, T.D. Lloyd, R. Dinkins, S.E. Perry, N.R. Forsthoefel, S.G. Clarke, D.M. Vernon, Z.S. Zhou,

T. Rejtar, and A.B. Downie (2010) Substrates of the *Arabidopsis thaliana* PROTEIN ISOASPARTYL METHYLTRANSFERASE1 Identified Using Phage Display and Biopanning. *Journal of Biological Chemistry, 285(48)* 37281-37292.
7. Zheng, Y., N. Ren, H. Wang, A.J. Stromberg and S.E. Perry (2009). Global Identification of Targets of the Arabidopsis MADS Domain Protein AGAMOUS-Like15. *The Plant Cell* **21**, 2563-2577.
8. Nakaminami, K., K. Hill, S.E. Perry, N. Sentoku, J.A. Long, and D.T. Karlson (2009). Arabidopsis Cold Shock Domain Proteins: Relationships to Floral and Silique Development. *Journal of Experimental Botany* **60**, 1047-1062
9. Hill, K., H. Wang, and S.E. Perry. (2008). A Transcriptional Repression Motif in the MADS Factor AGL15 is Involved in Recruitment of Histone Deacetylase Complex Components*. The Plant Journal* **53**, 172-185.
10. Thakare, D., W. Tang, K. Hill, and S.E. Perry. (2008). The MADS-Domain Transcriptional Regulator AGAMOUS-LIKE15 Promotes Somatic Embryo Development in Arabidopsis and Soybean. *Plant Physiology* **146**, 1663-1672.
11. Wang, H., L.V. Caruso, A.B. Downie, and S.E. Perry. (2004). The Embryo MADS-Domain Protein AGAMOUS-Like 15 Directly Regulates Expression of a Gene Encoding an Enzyme Involved in Gibberellin Metabolism. *The Plant Cell* **16**, 1206-1219.
12. Zhu, C., and S.E. Perry. (2005). Control of Expression and Autoregulation of *AGL15*, a Member of the MADS-box Family*. The Plant Journal* **41**, 583-594.
13. Tang, W., and S.E. Perry. (2003). Binding Site Selection for the Plant MADS Domain Protein AGL15: an *In vitro* and *In vivo* Study. *The Journal of Biological Chemistry* **278**, 28154-28159.
14. Harding, E.W., W. Tang, K.W. Nichols, D.E. Fernandez, and S.E. Perry. (2003). Expression and Maintenance of Embryogenic Potential is Enhanced Through Constitutive Expression of *AGAMOUS-Like 15*. *Plant Physiology* **133***,* 653-663*.*
15. Wang, H., W. Tang, C. Zhu, and S.E. Perry. (2002). A Chromatin Immunoprecipitation (ChIP) Approach to Isolate Genes Regulated by AGL15, a MADS-Domain Protein that Preferentially Accumulates in Embryos. *The Plant Journal* **32**, 831-843.

d. Synergistic Activities

1. Developed and disseminated an approach for chromatin immunoprecipitation (ChIP) in plants. Requests from over 80 laboratories world-wide for a detailed protocol and/or advice on ChIP have been honored.
2. Served as a Panel Member for USDA NRICGP/AFRI, 2003, 2005, 2006 and 2010 and for the NSF 2009, 2011 and 2013.
3. Participant in a National Science Foundation funded program "Girls in Science" as a mentor to encourage girls from Appalachia to consider STEM careers. Organizer for a “Girls in Research” workshop for 6th grade girls from Southeastern Kentucky on Cell Biology that had three sections: comparison of plant and animal cells that I ran, isolation of plant DNA (run by Dr. M. Goodin, Plant Pathology or Dr. A.B. Downie, Horticulture), and transformation of plants (run by Mr. C. Redmond or Ms. J. Prather, Plant & Soil Sci.). Developed and ran a workshop for 5th grade students from Lexington schools examining how plants respond to environmental cues. This is a collaboration with Raven Run Nature Sanctuary and involved 300 students total (in groups of 25) in 2011 and 2012.
4. Trained numerous students, postdoctoral scholars, and staff in microscopy techniques and use of equipment in the facility for microscopy (room 344 PSB).
5. Co-editor with Dr. Ling Yuan for Methods in Molecular Biology volume 754: Plant Transcription Factors: Methods and Protocols, Humana Press (J.M. Walker, Series Editor), 2011.

BIOGRAPHICAL SKETCH: Michael M. Goodin

A. Professional Preparation
1985-1989: Brock University, St. Catharines, Ontario, Canada.
1989-1995: The Pennsylvania State University, State College, Pennsylvania.
1995-June 31, 2002: Post-doctoral research fellow, University of California-Berkeley

B. Appointments

July 1, 2008 – present:
Associate Professor, Department of Plant Pathology, University of Kentucky.

July 1, 2002 – June 30, 2008:
Assistant Professor, Department of Plant Pathology, University of Kentucky.

C1. Five publications most relevant to this proposal

Ganesan, U., Bragg, J.N., Deng, M., Marr, S., Lee, M.Y., Qian., S., Shi, M., Kappel, J., Peters, C., Lee, Y., Goodin, M.M., Dietzgen, R.G., Li, Z., Jackson, A.O. (2013) Construction of a Sonchus Yellow Net Virus minireplicon: a step toward reverse genetic analysis of plant negative-strand RNA viruses. J Virol. 87:10598-10611.

Anderson, G., Wang, R., Bandyopadhyay, A., and Goodin, M. (2012) The nucleocapsid protein of *Potato yellow dwarf virus*: protein interactions and nuclear import mediated by a non-canonical nuclear localization signal Front. Plant Sci. doi: 10.3389/fpls.2012.00014

Martin, K.M., Dietzgen, R.G., Wang, R., and Goodin, M.M. (2012) Lettuce necrotic yellows cytorhabdovirus protein localization and interaction map, and comparison with nucleorhabdoviruses. J Gen Virol. 93:906-914.

Min, B-E., Martin, K., Wang, R., Tafelmeyer, P., Bridges, M., and Goodin, M. (2010) A host-factor interaction and localization map for a plant-adapted rhabdovirus implicates cytoplasm-tethered transcription activators in cell-to-cell movement. MPMI. 23:1420-1432

Bandyopadhyay, A., Kopperud, K., Anderson, G., Martin, K., and Goodin, M. (2010) An integrated protein localization and interaction map for Potato yellow dwarf virus, type species of the genus Nucleorhabdovirus. Virology. 402:61-71.

Martin, K., K. Kopperud, R. Chakrabarty, R. Banerjee. R. Brooks, and M. M. Goodin. **(**2009) Transient expression in *Nicotiana benthamiana* fluorescent marker line provides enhanced definition of protein localization, movement and interactions *in planta.* Plant J. 59:150-162 .

C2. Other significant publications
Kormelink, R., Garcia, M.L., Goodin, M., Sasaya, T., Haenni, A.L. (2011) Negative-strand RNA viruses: the plant-infecting counterparts. Virus Res. 162:184-202.

Goodin, M., Martin, K., and Kopperud, K. (2010) Bimolecular fluorescence complementation: Simultaneous determination of protein interaction and localization in plant cells In Principles and Practice of Advanced Technology in Plant Virology Ed. Aiming Wang

Goodin, M.M., Chakrabarty, R., Yelton, S., Martin, K., Clark, A., Brooks, R. (2007) Membrane and protein dynamics in live plant nuclei infected with Sonchus yellow net virus, a plant-adapted rhabdovirus. J Gen Virol. 88:1810-1820.

Ghosh, D., Brooks, R. E., Wang, R., Lesnaw, J., and Goodin, M.M. (2008) Cloning and subcelluar localization of the phosphoprotein and nucleocapsid proteins of *Potato yellow dwarf virus*, type species of the genus *Nucleorhabdovirus.* Virus Research. *135:26-35*

Chakrabarty, C., Banerjee, R., Chung, S-M., Farman, M., Citovsky, V., Hogenhout, S.A., Tzfira, T., and Goodin, M.M. (2007) pSITE Vectors for Stable Integration or Transient Expression of Autofluorescent Protein Fusions in Plants: Probing *Nicotiana benthamiana*-Virus Interactions. MPMI. 20:740-750

Deng, M., Bragg, J.N., Ruzin, S., Schichnes, D., King, D., Goodin, M.M., Jackson, A.O. (2007) Role of the sonchus yellow net virus N protein in formation of nuclear viroplasms. J Virol. 81:5362-5374.

Whitham, S. A., Yang, C., Goodin, M. M. (2006) Global impact: elucidating plant responses to viral infection. MPMI. 19:1207-1215.

Senthil, G., Liu, H., Puram, V.G., Clark, A., Stromberg, A., Goodin, M.M. (2005) Specific and common changes in *Nicotiana benthamiana* gene expression in response to infection by enveloped viruses. J Gen Virol. 86:2615-2625.

D1. Graduate and Post Doctoral Advising (present lab members only)
Gavin Anderson (Doctoral Candidate)
Chanyong Jang (Doctoral Candidate)

D2. Undergraduate Research Assistant Advising (present lab members only)
Kendall Holscher (freshman), Devin Henry (sophomore), Joseph Wells (sophomore)

E. Graduate and Post Doctoral Advisors
C. Peter Romaine, The Pennsylvania State University, Graduate Advisor
Andrew O. Jackson, University of California-Berkeley, Postdoctoral Advisor

F. Synergistic activities
1. Goodin currently advises six undergraduates enrolled in the University of Kentucky Agricultural Biotechnology (UK-ABT) B.S. Degree Program, for which he serves as Co-Director of Undergraduate Studies. As part of their requirements for graduation, students enrolled in this program must complete an internship in a research lab. Since many of the ABT students are from eastern Kentucky (Appalachia), their involvement in the research proposed above certainly contributes to building interest in science and technology careers among populations typically underrepresented in the sciences.

2. Goodin is an editor for Annual Review of Virology, Molecular Plant Pathology and Frontiers in Plant-Microbe Interactions and has also recently reviewed manuscripts submitted to the Journal of Virology, Journal of General Virology, Molecular Plant-Microbe Interaction, Molecular Plant Pathology, Plant Physiology, Plasmid and Virus Research.

G. **Collaborators and other Affiliations** (at University of Kentucky unless noted)
Judith Brown (UofA-Tucson), Vitaly Citovsky (SUNY), Ralf Dietzgen (DPI, Australia), Rebecca Dutch, Randy Dinkins (USDA ARS-FAPRU), Mark Farman, Kamal Gajendran (NCGR), Said Ghabrial, Richard Hardy (Indiana University), Saskia Hogenhout (John Innes Center), Arthur Hunt, Andrew Jackson (UC-Berkeley), Sophien Kamoun (Sainsbury Lab), Steve Lommel (NCSU), Reddy Palli, Sharyn Perry, Naidu Rayapati (WSU), David Rogers, Arnold Stromberg, Bruce Webb, Steve Whitham (ISU).

Luke A. Moe, Ph.D.
Assistant Professor
Department of Plant & Soil Sciences
University of Kentucky
Date Appointed: November 1, 2009
DOE: 75% research, 25% teaching

Plant Sciences Building, room 311
Lexington, KY 40546
e-mail: luke.moe@uky.edu
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fax: (859) 257-7125

EDUCATION

— 2005 Ph.D., Department of Biochemistry, University of Wisconsin, Madison, WI

— 1999 B.S., Biochemistry, Washington State University, Pullman, WA

RESEARCH POSITIONS

— Assistant Professor: Department of Plant & Soil Sciences, University of Kentucky (November 1, 2009-present)

— USDA NRI Postdoctoral fellow**:** Advisor: Jo Handelsman, Departments of Bacteriology and Plant Pathology, University of Wisconsin-Madison (2006-2009)

— Postdoctoral researcher: Advisor: Rachel N. Austin, Department of Chemistry, Bates College, Lewiston, ME. Research performed in the lab of Brian G. Fox, UW-Madison (2006)

— Graduate research assistant: Advisor: Brian G. Fox, Department of Biochemistry, University of Wisconsin-Madison (1999-2005)

RESEARCH PROJECTS (Total funds at UK: $1,279,816)

Research in the Moe laboratory has been largely focused in the following areas:

— Structure and function of plant-associated microbial communities

— Genetics and biochemistry of model soil-dwelling and plant-associated bacteria

— Non-conventional environmental reservoirs for antibiotic resistance

Funded: nationally competitive and industrial grants (Total funds: $1,164,816)

— "*Plant-microbe communication in the* Medicago truncatula *rhizosphere: functional metagenomics, biochemistry, and community analysis"* USDA NIFA AFRI foundational program (program area: Microbial Communities in Soil) ($452,000 for 4 years duration, 2011-2015); **Luke Moe (PI)**, Seth DeBolt (Co-PI, UK Horticulture) and David McNear (Co-PI, UK Plant & Soil Sciences)

— *"The role of endophytic bacteria in TSNA accumulation"* An international corporation ($30,000 total for three years duration) Investigators: Colin Fisher, **Luke Moe**, Anne Jack, and Lowell Bush (UK Plant & Soil Sciences and KTRDC)

— *"A first look at the tobacco microbiome"* An international corporation ($227,500 total for three year duration, 2013-2016) **Luke Moe (PI)**, Co-investigators Anne Jack, Huihua Ji, Lowell Bush (UK Plant & Soil Sciences and KTRDC)

— "*Isolation and improvement of tobacco plant-associated microbes for the production of vanillin, organic acids and other flavor compounds*" An international corporation ($455,316 for three years duration 2013-16); Ling Yuan (PI, UK Plant & Soil Sciences), **Luke Moe (co-PI)**; (Approved, waiting for contract finalization)

Funded: regional grants (Total funds: $115,000)

— "*Metagenomic analysis of microbial urea transformation in soil"* Kentucky Water Resources Research Institute (Sponsored by US Geological Survey) ($5,000 for 1 year duration, 2011-2012); **Luke Moe (PI)**, Mark Coyne (Co-PI, UK Plant & Soil Sciences)

— "*Bacteria and bioethanol fermentation: characterizing the impact of bacterial contaminants and bacterial community structure on bioethanol fermentations across the US"* Kentucky Science and Engineering Foundation ($90,000 for two years duration, 2011-2013); **Luke Moe (PI)** Pat Heist (Co-PI, Ferm Solutions, Inc., Danville, KY)

— *"Harm reduction through enzymatic denitrosation of tobacco-specific ntirosamines"* Kentucky Tobacco Research and Development Center, 2012-2013 ($20,000 for 1 year duration**); Luke Moe (PI)**, Ling Yuan (Co-PI, UK Plant & Soil Sciences)

Funded/Approved: other proposals

— USDA NIFA Hatch proposal: "*Functional metagenomic analysis of soil-dwelling and plant-associated microbial communities*" has been approved (7/1/2011-6/30/2016)

— "*A Thermo Scientific BioMate 3 UV/Vis spectrophotometer for the ABT teaching laboratory*" UK College of Agriculture Teaching Incentive & Improvement Fund (TIIF) funds ($4,200 total funds).

Funded: prior to starting at UK

— "*Functional metagenomics of beta-lactamases and lactonases from topsoil on Wisconsin dairy farms"* USDA-NRI postdoctoral fellowship ($120,000 for two years duration, 2006-2008)

Proposals Submitted (Pending or Declined):

As PI:

— "*A functional metagenomic approach to identify biological recognition elements for biosensing applications"* Submitted to the NSF (Biosensors program) 3/3/2011 ($215,866 requested for 3 years duration); Declined 7/7/2011

— "*Microbial ecology of bioethanol fermentation*" Pre-proposal submitted to the DOE (Early Career Research Program) 9/1/2011($750,000 requested for 5 years duration); Not selected for full submission 10/3/2011.

— "*D-Amino acids as currency in the rhizosphere*" Submitted to the NSF (CAREER) 7/25/2011 ($622,764 requested for 5 years duration); Declined 12/10/2011.

— "*Expanding the explosives biosensing toolkit: identifying genetic circuits responsive to explosives through functional metagenomics*" Submitted to the Office of Naval Research 12/21/2011 ($510,000 requested for 3 years duration); Declined 3/28/2012.

— "*Functional genomics and metagenomics of D-amino acid metabolism among rhizosphere-dwelling bacteria*" Submitted to the NSF (CAREER) 7/23/2012 ($869,401 requested for 5 years duration); Declined 11/30/2012.

— "*Amino acids as a driver of rhizosphere microbial community structure and function*" Submitted to USDA NIFA AFRI (Understanding Plant-Associated Microorganisms and Plant-Microbe Interactions) 2/18/2013 ($500,000 requested for 4 years duration); Declined 9/27/2013

As Co-PI

— "*A versatile biomimetic membrane system for sensing and separation"* Pre-proposal submitted to NASA KY EPSCoR 1/9/2012 ($675,000 requested for 3 years) PI Yinan Wei (UK Chemistry); Co-PIs Dibakar Bhattacharya (UK Chemical Engineering), Yuguang Cai (UK Chemistry), Bruce Hinds (UK Materials Engineering), Luke Moe (UK Plant & Soil Sciences), Andrew Pohorille (NASA Ames Research Center); Not selected for full submission.

— "*Linking chronic exposure of environmental contaminants to gut microbiome composition and disease*" Pre-proposal submitted to the University of Kentucky Center for Clinical and Translational Science 2013 Pilot Grant Program ($50,000 requested for 18 months) 8/16/2013; (PIs) Dave McNear (UK Plant & Soil Sciences), Phillip Kern (UK Endocrinology and Molecular Medicine), (Co-PIs) Barnhard Hennig (UK Animal Sciences), Luke Moe (UK Plant & Soil Sciences); Pending

Publications (Since UK appointment):

*Note: * = graduate student in my lab, underline = postdoc or research staff in my lab, † = ABT undergraduate*

1. *Radkov, A.D., and **Moe, L.A**. (2013) "Amino acid racemization in *Pseudomonas putida* KT2440" *Journal of Bacteriology* (in press)
2. **Moe, L.A.** (2013) "Amino acids in the rhizosphere: from plants to microbes" *American Journal of Botany* **100**, 1692-1705. ***(Invited Review)***
3. Donato, J.J., **Moe, L.A.**, Converse, B.J., Smart, K.D., Berklein, F.C., McManus, P.S., and Handelsman, J. (2010) "Metagenomics reveals antibiotic resistance genes encoding predicted bifunctional proteins in apple orchard soil" *Applied and Environmental Microbiology* **76**, 4396-4401.

Submitted and under review:

4. Murphree, C.A., Heist, E.P., and **Moe, L.A.** "Antibiotic resistance among cultured

bacterial isolates from bioethanol facilities across the United States“ submitted to *Current Microbiology*

5. Murphree, C.A., *Li, Q., Heist, E.P., and **Moe, L.A.** “A multiple antibiotic-resistant *Enterobacter cloacae* strain isolated from a bioethanol fermentation facility” submitted to *Microbial Drug Resistance*
6. *Szoboszlay, M., †Lambers, J., †Chappell, J., Kupper, J.V., **Moe, L.A.**, and McNear, D.H., Jr. “Getting to the root of corn domestication: comparing root system architecture and rhizosphere processes of Balsas teosinte and domesticated corn cultivars” submitted to *Soil Biology and Biochemistry*

In preparation (listed projects ≥50% complete):

1. **Moe, L.A**., Allen, H.K, *An, R., Handelsman, J. “Antibiotic resistance in *E. coli* through acquisition of a transcription factor that modulates expression of a native antisense RNA: the curious case of the BLR16 metagenomic clone”
   — Work for this paper is ~80% finished
2. Law, A.D, Fisher, C., Jack, A., Bush, L.P., **Moe, L.A**. “Correlation between tobacco cure conditions, tobacco-specific nitrosamine content, and cured leaf microbial community”
   — Work for this paper is ~75% finished
3. *An, R., **Moe, L.A**. “Regulation of PQQ-dependent glucose dehydrogenase activity in the model rhizosphere-dwelling bacterium *Pseudomonas putida* KT2440”
   — Work for this paper is ~50% finished
4. *Radkov, A.D., **Moe, L.A.** “A multifunctional amino acid racemase involved in D-amino acid synthesis for peptidoglycan and D-amino acid catabolism”
   — Work for this paper is ~50% finished
5. White, A., *Szoboszlay, M., DeBolt, S., **Moe, L.A**., McNear, D.H., Jr., “Mutations in *Medicago truncatula* for plant symbioses alter the metabolomic profile of root exudates”
   — Work for this paper is ~50% finished
6. Law, A.D., Su, A., Moe, L.A. “Bacterial degradation of tobacco-specific nitrosamines”
   — Work for this paper is ~50% finished

Publications (Prior to UK appointment):

1. Allen, H.K., **Moe, L.A**., Rodbumrer, J., Gaarder A. and Handelsman, J. (2009) “Functional metagenomics reveals diverse β-lactamases in a remote Alaskan soil” *The International Society for Microbial Ecology Journal* 3, 243-251
2. Rozhkova-Novosad, E.A., Chae, J.-C., Zylstra, G.J., Bertrand, E.M., Alexander-Ozinskas, M., Deng, D., **Moe, L.A.**, van Beilen, J.B., Danahy, M., Groves, J.T., and Austin, R.N. (2007) “Profiling mechanisms of alkane hydroxylase activity *in vivo*

using the diagnostic substrate norcarane" *Chemistry & Biology* 14, 165-172.

3. Elsen, N.L., **Moe, L.A.**, McMartin, L.A., and Fox, B.G. (2007) "Redox and functional analysis of the Rieske ferredoxin component of the Toluene 4-Monooxygenase" *Biochemistry* 46, 976-986.
4. **Moe, L.A.**, McMartin, L.A., and Fox, B.G. (2006) "Component interactions and implications for complex formation in the multicomponent Toluene 4-Monooxygenase" *Biochemistry* 45, 5478-5485.
5. **Moe, L.A.**, Bingman, C.A., Wesenberg, G.E., Phillips, G.N., Jr., and Fox, B.G. (2006) "Structure of T4moC, the Rieske-type ferredoxin component of Toluene 4-Monooxygenase" *Acta Crystallographica section D – Biological Crystallography* 62, 476-482.
6. **Moe, L.A**. and Fox, B.G. (2005) "Oxygen-18 tracer studies of enzyme reactions with radical/cation diagnostic probes" *Biochemical and Biophysical Research Communications* 338, 240-249.
7. Bertrand, E., Sakai, R., Rozhkova-Novosad, E., **Moe, L.**, Fox, B. G., Groves, J. T., and Austin, R. N. (2005) "Reaction mechanisms of non-heme diiron hydroxylases characterized in whole cells" *Journal of Inorganic Biochemistry* 99, 1998-2006.
8. Kemner, K. M., Kelly, S. D., O'Loughlin, E. J., Khare, T., **Moe, L. A.**, Fox, B. G., Donnelly, M. I., Londer, Y., Schiffer, M., and Giometti, C. S. (2005) "XRF and XAFS analysis of electrophoretically isolated nondenatured proteins" *Physica Scripta* T115, 940-942.
9. **Moe, L. A.**, Hu, Z. B., Deng, D. Y., Austin, R. N., Groves, J. T., and Fox B. G. (2004) "Remarkable aliphatic hydroxylation by the diiron enzyme Toluene 4-Monooxygenase in reactions with radical or cation diagnostic probes norcarane, 1,1-dimethylcyclopropane and 1,1-diethylcyclopropane" *Biochemistry* 43, 15688-15701.
10. Skjeldal, L, Peterson, F. C., Doreleijers, J. F., **Moe, L. A.**, Pikus, J. D., Westler, W. M., Markley, J. L., Volkman, B. F., and Fox, B. G. (2004) "Solution structure of T4moC, the Rieske ferredoxin component of the Toluene 4-Monooxygenase complex" *Journal of Biological Inorganic Chemistry* 9, 945-953.
11. **Moe, L. A**. and Fox, B. G. "Rapid mixing techniques". *Ergito: Life Science Textbooks on the WWW*, 2004. Virtual text. 10 May, 2005. <http://www.ergito.com/main-lcd.jsp?bcs=TECH.12>
12. Luo, W., **Moe, L. A.**, Skjeldal, L., Pikus, J. D., Markley, J. L., and Fox, B. G. (2001) "Letter to the Editor: Assignment of H-1, C-13, and N-15 NMR signals from Toluene 4-Monooxygenase Rieske ferredoxin in its oxidized state" *Journal of Biomolecular NMR* 21, 73-74.

Peer-Reviewed Book Chapter:

Moe, L.A., McMahon, M.D. and Thomas, M.G. "Functional metagenomics as a technique for the discovery of novel enzymes and natural products." *Enzyme Technologies for Drug Discovery and Development, Volume I: Chemical Biology of*

Enzymes for Biotech and Pharmaceutical Applications. Eds. J.R. McCarthy, H.C. Yang and W.K. Yeh. Wiley, 2010

Teaching and Advising

Courses taught:

Fall 2010: ABT 495 "Experimental techniques in biotechnology"; 4 credits; 15 students. I team-taught this course with Professor Joe Chappell (UK Plant & Soil Sciences). I was responsible for 50% of the course.

Course #	Section #	**Course Mean**	Dept. Course Mean	Univ. Course Mean	College Course Mean	**Teaching Mean**	Dept. Teaching Mean	Univ. Teaching Mean	College Teaching Mean
ABT 495	001	**3.5**	3.5	3.3	3.4	**3.5**	3.6	3.4	3.5

Fall 2011: ABT 495 "Experimental techniques in biotechnology"; 4 credits; 21 students. I was fully responsible for the course (100%).

Course #	Section #	**Course Mean**	Dept. Course Mean	Univ. Course Mean	College Course Mean	**Teaching Mean**	Dept. Teaching Mean	Univ. Teaching Mean	College Teaching Mean
ABT 495	001	**3.5**	3.6	3.3	3.4	**3.7**	3.7	3.4	3.5

Spring 2012: ABT 460 "Introduction to molecular genetics"; 3 credits; 16 students. I was fully responsible for the course (100%)

Course #	Section #	**Course Mean**	Dept. Course Mean	Univ. Course Mean	College Course Mean	**Teaching Mean**	Dept. Teaching Mean	Univ. Teaching Mean	College Teaching Mean
ABT 460	001	**3.2**	3.4	3.3	3.4	**3.1**	3.4	3.4	3.5

Fall 2012: ABT 495 "Experimental techniques in biotechnology"; 4 credits; 16 students. I was fully responsible for the course (100%).

Course #	Section #	**Course Mean**	Dept. Course Mean	Univ. Course Mean	College Course Mean	**Teaching Mean**	Dept. Teaching Mean	Univ. Teaching Mean	College Teaching Mean
ABT 495	001	**3.1**	3.4	3.3	3.4	**3.1**	3.6	3.4	3.4

Fall 2013: ABT 495 "Experimental techniques in biotechnology"; 4 credits; 21 students. I am fully responsible for the course (100%). Teaching evaluations are not yet available.

Graduate Students Advised:

Graduate students in my laboratory:
— Atanas Radkov (Plant Physiology PhD student, 2010-present)
— Ran An (Soil Science PhD student, 2011-present)
— Marton Szoboszlay (Soil Science PhD student, 2011-present)
— Qing Li (IPSS MS student, 2012-present)

Graduate student committees (in addition to the students in my lab):
— Qian Chai (Chemistry)
— Derek Law (Geography)
— Shuang Liu (Soil Science)
— Linliang Yu (Chemistry; outside examiner)
— Matthew McErlean (Pharmaceutical Sciences)
— Zheng Cui (Pharmaceutical Sciences)

Postdoctoral scholars advised:
— Dr. Jeanne Rasbery (August 1, 2010—July 31, 2012)
— Dr. Alison White (shared with McNear lab, March 1, 2013—present)
— Dr. Muhammad Saleem (September 1, 2013—present)

Undergraduate students advised:
— I have been academic advisor for 11 Agricultural Biotechnology (ABT) students
— I have participated in summer academic advising for incoming ABT freshman during the summers of 2011, 2012, and 2013
— I have had 4 ABT students perform research in my lab

Service/Outreach:

— Manuscript reviewer: *Applied and Environmental Microbiology*, *Current Opinion in Microbiology*, *Plant and Soil, Trends in Biotechnology, Journal of Hazardous Materials*
— *Ad hoc* reviewer for *Kaleidoscope*, the UK undergraduate research journal
— Member of the following UK Plant & Soil Sciences departmental committees: (2010-2011) social committee, web page committee (2011-2012) plant biology seminar sub-committee, web page committee (2012-2013) web page committee
— Member of the coordinating committee for the ABT major at UK (2011-2014)
— I have also performed a variety of service-related roles for ABT including representing ABT at the Institute for Future Agricultural Leaders (IFAL) luncheon (2011, 2012), serving as the faculty advisor for the ABT club, and serving as the advisor for an ABT student's EXP396 course during the Fall 2013 semester
— I initiated and have organized the Soil Microbiology Interest Group (SMIG) from May 2012 until present
— Member of the *ad hoc* committee to write the job description for the Jason Unrine position

- *Ad hoc* reviewer for a departmental Hatch proposal
- I developed and ran an interactive lab exercise with 19 visiting KY Governor's scholars (6/18/13) entitled "assessing the impact of *CDO* gene mutations on the function of the CDO enzyme"
- Non-research, service-related presentations include:
    - "Life at the confluence of molecular biology, agriculture, and environmental science" Presentation to students in ABT 201 (Fall 2010)
    - "Metagenomics: everybody's doing it" Presentation to students in a graduate-level chemistry class (CHE 776) at UK (Spring 2011)
    - "Culture-independent analysis of microbial communities: what, why, how?" Presentation at the UK SMIG (Spring 2012)
    - Two separate presentations to the Floyd County Early College Academy and two Big Sandy Community and Technical College biology courses in Prestonsburg, KY (Fall 2012) describing opportunities available for students in the UK College of Agriculture

Professional Development

Invited research presentations (since UK appointment):

1. Invited speaker, Department of Microbiology, Miami University, Oxford, OH (October 12, 2011)
2. Invited speaker, Botanical Society of America meeting, Columbus, OH, July 10, 2012
3. Invited speaker, University of Kentucky Natural Products Consortium, Lexington, KY, August 16, 2012

Meetings attended (since UK appointment):

1. Emerging Frontiers in Rhizosphere Science workshop, March 16-17, 2011, Warrenton, VA
2. Plant and Animal Genome XX, January 14-18, 2012, San Diego, CA
3. American Society for Microbiology (ASM) annual meeting, June 16-19, 2012, San Francisco, CA
4. Botanical Society of America annual meeting, July 7-11, 2012, Columbus, OH
5. Kentucky Innovation and Entrepreneurship Conference, Louisville, KY, June 1, 2012
6. University of Kentucky Natural Products Consortium, Lexington, KY, August 16, 2012
7. ASA-CSSA-SSSA annual meeting, October 21-24, 2012, Cincinnati, OH
8. KY-TN regional ASM meeting, October 26-27, 2012, Maryville, TN
9. USDA NIFA AFRI Microbial Programs Awardee meeting, August 7-8, Washington, DC
10. University of Kentucky Natural Products Consortium, Lexington, KY, August 15, 2013
11. Kentucky Innovation and Entrepreneurship Conference, Lexington, KY August 29, 2013
12. 5th Argonne Soil Metagenomics Conference, Bloomingdale, IL, October 2-4, 2013

I. PERSONAL DATA

Name: Robert L. Houtz

Address: Department of Horticulture
401D Plant Science Building
1405 Veterans Drive
University of Kentucky, Lexington, KY 40546-0312
Phone: (859)257-1982 (day); (859)527-3850 (evening)

II. EDUCATION

Doctorate of Philosophy, 1984

Institution: Michigan State University, East Lansing, MI 48824
Major: Horticulture
Dissertation Title: Stimulation of Growth and Photosynthetic Carbon Metabolism in *Chlamydomonas reinhardtii* with Triacontanol

Master of Science, 1980

Institution: Michigan State University, East Lansing, MI 48824
Major: Horticulture
Thesis Title: Development and Characterization of an *In Vitro* System Responsive to 1-Triacontanol

Bachelor of Science (*magna cum laude*), 1977

Institution: University of Florida, Gainesville, FL 32611
Major: Horticulture

III. PROFESSIONAL EMPLOYMENT

Professor and Chair, Department of Horticulture, University of Kentucky, (60% research, 20% teaching, 20% extension), May 1, 2009-present.

Professor of Horticulture, University of Kentucky, Department of Horticulture, (70% research, 20% teaching, 10% administration), July 1, 1999-2009

Associate Professor of Horticulture, University of Kentucky, Department of Horticulture and Landscape Architecture, (85% research, 15% teaching), December 1, 1990-June 30, 1999

Assistant Professor of Horticulture, University of Kentucky, Department of Horticulture and Landscape Architecture, (90% research, 10% teaching), January 1, 1985 - November 30, 1990

Graduate Research Assistant, Michigan State University, Department of Horticulture, September 1977 - September 1984

IV. RESEARCH

Research Area: Structure/function studies and post-translational modifications in ribulose-1,5-bisphosphate carboxylase/oxygenase ; Chloroplast-localized co- and post-translational protein processing; Enzymology of SET domain protein N-methyltransferases. Functional significance of calmodulin methylation.

Significant Research Accomplishments:

- Provided evidence for the necessity of the N-terminal region of the large subunit of ribulose bisphosphate carboxylase/oxygenase for catalytic activity and identified this same region as the location of catalytic-dependent, conformational changes.

- Discovered all of the known post-translational modifications in the large subunit of ribulose bisphosphate carboxylase/oxygenase, including N-terminal removal of Met-1 and Ser-2, acetylation of Pro-3, and methylation of Lys-14.

- Provided the first evidence for species diversity in the post-translational modifications of the large subunit of ribulose bisphosphate carboxylase/oxygenase.

- Discovered the chloroplast-localized enzymatic activity responsible for one of the post-translational modifications in the large subunit of ribulose bisphosphate carboxylase/oxygenase.

- Provided the first reported DNA and protein sequence for a protein (lysine) $^{\prime}$N-methyltransferase enzyme.

- Discovered chloroplast-localized eukaryotic peptide deformylase

- Provided one of the first structural determinations of a SET domain protein methyltransferase.

- Demonstrated the potential commercial utility of peptide deformylase and peptide deformylase inhibitors as a new platform for selectable marker and broad-spectrum herbicide technology.

- Discovered the DNA and protein sequence for calmodulin lysine methyltransferase.

Patents:

Patent pending - Nucleotide and Amino Acid Sequences for Calmodulin Protein Methyltransferase, Inventor: Robert L. Houtz, Co-Inventors, Roberta Magnani, and Lynnette Dirk, U.S. Application No. 12/757,388 filed April 9, 2010.

Crystallization and Structure of a Plant Peptide Deformylase, Inventor: Robert L. Houtz, Co-Inventors, David Rodgers, Lynnette Dirk, and Mark Williams. Patent # 7,445,923 - issued November 4, 2008

U.S. Provisional Application Serial No. 60/468,966 - A Modified Rubisco Large Subunit $^{\varepsilon}$N-methyltransferase Useful for Targeting Molecules to the Active-site Vicinity of Ribulose-1, 5-Bisphosphate - Inventor Robert L. Houtz - Filed May 7, 2004.

Inhibitors of Plant Peptide Deformylase for Use as Broad-Spectrum Herbicides. Inventors Robert L. Houtz, Lynnette Dirk, and Mark Williams. Patent # 6,730,634 - issued May 4, 2004

Nucleotide sequence of cDNAs encoding Ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit $^{\prime}$N-methyltransferase from Spinach and method of inactivating Ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit $^{\prime}$N-methyltransferase activity. Patent #5,908,972 - issued June 1, 1999.

Nucleotide sequence of the gene for Ribulose-1,5-bisphosphate carboxylase/ oxygenase large subunit $^{\prime}$N-methyltransferase from tobacco. Continuation of patent below. Patent #5,866,394 - issued February 2, 1999.

Nucleotide sequence of a cDNA encoding for Ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ˈN-methyltransferase. Patent #5,723,752 - issued 3/15/98.

Grants:

06/09 – 07/13 Special Appropriations Grant, USDA NIFA, non-competitive, PI: R. Houtz, Crop Diversification and Biofuel Research and Education, $978,052.00

Date	Agency		Title	Duration	Amount	Status
Nationally Competitive - Extramural						
07/03	DOE OER Basic Energy Science Energy Bioscience (currently in 2 yr extension with $50,000 new funds)	PI: **R. Houtz** Co-PI: L. Dirk	Mechanism and Significance of Post-Translational Modifications in the Large and Small Subunits of Ribulose Bisphosphate Carboxylase/Oxygenase	4 yrs	$380,000.	Funded 7/03-6/08
07/02	NSF (currently in 2 yr no cost extension,	PI: **R. Houtz**, Co-PIs: L. Dirk M. Williams and A. Francis-Miller	Chloroplast-localized N-terminal protein processing by peptide deformylase	3 yrs	$300,000.	Funded 1/03-12/08
7/98	DOE OER Basic Energy Science Energy Bioscience (renewal)	PI: R Houtz Co-PI: none	Mechanism and Significance of Post-Translational Modifications in the Large and Small Subunits of Ribulose Bisphosphate Carboxylase/Oxygenase	3 yrs	$264,255	Funded 1/99-12/02
6/95	DOE OER Basic Energy Science Energy Bioscience (renewal)	PI: R Houtz Co-PI: none	Mechanism and Significance of Post-Translational Modifications of Ribulose Bisphosphate Carboxylase/Oxygenase	3.5 yrs	$264,119	Funded 6/95-12/98
6/92	USDA/ARS Cooperative Agreement	Co-PIs: R Houtz and S Crafts-Brandner	A Combination of Nuclear and Chloroplast Factors Determines Protein Stability in Tobacco Chloroplasts	2 yrs	$37,438	Funded 7/93-6/95
6/91	DOE Competitive Grants Program Division of Energy Biosciences	PI: R Houtz Co-PI: none	Mechanism and Significance of Post-Translational Modifications in the Large Subunit of Ribulose Bisphosphate Carboxylase/Oxygenase	3 yrs	$269,000	Funded 7/92-6/95
12/88	USDA Competitive Grants Program (Photosynthesis)	PI: R Houtz Co-PI: none	Mechanism and Significance of Post-Translational Modifications in the Large Subunit of Ribulose Bisphosphate Carboxylase/Oxygenase	2 yrs	$100,000	Funded 7/89-6/91

Date	Agency		Title	Duration	Amount	Status
Nationally Competitive - Extramural - Equipment						
1/01	NSF EPSCOR, Major Research Equipment Grant	PI: T Vanaman Co-PI: R Houtz, D Rodgers, T Creamer, P Speilman, M Oliveira	Center for Proteomics	3 yrs	$1,270,033	Funded 1/02-12/05
Competitive - Internal - Equipment						
5/96	UK, Major Research Equipment Grant		IAsys Optical Biosensor System (I was the lead PI on this application which had 7 other Co-PIs)		$87,035	Funded
9/89	UK, Major Research Equipment Grant		Low Pressure Liquid Chromatography System		$4,550	Funded
9/88	UK, Major Research Equipment Grant		High Performance Liquid Chromatography System		$6,780	Funded
9/87	UK, Major Research Equipment Grant		Ultra-Low Freezer, Liquid Scintillation Counter		$18,450	Funded
Competitive – Internal/local – Projects						
10/07	KSEF	PI: **R. Houtz** Co-PIs: MA Williams, Horticulture	Isolation and Identification of Plant-Specific Peptide Deformylase Inhibitors from Soil Micro-organisms for Use as Broad-Spectrum Herbicides and Selectable Markers	1 yr	$19,976	Funded 10/07-09/08
10/06	UK NPA (Natural Products Alliance)	PI: **R. Houtz** Co-PIs: MA Williams, Horticulture; R B Grossman, Chemistry; EM D'Angelo, Plant and Soil Science; and DW Rodgers, Biochemistry	Isolation and Identification of Plant-Specific Peptide Deformylase Inhibitors from Soil Micro-organisms for Use as Broad-Spectrum Herbicides and Selectable Markers.	2 yr	$40,000	Funded 01/07-12/08
11/04	KTRDC	PI: **R. Houtz**	Development and Utilization of Rubisco LSMT as a Molecular Vehicle for Targeting Enzymes to Rubisco	2 yrs	$100,000.	Funded 06/05-07/07
7/02	USDA New Crop Opportunities	PI: R Houtz Co-PI: B Rowell	Evaluation of High-Tunnels as a Seasonal Extending Technology	3 yrs	$60,020	Funded 7/02-6/05

Date	Agency		Title	Duration	Amount	Status
7/01	KTRDC	PI: M Williams Co-PI: R Houtz	Peptide Deformylase in Tobacco: A Novel Herbicide Target Amenable to Genetically Engineered Tolerance	2 yrs	$103,256	Funded 7/01-6/03
6/96	UK, Office of the Vice Chancellor for Research & Graduate Studies		Member, Plant Biotech-nology Initiative (joint proposal, majority effort held by Co-Chairs: Maelor. Davies, Director, Tobacco & Health Research Institute; and Dr. George Wagner, Agronomy.)	2 yrs	$100,000	Funded
Internal						
8/02	Office of the Vice President for Research	PI: R Houtz	Bridge Funding for graduate research assistantship stipends	1 yr	$18,000	Funded
Hatch Projects						
7/02-7/07			Mechanism and Signifi-cance of Post-Trans-lational Modifications in the Large and Small Subunits of Ribulose Bisphosphate Carboxylase/Oxygenase			Approved
7/95-6/00			Mechanism and Signifi-cance of Post-Trans-lational Modifications in the Large and Small Subunits of Ribulose Bisphosphate Carboxylase/Oxygenase			Approved
7/90-6/95			Influence of Lys-14 methylation of stability of Rubisco LS			Approved
7/85-6/90			Relationships among light, photosynthetic CO_2 assimilation, and ribulose-1,5-bisphosphate carboxylase			Approved
Non-Competitive						
7/98-8/01	Monsanto Corp		Construction and Evaluation of Transgenic Wheat and Maize Plants Expressing Full-Length and Truncated Forms of Pea Rubisco LSMT	2 yrs	$26,600	Funded
9/90-9/92	AIRCO Carbon Dioxide		*In Situ* Field Fertilization with CO_2	2 yrs	$3,000	Funded

Date	Agency	Title	Duration	Amount	Status
9/85-9/87	Kentucky Vegetable Growers Association	Optimization of Factors Affecting Bell Pepper Production	3 yrs	$1,500	Funded

V. PUBLICATIONS

*student, #post-doc

A. Research Papers

Whitney, S. M., **R. L. Houtz**, and Alonso, H. (2011). Advancing our understanding and capacity to engineer nature's CO_2-sequestering enzyme, Rubisco. **Plant Physiol.** 155(1): 27-35.

Del Rizzo, Paul A., Couture, Jean-Francois, Dirk, Lynnette M. A., Strunk, Bethany S., Roiko, Marijo S., Brunzelle, Joseph S., **Houtz, Robert L**., and Trievel, Raymond C. (2010). SET7/9 catalytic mutants reveal the role of active site water molecules in lysine multiple methylation. **J. Biol. Chem.** 285(41): 31849-31858.

Magnani, R#., Dirk, L. M., Trievel, R. C., and **Houtz, R. L.** (2010). Calmodulin methyltransferase is an evolutionarily conserved enzyme that trimethylates Lys-115 in calmodulin. **Nat. Commun.** 1:43.

Whitney, S. M., Kane, H. J., **Houtz, R. L**., and Sharwood, R. E. (2009). Rubisco oligomers composed of linked small and large subunits assemble in tobacco plastids and have higher affinities for CO_2 and O_2. **Plant Physiol.** 149(4): 1887-1895.

Raunser, S., Magnani, R#., Huang, Z., **Houtz, R. L.**, Trievel, R. C., Penczek, P. A., and Walz, T. (2009). Rubisco in complex with Rubisco large subunit methyltransferase. **Proc. Natl. Acad. Sci. USA** 106(9): 3160-3165.

Couture, J. F., Dirk, L. M., Brunzelle, J. S., **Houtz, R. L.**, and Trievel, R. C. (2008). Structural origins for the product specificity of SET domain protein methyltransferases. **Proc. Natl. Acad. Sci. USA.** 105(52): 20659-20664.

Dinkins, R. D., Majee, S. M., Nayak, N. R., Martin, D., Xu, Q., Belcastro, M. P., **Houtz, R. L.**, Beach, C. M., and Downie, A. B. (2008). Changing transcriptional initiation sites and alternative 5'- and 3'-splice site selection of the first intron deploys Arabidopsis protein isoaspartyl methyltransferase2 variants to different subcellular compartments. **Plant J.** 55(1): 1-13.

Dirk, L. M., Schmidt, J. J., Cai, Y., Barnes, J. C., Hanger, K. M., Nayak, N. R., Williams, M. A., Grossman, R. B., **Houtz, R. L.**, and Rodgers, D. W. (2008). Insights into the substrate specificity of plant peptide deformylase, an essential enzyme with potential for the development of novel biotechnology applications in agriculture. **Biochem J.** 413(3): 417-427.

Houtz, Robert L., R. Magnani#, N. R. Nayak#, and L. M. A. Dirk. (2008). Co- and post-translational modifications in Rubisco: unanswered questions. **J. Exp. Bot**. 59(7): 1635-1645.

Magnani, R#., N. R. Nayak#, M. Mazarei, L. M. Dirk, and **R. L. Houtz**. (2007). Polypeptide substrate specificity of PsLSMT. A set domain protein methyltransferase. **J. Biol. Chem.** 282:27857-27864.

Dirk, L. M. A., E. M. Flynn*, K. Dietzel*, J.-F. Couture, R. C. Trievel, and **R. L. Houtz**. (2007). Kinetic manifestation of processivity during multiple methylations catalyzed by SET-domain protein methyltransferases. **Biochemistry** 46:3905-3915.

Hou, Cai-Xia, Dirk, Lynnette M.A., Pattanaik, Sitakanta, Das, Narayan C., Maiti, Indu B., **Houtz, Robert L.**, and Williams, Mark A. (2007). Plant Peptide Deformylase: A Novel Selectable Marker and

Herbicide Target Based on Essential Co-Translational Chloroplast Protein Processing. **Plant Biotechnology** 5:275-281 (cover article).

Shepherd, R.W., Bass, W. T., **Houtz, R.L**., and Wagner, G.J. (2005). Phylloplanins of tobacco are defensive proteins deployed on aerial surfaces by short glandular trichomes. **Plant Cell** 17: 1851-1861.

Houtz, Robert L. and Portis, Archie R. Jr. (2003) The life of ribulose-1,5-bisphosphate carboxylase/oxygenase – post-translational facts and mysteries. Minireview. **Archives Biochemistry and Biophysics**, 414:150-158, special issue on C-fixing enzymes.

Trievel, Raymond C., Flynn E.M[*]., **Houtz, Robert L.**, and Hurley, J.H. (2003). Mechanism of multiple lysine methylation by the SET domain enzyme Rubisco LSMT. **Nature Structural Biology**, 10:545-552.

Dinkins, Randy D., Conn, Heather M., Dirk, Lynnette M.A., Williams, Mark A., and **Houtz, Robert L.** (2003). The *Arabidopsis thaliana* peptide deformylase 1 protein is localized to both mitochondria and chloroplasts. **Plant Science**, 165:751-758.

Trievel, Raymond C., Beach, Bridgette M., Dirk, Lynnette, M.A., **Houtz, Robert L.** and Hurley, James H. (2002). Structure and catalytic mechanism of a SET domain protein methyltransferase. **Cell** 111:91-103 (cover article, with depiction of the active-site of pea Rubisco LSMT).

Dirk, Lynnette M.A., Mark A. Williams, and **Robert L. Houtz**. (2002). Specificity of chloroplast-localized peptide deformylases as determined with peptide analogs of chloroplast-translated proteins. **Archives of Biochemistry and Biophysics** 406:135-141.

Dirk, Lynnette, Mark A. Williams, and **Robert L. Houtz**. (2001). Eukaryotic peptide deformylases: Nuclear-encoded and chloroplast-targeted enzymes in *Arabidopsis thaliana*. **Plant Physiology** 127:97-107 (featured article).

Ying, Z.[#], Mulligan, R.M., Janney, J., Royer, M., and **Houtz, R.L.** (1999). Rubisco SSMT and LSMT: Related $^{\nabla}$N- and $^{\prime}$N-methyltransferases that methylate the large and small subunits of Rubisco. **Journal of Biological Chemistry** 274:36750-36756.

Kumar, G.N.M., **Houtz, R.L.** and Knowles, N.R. (1999). Age-induced protein modifications and increased proteolysis in potato seed-tubers. **Plant Physiol.** 119:89-99.

Keathley, C., Potter, D.A., **Houtz, R.L. (**1999). Freezing-altered palatability of Bradford pear to Japanese beetle: evidence for decompartmentalization and enzymatic degradation of feeding deterrents. **Entomologia Experimentalis et Applicata** 90:49-59.

Zheng, Q.[*], Simel, E.J.[*], Klein, P.E., Royer, M.T., and **Houtz, R.L.** (1998). Expression, purification, and characterization of recombinant ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit $^{\prime}$N-methyltransferase. **Protein Expression and Purification** 14:104-112.

Mazarei, M.[#], Ying, Z.[#], and **Houtz, R.L.** (1998). Functional analysis of the Rubisco large subunit $^{\prime}$N-methyltransferase promoter from tobacco and its regulation by light in soybean hairy roots. **Plant Cell Reports** 17:907-912.

Kester, S.T., Geneve, R.L. and **Houtz, R.L.** (1997). Priming and accelerated aging affect L-iso-aspartyl methyltransferase activity in tomato (*Lycopersicon esculentum* Mill.) seed. **J. Experimental Botany** 48:943-949.

Ying, Z.[#], Janney, N., and **Houtz, R.L.** (1996). Organization and characterization of the ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit $^{\prime}$N-methyltrans-ferase gene in tobacco. **Plant Mol. Biol.** 32(4):663-672.

Wang, P.[*], Royer, M., and **Houtz, R.L.** (1995). Affinity purification of Ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ^{0}N-methyltransferase **Protein Expression and Purification** 6:528-536.

Klein, R.R. and **Houtz, R.L.** (1995). Cloning and developmental expression of pea ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit N-methyltransferase **Plant Mol. Biol.** 27:249-261.

Houtz, R.L., L. Poneleit*, S.B. Jones*, M. Royer, J.T. Stults. (1992). Post-translational modifications in the amino-terminal region of the large subunit of ribulose-1,5-bisphosphate carboxylase/oxygenase from several plant species. **Plant Physiol.** 98:1170-1174.

Houtz, R.L., M. Royer, M.E. Salvucci. (1991). Partial purification and characterization of ribulosebisphosphate carboxylase/oxygenase large subunit N-methyltransferase. **Plant Physiol.** 97:913-920.

Houtz, R.L., R.M. Mulligan. (1991). Catalytic protection of tryptic sensitive sites in the large subunit of ribulosebisphosphate carboxylase/oxygenase. **Plant Physiol.** 96:335-339.

Knavel, D.E., **R.L. Houtz. (**1990). Characteristics of 'Main Dwarf' short-internode muskmelon genotype as compared with its normal-internode "parent" and F_1 hybrid ('Main Dwarf' x 'Mainstream'). **HortScience.** 25:1277-1279.

Houtz, R.L., J. Stults, R.M. Mulligan, N.E. Tolbert. (1989). Post-translational modifications in the large subunit of ribulose bisphosphate carboxylase/oxygenase. **Proc. Natl. Acad. Sci. USA** 86:1855-1859.

Biernbaum, J.A., **R.L. Houtz**, S.K. Ries. (1988). Field studies with crops treated with colloidally dispersed triacontanol. **J. Amer. Soc. Hort. Sci.** 113:679-684.

Mulligan, R.M., **R.L. Houtz**, N.E. Tolbert. (1988). Reaction-intermediate analogue binding by ribulose bisphosphate carboxylase/oxygenase causes specific changes in proteolytic sensitivity: The amino-terminal residue of the large subunit is acetylated proline. **Proc. Natl. Acad. Sci. USA** 85:1513-1517.

Houtz, R.L., R.O. Nable, G.M. Cheniae. (1988). Evidence for effects on the *in vivo* activity of ribulose-bisphosphate carboxylase/oxygenase during development of Mn toxicity in tobacco. **Plant Physiol.** 86:1143-1149.

Nable, R.O., **R.L. Houtz**, G.M. Cheniae. (1988). Early inhibition of photosynthesis during development of Mn toxicity in tobacco. **Plant Physiol.** 86:1136-1142.

Archbold, D.D., **R.L. Houtz**. (1988). Photosynthetic characteristics of strawberry plants treated with paclobutrazol or flurprimidol. **HortScience.** 23(1):200-202.

Sterling, T.M., **R.L. Houtz**, A.R. Putnam. (1987). Phytotoxic exudates from velvet leaf (*Abutilon theophrasti*) glandular trichomes. **Amer. J. Bot.** 74(4):543-550.

Cockfield, S.D., D.A. Potter, **R.L. Houtz**. (1987). Chlorosis and reduced photosynthetic CO_2 assimilation of *Euonymus fortunei* infested with Euonymus scale (Homoptera: Diaspididae). **Environ. Entomol.** 16:1314-1318.

Houtz, R.L., S.K. Ries, N.E. Tolbert. (1985). Effect of triacontanol on *Chlamydomonas*. Stimulation of growth and photosynthetic CO_2 assimilation. **Plant Physiol.** 79:357-364.

Houtz, R.L., S.K. Ries, N.E. Tolbert. (1985). Effect of triacontanol on *Chlamydomonas*. II. Specific activity of ribulose-bisphosphate carboxylase/oxygenase, ribulose-bisphosphate concentration, and characteristics of photorespiration. **Plant Physiol.** 79:365-370.

Houtz, R.L. and S.K. Ries. (1983). Triacontanol levels in ascending sugar maple sap. **HortScience.** 18(1):101-102.

Ries, S.K. and **R.L. Houtz**. (1983). Triacontanol as a plant growth regulator. **HortScience** 18(5):654-662.

B. Book Chapters

1. Dirk, L. M. A., R. C. Trievel, and **R. L. Houtz.** 2006. Non-Histone Protein Lysine Methyltransferases - structure and catalytic roles p. 179-229. In Fuyu Tamanoi and Steven Clarke (ed.), *The Enzymes*. Elsevier Academic Press.

C. Conference Proceedings

1. **Robert L. Houtz**, Lynnette M.A. Dirk, Mark A. Williams, and Brent W. Meier. 2000. Primary and secondary structural elements influence the susceptibility of the Rubisco small subunit to methylation by Rubisco small subunit methyltransferase. Proceedings of the 5th International Jubilee Conference on the Role of Formaldehyde in Biological Systems. Methylation and Demethylation Processes. October 9-13, 2000. Sopron, Hungary. pp. 31.
2. **Robert L. Houtz**, Brent Meier, Lynnette Dirk, and Malcolm Royer. 1999. Characterization and functional significance of $^{\forall}$N-methylmethionine formation in the small subunit of Rubisco. Proceedings of the 6th International Congress on Amino Acids. Bonn, Federal Republic of Germany. August 3-7, 1999. Amino Acids Vol. 17:84 #2.
3. Ying, Z.[#], Mulligan, R.M., Janney, N., Royer, M., and **Houtz, R.L.** 1998 Related $^{\forall}$N- and ,N-methyltransferases methylate the large and small subunits of Rubisco. Acta Biologica Hungarica 49:173-184.
4. Ying, Z.[#], Mulligan, R.M., Janney, J., Royer, M., and **Houtz, R.L.** 1998 "Chloroplast-localized protein N-methyltransferases." Proceedings of the 4th International Conference on the Role of Formaldehyde in Biological Systems. Methylation and Demethylation Processes. July 1-4, 1998, Budapest, Hungary. Acta Biologica Hungarica 49:173-184.
5. **Houtz, R.L.**, M. Royer. 1990. "N-terminal processing of the large subunit of ribulose-P_2 carboxylase/oxygenase." Proceedings of the XXIII International Horticultural Congress. Florence, Italy. Vol. 2, 4154.
6. **Houtz. R.L.**, Putnam, A.R. and T.M. Sterling. 1984. Phytotoxic exudates from trichomes on the stems and petioles of velvetleaf (*Abutilon theophrasti* Medic.) plants. Proceedings of the ACS Symposium Series, "The Chemistry of Allelopathy."
7. **Houtz, R.L.** and S.K. Ries. 1982. Effect of triacontanol on starch phosphorylase and PEP carboxylase activities. Proceedings of the XXIst International Horticulture Congress. Hamburg, Germany. Vol. II. #2087.

D. Invited Presentations and/or Participation

International

Invited Member, Editorial Board for *Journal of Biological Chemistry*, Term, July 2003-June 2008.
Invited Member, Scientific Advisory Board, 6th International Conference on the Role of Formaldehyde in Biological Systems – Methylation and Demethylation Processes, Hungary, Oct., 12-16 2003.
Invited Speaker, NIAR/COE/BRAIN-RITE International Symposium on Photosynthetic CO_2-Assimilating Enzymes: Rubisco and PEPC, Nov. 30-Dec. 2, 2000, Greenpier Miki, Hyogo, Japan
Invited Member, Scientific Advisory Board, 5th International Conference on the Role of Formaldehyde in Biological Systems – Methylation and Demethylation Processes, Sopron, Hungary, October 9-13, 2000.
Invited Speaker, 6th International Congress on Amino Acids, Bonn, Federal Republic of Germany, August 3-7, 1999.
Invited Speaker, 4th International Conference on the Role of Formaldehyde in Biological Systems: Methylation and Demethylation Processes, Hot Topics, Budapest, Hungary, July 1-4, 1998.
Invited Seminar Speaker, Department of Agricultural, Food, and Nutritional Science, University of Alberta, Edmonton, Alberta, Canada. "Functional Aspects of Lys-14 Methylation in the Large Subunit of Ribulose-1,5-Bisphosphate Carboxylase/ Oxygenase." June 19-20, 1996.
Invited Presentation, First Joint USA-Mexico Symposium on Agrobiology, Molecular Physiology and Biotechnology of Crops Important to Mexican Agriculture, Cocoyoc, Mexico; Myrna I. Lopez (presenter), Malcolm Royer, and Robert L. Houtz, "Post-Translational Methylation of Lys-14 in the Large Subunit of Ribulose-1,5-bisphosphate Carboxylase/Oxygenase." November 5-9, 1995.
Invited Seminar Speaker and External Ph.D. Examiner, Department of Plant Science, University of Alberta, Edmonton, Alberta, Canada. November, 1992.
Invited Symposium Speaker, 5th Annual Meeting for Plant Biochemistry, Saltillo, Coahuila, Mexico. Post-translational modifications in the large subunit of ribulose bisphosphate carboxylase/oxygenase. Site specific methylation of Lys-14. October 13-17, 1991.

External Reviewer, Natural Sciences and Engineering Research Council (NSERC) of Canada Competitive Grants Program. 1989-present.
Invited External Examiner, Department of Plant Science, University of Alberta, Loretta Mikitzel, Ph.D. candidate. Dissertation title: "Physiological and biochemical characteristics of aging in potato tubers." October, 1989.
Invited Seminar Speaker and Guest Lecturer, Department of Plant Science, University of Alberta. Post-Translational Modifications in the Large Subunit of Ribulosebisphosphate Carboxylase/Oxygenase. September 20, 1988.

National

Invited Member, Editorial Board for Journal of Biological Chemistry, Term, July 2003-June 2008.
Host and Organizer, Annual meeting of Regional Project, NC-1142 Regulation of Photosynthetic Processes, University of Kentucky, November 11, 2006.
Invited Seminar Speaker, South Dakota State University, Department of Plant Science, Chloroplast-Localized Co- and Post-Translational Protein Modifications, July 18,2006.
Invited Seminar Speaker, Department of Plant Biology, University of Illinois, November 3, 2005. Chloroplast-localized co- and post-translational protein modifications: Structure/Function/ Significance.
Invited Seminar Speaker, Virginia Tech, Department of Plant Pathology, Physiology and Weed Science, Mechanism and Significance of Post-Translational Modifications in the Large and Small Subunits of Ribulose Bisphosphate Carboxylase/Oxygenase. July 20, 2005.
Invited Seminar Speaker, Department of Biochemistry, Emory University, September 23, 2004. Chloroplast-localized co- and post-translational protein modifications: Structure/Function/ Significance.
Invited Speaker, FASEB Summer Research Conference, July 10-15, 2004. Biological Methylation. Saxtons River, Vermont.
Invited Panel Review Member, DOE, Div. of Energy Biosciences grant review panel, Nov. 5-7, 2003.
Invited Seminar Speaker, Institute of Biological Chemistry, Washington State Univ., Oct. 14, 2003. Chloroplast-localized co- and post-translational protein modifications: Structure/Function/ Significance.
Invited Panel Review Member, NIH reverse site visit, NIAID, Project Grant, Oldest-Old Mortality-Demographic Models and Analysis. July 29-30, 2003.
Routine Reviewer of competitive grants for USDANRI, NSF, DOE, NIH, and BARD.
Invited Seminar Speaker, Department of Horticulture, Texas A&M University, "Chloroplast-localized Co- and Post-Translational Protein Modifications: Essential Administrative Processing of Critical Information," January 2002.
Invited Seminar Speaker, Integration Photosynthesis Research Program, University of Illinois, "Post-translational Modifications of the Large and Small Subunits of Rubisco," March 2, 2000.
Invited Seminar Speaker, Department of Biochemistry, University of Nebraska, "Post-translational Modifications of the Large and Small Subunits of Rubisco," September 29, 1998.
Invited Seminar Speaker, Botany and Plant Pathology Department, Purdue University. "Post-Translational Methylation of Lys-14 in the Large Subunit of Ribulose-1,5-bisphosphate Carboxylase/Oxygenase." March 22, 1995.
Invited Seminar Speaker, Molecular and Cellular Biology Program, Ohio University, Athens, OH. "Post-Translational Modifications in the Large Subunit of Ribulose Bisphosphate Carboxylase/Oxygenase." February 21, 1994.
External Reviewer, Consortium for Plant Biotechnology Research Inc. 1994-Present.
External Reviewer, USDA/NRI, DOE, NSF Competitive Grants Programs. 1989-Present.
Invited Attendee, The N. Edward Tolbert Symposium, Michigan State University, "Photosynthetic Carbon Metabolism and Regulation of Atmospheric CO_2 and O_2." March 4-6, 1990.
Invited Attendee, Gordon Research Conference on CO_2 Fixation in Green Plants, Plymouth State College, Plymouth, NH. July 23-27, 1990.
External Reviewer, Preproposals, Program in Science & Technology Cooperation/U.S.- Cooperative Development Research Agency for International Development, National Research Council. 1990-present.
Reviewer of manuscripts submitted for publication in *HortScience, Journal of the American Society for Horticultural Science, Plant Physiology*, and *Journal of Biological Chemistry*.
Moderator, Photosynthesis Session, 1987 meetings of the American Society for Horticultural Science.
Member, Screening Committee for the 1986 American Society for Horticultural Science, Cross-Commodity Publication Award.

Invited Participant, International Conference on Crop Productivity - Research Imperatives Revisited. Boyne Highlands, Michigan. Oct. 14-18, 1985.

Regional/Local

Special Awards Judge, Intel International Science and Engineering Fair, Louisville, KY, 2002.
Invited Speaker, Fayette County Hoe'nHope Garden Club, "Biotechnology and You," February 2002.
Science Demonstration Project - 5th grade science classes (4 sessions), Strode Station Elementary School, Winchester, KY, "Electron Transport and Photosynthesis, Chemiluminescence," September 2001.
Invited Seminar Speaker, Fayette County Master Gardener Association, "Agricultural Biotechnology in the Future," January 23, 1999.
Invited Seminar Speaker, Plant Physiology/Biochemistry Molecular Biology Program, University of Kentucky. "Exploring Methylation of Lys-14 in the Large Subunit of Rubisco. April 16, 1997.
Invited Judge, Intel International Science and Engineering Fair, Botany Section, Louisville, KY. May 10-16, 1997.
Invited Judge, Central Kentucky Science Fair, Botany Section, University of Kentucky. March 30, 1996; March 22, 1997.
Invited Seminar Speaker, Monsanto, St. Louis, MO. "Functional Aspects of Lys-14 Methylation in the Large Subunit of Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase." September 23, 1996.
Invited Seminar Speaker, Monsanto, St. Louis, MO. "Post-Translational Methylation of Lys-14 in the Large Subunit of Ribulose-1,5-bisphosphate Carboxylase/Oxygenase." December 19, 1995.
Invited Seminar Speaker, 25th Educational Conference and Kentucky Association of Milk, Food and Environmental Sanitarians, Louisville, KY. "Biotechnology." February 21-23, 1995.
Reviewer, Undergraduate Research Proposals, Howard Hughes Medical Institute Undergraduate Initiative Program in Biological Sciences, University of Kentucky. 1993-1994; 1997.
Invited Member and Reviewer, Technical Advising Committee of the Tobacco and Health Research Institute, Lexington, KY. 1993-1995.
Reviewer, American Society of Testing and Materials (ASTM), Special Technical Publications. June, 1990.
Selected Participant, Technology Transfer Conference. "Structure/ Function Relationships and Post-Translational Modifications in the Large Subunit of Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase." University of Kentucky, 1988.
Seminar Speaker, College of Pharmacy, Medicinal Chemistry seminar series, University of Kentucky. "Light/Dark Regulation of Ribulose-bisphosphate Carboxylase/Oxygenase Activity in Muskmelon Leaves." January 29, 1987.
Seminar Speaker, Department of Horticulture, Michigan State University. "Light/Dark Regulation of Ribulosebisphosphate Carboxylase/Oxygenase Activity in Muskmelon Leaves." Oct. 7, 1986.

E. Presentations before Professional Societies (Abstracts)

N.R. Nayak, R. Magnani, L.M. Dirk and R.L. Houtz. 2006. Elucidation of consensus amino acid sequence and potential alternate substrates of rubisco large subunit methyltransferase. American Society for Biochemistry and Molecular Biology Meetings.
Dirk, Lynnette MA , Hanger, Katherine M., Cai, Yiying, Schmidt, Jack J., Barnes, Jonathan C. Williams, Mark A., Grossman, Robert B., Rodgers, David W., **Houtz, Robert L**., 2006. Preliminary crystal structure of plant peptide deformylase, a unique potential target for broad spectrum herbicides. American Society of Plant Biologists Meetings.
EM Flynn, LMA Dirk, RC Trievel, BM Beach, JH Hurley, RL Houtz. Analysis of a structurally unique C-terminal domain of a SET domain-containing protein methyltransferase Rubisco LSMT. American Society of Biochemistry and Molecular Biology Annual Meeting. Boston, MA. June 12-16, 2004.
EM Flynn, KL Dietzel, LMA Dirk, BM Beach, JH Hurley, RC Trievel, RL Houtz. Elucidation of the Mechanism for Successive Methyl Group Transfers by SET Domain Containing Protein Methyltransferases. 29th FEBS Congress. Warsaw, Poland. June 26-July 1, 2004.
Zhang C, Dirk LMA, Hanger KM, Miller A-F, Houtz RL. 2004. The pH dependence of the active site Co(II) and Co-supported catalytic activity of peptide deformylase-2 from *Arabidopsis*. 228th American Chemical Society (ACS) National Meeting. August 22-26, 2004 Philadelphia, PA, USA.
Hanger KM, Houtz RL, Dirk LMA. 2004. Limited tryptic proteolysis of peptide deformylase

generates a core protein that retains the majority of activity without a salt-requirement for solubility. American Society of Plant Biologists' (ASPB) Plant Biology 2004. July 24 - 28, 2004 Lake Buena Vista, FL, USA.

Cai-Xia Hou, Heather M. Conn, Lynnette M.A. Dirk, Robert L. Houtz, and Mark A. Williams. Genetically Engineered Tolerance to a Peptide Deformylase Inhibitor in Tobacco. American Society of Plant Biologists Meeting. Lake Buena Vista, Florida. July 2004.

Williams MA, Houtz RL, Dirk LMA. 2004. Peptide deformylase: Site-directed mutation directed towards engineering inhibitor resistance. American Society of Plant Biologists' (ASPB) Plant Biology 2004. July 24 - 28, 2004 Lake Buena Vista, FL, USA.

Meier, Brent W., Zamora, Brian G., and Houtz, Robert L. 2002. Alteration of the methylation status of Rubisco by RNAi-mediated gene silencing of Rubisco LSMT. American Society of Plant Biologists. Abstract #616.

Conn HM, Dinkins R, Dirk LMA, Williams MA, and Houtz RL. 2002. Subcellular localization of plant peptide deformylases. American Society of Plant Biologists' Plant Biology 2002. August 3-7, 2002. Denver, CO.

Xu Q, Dirk LMA, Lowenson J, Houtz RL, Clarke S, and Downie B. 2002. An Arabidopsis protein isoaspartyl-methyltransferase gene, which produces two proteins through differential splicing, may function in the nucleus. American Society of Plant Biologists' Plant Biology 2002. August 3-7, 2002. Denver, CO.

Houtz RL, Williams MA, and Dirk LMA. 2002. Specificity of chloroplast-localized peptide deformylases as determined with N-terminal peptide analogs of chloroplast-translated proteins. American Society of Plant Biologists' Plant Biology 2002. August 3-7, 2002. Denver, CO.

Dirk LMA, and Houtz RL. 2002. Knocking out Arabidopsis peptide deformylase 2 has drastic consequences to plant growth. American Society of Plant Biologists' Plant Biology 2002. August 3-7, 2002. Denver, CO.

Williams MA, Dirk LMA, and Houtz RL. 2002. Chloroplast-localized peptide deformylase: A new target for the development of novel broad-spectrum herbicides. 42nd Annual Meeting of the Weed Science Society of America, February 10-13, 2002. Reno, NV.

Williams MA, Dirk LMA, and Houtz RL. 2001. Characterization and inhibition of chloroplast-localized peptide deformylases from *Arabidopsis thaliana*. American Society of Horticultural Science 2001 Conference and Exhibition. July 22-25, 2001. Sacramento, CA.

Dirk LMA, Kennedy HM, Conn HM, Williams MA, and Houtz RL. 2001. Activity and inhibition of two chloroplast-localized peptide deformylases. American Society of Plant Biologists' Plant Biology 2001. July 21-25, 2001. Providence, RI.

Lynnette M.A. Dirk, Mark A. Williams, and Robert L. Houtz. 2000. Post-translational modification of Rubisco SS: Methionine oxidation determines the methylatability of the N-terminal a-amino group? Plant Physiology Supplement #619

Mark A. Williams, Lynnette M.A. Dirk, and Robert L. Houtz. 2000. Characterization of a chloroplast-localized peptide deformylase from *Arabidopsis thaliana.* Plant Physiology Supplement #621.

Brent W. Meier, Malcolm Royer, and Robert L. Houtz. 1999. Characterization of Rubisco small subunit $^{\nabla}$N-methyltransferase (Rubisco SSMT) activity in spinach chloroplast lysates. Plant Physiology Supplement #307.

Lynnette M.A. Dirk, Malcolm Royer, Brent Meier, and Robert L. Houtz. 1999. Alterations in the penultimate amino acid residue of the processed form of the Rubisco SS: Influencing methylation by Rubisco. SSMT and SS stability. Plant Physiology Supplement #304.

Durbin, L., Ray, M., Royer, M., Zheng, Q., and Houtz, R.L. 1997. Identification of the S-adenosyl-L-methionine binding site in pea Rubisco large subunit $^{'}$N-methyltransferase. Plant Physiol. 114:149(706).

Kumar, G.N.M., Knowles, N.R., and Houtz, R.L. 1997. Further studies on protein degradation in aging potato tubers. Plant Physiol. 114:152(725).

Zheng, Q., Royer, M., and Houtz, R.L. 1997. Characterization of the interaction between Rubisco and Rubisco large subunit $^{'}$N-methyltransferase. Plant Physiol. 114:211(1062).

Ying, Z., Janney, N., and Houtz, R.L. 1996. Molecular rationale for the absence of methylation at lysyl residue 14 in the large subunit of spinach rubisco. Plant Physiol. 111:93(343).

Zheng, Q. and Houtz, R.L. 1996. Investigations of the interaction between pea rubisco LSMT and spinach rubisco using bifunctional cross-linking reagents. Plant Physiol. 111:93(344).

Kumar, G.N.M., Knowles, N.R., and Houtz, R.L. 1996. Mechanisms of protein degradation in aging potato tubers. Plant Physiol. 111:103(402).

Kester, S.T., Geneve, R.L. and Houtz, R.L. 1996. Priming and accelerated aging affect L-isoaspartyl methyltransferase activity in tomato seed. HortScience 31:632(391).

Zheng, Q., Simel, E.J., Klein, P.E. and Houtz, R.L. 1995. Functional expression of pea rubisco in *Escherichia coli*. Plant Physiol. 108:72(321).
Ying, Z., Janney, N. and Houtz, R.L. 1995. Isolation and characterization of the rubisco LSMT gene in tobacco. Plant Physiol. 108:135(701).
Wang, J., Klein, R.R. and Houtz, R.L. 1995. Transformation of *Arabidopsis thaliana* with a pea rubisco LSMT cDNA. Plant Physiol. 108:151(798).
Klein, R.R. and R.L. Houtz. 1994. Cloning and expression of Rubisco large subunit methyltransferase gene from pea. Plant Physiol. 105:85(438).
Houtz, R.L. and Royer, M. 1994. Characterization of the effects of methylation of Lys-14 in the large subunit of spinach Rubisco. Plant Physiol. 105:88(456).
Houtz, R.L., Wang, P., and Royer, M. 1993. Protein amino acid sequence of ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ε-N-methyltransferase. Plant Physiol. 102:47(248).
Crafts-Brandner, S.J. and Houtz, R.L. 1993. Protein degradation in chloroplast lysates. Agron. Abstr. 110.
Houtz, R.L., P. Wang, and M. Royer. 1992. Affinity purification of ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ε-N-methyltransferase. Plant Physiol. 99:58(343).
Houtz, R.L., H. Fang, and M. Royer. 1992. Identification and specificity studies of ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ε-N-methyltransferase. Plant Physiol. 99:58(344).
Houtz, R.L., M. Royer, and M.E. Salvucci. 1991. Partial purification and characterization of ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ε-N-methyltransferase. Plant Physiol. 96:9.
Houtz, R.L., D.D. Archbold, and M. Royer. 1990. Atmospheric CO_2 enrichment of tomato and strawberry plants under field production conditions. HortScience (in press).
Houtz, R.L., L. Poneleit, and M. Royer. 1990. N-terminal acetylation and methylation of lys-14 in the N-terminus of the large subunit of rubisco from several plant species. Plant Physiol. 93(1):64.
Knavel, D.E., R. Houtz. 1988. Yield and leaf area of short-internode muskmelon genotypes at different spacings. HortScience 23(3):136.
Houtz, R.L., R.M. Mulligan, J.T. Stults, and N.E. Tolbert. 1988. Structure/function studies of the large subunit of rubisco from spinach and muskmelon by limited tryptic proteolysis. HortScience 23(3):154.
Houtz, R.L., R.M. Mulligan, J.T. Stults, and N.E. Tolbert. 1988. Amino-terminus of the large subunit of rubisco from spinach, wheat, tobacco, and muskmelon leaves. Plant Physiol. 86(4):30.
Lakitan, B., Dean E. Knavel, Robert L. Houtz, Robert L. Geneve, Douglas D. Archbold. 1987. Water influx and calcium content as related to fruit cracking in pepper (*Capsicum annuum* L.). HortScience 22(5):1082.
Houtz, R.L., J.G. Strang. 1987. Yield of fresh-market bell peppers (*Capsicum annuum*) as influenced by cultivar and several cultural practices. HortScience 22(5):1100.
Houtz, R.L., R. Michael Mulligan. 1987. Transition-state analogue binding or catalytic conditions protect the tryptic sensitive sites on the large subunit of rubisco from proteolysis. Plant Physiol. 83(4):69.
Knavel, D.E., R.L. Houtz. 1986. Main dwarf muskmelon. HortScience 21(3):705.
Archbold, D.D., R.L. Houtz. 1986. Strawberry plant growth, photo- synthesis, and ribulose-1,5-bisphosphate carboxylase/oxygenase (rubisco) activity as affected by paclobutrazol and flurprimidol. HortScience 21(3):156.
Houtz, R.L., M. Royer. 1986. Light regulation of ribulose-1,5-bisphosphate carboxylase/oxygenase (rubisco) in muskmelon (*Cucumis melo*) leaves. HortScience 21(3):156.
Houtz, R.L., Ries, S.K. and N.E. Tolbert. 1984. Stimulation of photosynthetic CO_2 fixation by *Chlamydomonas reinhardtii* with triacontanol. HortScience 19(3):441.
Houtz, R.L., Putnam, A.R. and S.K. Ries. 1984. Allelopathic exudates from velvetleaf (*Abutilon theophrasti* Medic.) trichomes. Weed Science Society of America (Abstracts) p.58.
Houtz, R.L. and S.K. Ries. 1981. An *in vitro* system responsive to triacontanol. HortScience 16(3):441.
Ries, S., Wert, V., and R. Houtz. 1981. Rapid *in vivo* and *in vitro* effects of triacontanol. Proc. 8th Ann. Plant Growth Reg. Soc. of Amer. 137.
Ries, S., Wert, V., and R. Houtz. 1981. The rapid response of plants to triacontanol. Presented at the First Coordination Meeting of the Coordinated Research Program on Isotopic Tracer-Aided Studies of the Management, Sept. 28-Oct. 2, 1981, Vienna, Austria.
Houtz, R.L. 1981. Development and characterization of an *in vitro* system responsive to 1-triacontanol. Plant Growth Regulator Bulletin 9(3):5.

Ries, S., Wert, V., Dilley, D., Houtz, R. and R. Knowles. 1979. Rapid response of plants to triacontanol. Plant Physiol. (Supplement) 63:47.

F. Professional and Honor Societies

American Society of Horticultural Science
American Society of Plant Physiologists
American Association for the Advancement of Science
Gamma Sigma Delta
Sigma XI

G. Honors and Awards

Member of the Editorial Board for the *Journal of Biological Chemistry* 2003-2008

Thomas Poe Cooper Award for Excellence in Research, College of Agriculture, University of Kentucky, 2001.

Chairman (2006), NC1142, Regulation of Photosynthetic Processes, Multi-State Research Project

VI. RESEARCH ADVISING

A. Post-Doctoral Research Associates

Major Advisor:

Niahr Nayak, Ph.D. Development and Utilization of Rubisco LSMT as a Molecular Vehicle for Targeting Enzymes to Rubisco. From the Department of SAgronomy, University of Kentucky. June 1, 2005 – present.

Roberta Magnani, Ph.D. Mapping Polypeptide Substrate Specificity Determinants in Rubisco LSMT. From the Department of Agricultural Sciences, University of Bologna, Italy. April 21, 2005 – present

Mark A. Williams, Ph.D. Molecular Engineering of Rubisco LSMT for increased Rubisco Activity *In Vivo*. From the Department of Developmental and Cell Biology, University of California, Irvine. August, 1999-December 1, 2000.

Lynnette M. Dirk, Ph.D. Molecular and Biochemical Characteristics of the Methylation of the Small Subunit of Rubisco. From the Department of Botany, University of California, Davis. March 1, 1999- Present.

Anandita Das, Ph.D. Molecular and Biochemical Characteristics of the Methylation of the Small Subunit of Rubisco. From the Department of Botany, Bose Institute, Calcutta, India. April 1, 1998-present.

Mitra Mazarei, Ph.D., Functional Analysis of the Promoter Region for the Tobacco Rubisco LSMT Gene. From the Plant Biology Division, The Samuel Roberts Noble Foundation. January 2, 1997-January 2, 1998.

Zhentu Ying, Ph.D., Mechanism and Significance of Post-Translational Modifications in the Large Subunit (LS) of Ribulose Bisphosphate Carboxylase/Oxygenase (Rubisco). From the University of Miami Medical School, Miami, FL. 1994-1996. Currently employed by the University of Florida at the Homestead Experiment Station.

Co-Advisor:

Ross O. Nable, Ph.D., in the Department of Agronomy. Major Advisor: Dr. James E. Leggett, Adjunct Professor, Department of Agronomy. The Effects of Manganese Toxicity on Photosynthetic CO_2 Assimilation in Tobacco. May, 1985 - April, 1986.

B. Graduate

Major Advisor:

Amanda Fergusson, M.S. graduate, Plant and Soil Science Program; Project: Evaluation of high tunnels as a seasonal extending technology for vegetable production in Kentucky. Fall 2004.

Brent Meier, Ph.D. graduate, Department of Horticulture, Plant Physiology/Biochemistry/Molecular Biology Program; Project: "Molecular targeting of human carbonic anhydrase to the active-site vicinity of Rubisco LSMT." Spring 2004.

Qi Zheng, Ph.D. graduate, Department of Horticulture and Landscape Architecture, Plant Physiology/Biochemistry/Molecular Biology Program; Project: "The Mechanism of Specificity for the Interaction between Rubisco Large Subunit ε-N-Methyltransferase and Rubisco." Summer 1994; Graduated August, 1997. Currently employed by the University of Florida at the Homestead Experiment Station.

Myrna I. Lopez, M.S. graduate and recipient of Lyman T. Johnson doctoral fellowship, Department of Horticulture and Landscape Architecture, Plant & Soil Science Program; Project: "Kinetic Analysis of the Reaction Mechanism for Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase Large Subunit ε-N-Methyltransferase." Graduated July, 1997.

Jianmin Wang, Ph.D. candidate, Department of Horticulture and Landscape Architecture, Plant Physiology/Biochemistry/Molecular Biology Program; Project: "Effects of Antisense and Sense Expression of Rubisco LSMT in Transgenic Tobacco Plants on the Methylation of Lys-14 in the Large Subunit of Rubisco." Fall 1994 - Fall 1995. Elected to leave program.

Pinger Wang, M.S. graduate, Department of Horticulture and Landscape Architecture, Plant Physiology/Biochemistry/Molecular Biology Program; Project: "Characterization of an Affinity Purification Technique for Rubisco Large Subunit ε-N-methyltransferase." Graduated Spring 1993.

Hui Fang, M.S. graduate, Department of Horticulture and Landscape Architecture, Plant Physiology/Biochemistry/Molecular Biology Program; Project: "Effects of Lysine-14 methylation in the Large Subunit of Ribulose Bisphosphate Carboxylase/Oxygenase on Catalytic Activity and Stability." Graduated Spring 1993.

Committee Member:

Keith Allen, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. (in progress).

Nitima Suttipanta, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 2011.

Tom Niehaus, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 2011.

Darby Harris, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 2011.

Meshack Afitlhile, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 2000.

Timothy P. Devarenne, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1998.

Cunxi Wang, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. 1995-1998.

Shaohui Yin, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1996.

Qingshun Li, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1995.

Kyoungwhan Back, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1995.

Yan Huang, M.S. graduate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1995.

Xiangha Yan, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1995.

Rui Wang, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1995.

Jeffrey W. Stringer, Ph.D. candidate, Department of Forestry. Graduated 1993.

Guoqiang Hou, Ph.D. candidate, Crop Science Program. 1992.

Robert C. MacDonald, Ph.D. candidate, Department of Forestry. Graduated 1991.

Lorianne Matthews, Ph.D. candidate, Department of Plant Pathology. Graduated 1991.

Herawati Thalib, M.S. candidate, Department of Horticulture and Landscape Architecture. Graduated 1988.

Benyamin H.T. Lakitan, M.S. candidate, Department of Horticulture and Landscape Architecture. Graduated 1987.

C. Undergraduate

Advisor: (research projects supplemented or fully funded by external competitive grant dollars)

Erin Mulligan, graduated Fall 2006, Agricultural Biotechnology major. Research project: Kinetic analyses of the reaction mechanism for SET-domain containing protein methyltransferases.

Janey Moore, Agricultural Biotechnology major. Research Project: Chloroplast-localized N-terminal protein processing by peptide deformylase.

Megan Flynn, Honors student and Agricultural Biotechnology major. Research project: Kinetic analyses of the reaction mechanism for SET-domain containing protein methyltransferases. Graduated Spring 2004.

Heather Conn, graduated Spring 2002, Agricultural Biotechnology major. Research project: Molecular and biochemical characterization of chloroplast-localized peptide deformylase. Recipient of a travel grant from the American Society of Plant Biology to attend the 2002 meetings. Current Position: Senior Research Analyst, Department of Horticulture, Supervisor – Dr. Mark Williams.

Brian Zamora, graduated *summa cum laude* Spring 2002, Honors student and Agricultural Biotechnology major. Research project: Molecular engineering of resistance to peptide deformylase inhibitors in *Arabidopsis thaliana*. University of Kentucky Undergraduate Research and Creativity Grant, $502., Spring 2002. Current Position: M.D./Ph.D. program at West Virginia University.

Augustine Torres, undergraduate in Agricultural Biotechnology. Senior Research Project. Summer 1998.

Laura Durbin, undergraduate in Agricultural Biotechnology. Senior Research Project. University of Kentucky Honors Program Student. Recipient: Howard Hughes Medical Institute Undergraduate Initiative Grant for Research, funded Jan 30, 1996, $850. Fall 1995-Spring 1997.

Myrna I. Lopez, recipient of United Stated Department of Education Summer Fellowship to Encourage Minority Participation in Graduate Education. Summer 1994.

Undergraduate French Interns (3), Undergraduate Fellowship Program through Agricultural International Programs, University of Kentucky:
-Maryse Cattaneo, Summer 1993
-Celine Hanot, Summer 1994
-Guilleume Portejoie, Summer 1996

Loelle Poneleit, undergraduate in the Department of Horticulture and Landscape Architecture. Independent Research Project. 1989-1990.

Samantha B. Jones, recipient of United States Department of Education Summer Fellowship to Encourage Minority Participation in Graduate Education. Summer 1989.

Co-Advisor:

Mark Williams, undergraduate in the Department of Biology, independent research project with Dr. William Cohen. 1989-1990.

Academic Advisor:

Advise all Agriculture Biotechnology students fulfilling ABT 395 requirement.
1999-present Advised avg. 20 Agriculture Biotechnology students each semester.
1993-1999 Advised 5-10 Agriculture Biotechnology students each semester

D. Other

External Examiner - Eun Jeong Lim, Department of Biochemistry, September 2006

Research Mentor - Ms. E. Megan Flynn, recipient of a Beckman Scholarship, 2003.

Research Mentor - Melanie A. Stamper, Chemistry Instructor, Jessamine County High School. Recipient: Howard Hughes Medical Institute Summer Internship for Selected High School Instructors in Chemistry and Biological Science. Summer 1997.

Research Mentor - Melanie A. Stamper, Chemistry Instructor, Jessamine County High School. Recipient: Howard Hughes Medical Institute Summer Internship for Selected High School Instructors in Chemistry and Biological Science. Summer 1996.

High School Student Advisor: John Hafner, recipient of the 1995 Golden Scholarship ($7,000) award from the Multiple Sclerosis Association of America. I provided the guidance and laboratory for scientific research experience for John since 1990. John's accomplishments were featured in both the *Lexington Herald-Leader* and *Paris Sun* newspapers, where his internship at the University of Kentucky was featured as notable scholastic achievement.

Contact and placement person for Lafayette High School Experience Based Career Education Program. Coordinator: Lynn Akers. 1995-present.

University coordinator and contact individual for the implementation of the site-licensed Research Information System (RIS) Reference Update (RU) reference retrieval system. Implementation of the site-licensed software resulted in a minimum savings of $6000 to those research personnel at the University of Kentucky with active subscriptions to the RIS-RU database.

VII. RESIDENT INSTRUCTION (Teaching Portfolio available on request)

BCH/PPA/PLS 609, 3 credit hours, Plant Biochemistry (formerly BCH/PPA/PLS 503 with additional information). An in-depth examination of the biochemical mechanisms and enzymology associated with photosynthesis. 12 hours lecture. Spring 2003.

ABT 395, 1-4 credit hours, Independent Study in Biotechnology. Independent study under the supervision of a faculty member. Coordinator, Fall/Spring/Summer 1999-present.

ABT 399, 1-6 credit hours, Experiential Learning in Biotechnology. An internship in biotechnology under the supervision of a faculty member. Fall/Spring/Summer 2001-present.

ABT 201, 1 credit hour, Scientific Method and Logic in Agricultural Biotechnology. A required course for Agriculture Biotechnology majors designed to acquaint students with common experimental methods used in biotechnology, the interpretation of scientific data, and its effective communication via written and oral reports. 8 hours lecture. Fall 1994-present.

BIO/PLS/HOR/AGR/FOR 623, 3 credit hours, Physiology of Plants II. Detailed examination of the biochemical pathways involved in chaperonin-mediated protein folding and targeted protein degradation. 7 hours lecture. 1997-present.

BCH/PPA/PLS 503, 3 credit hours, Plant Biochemistry. An in-depth examination of the biochemical mechanisms and enzymology associated with photosynthesis. 12 hours lecture. 1986-2002.

HOR 375/410, 3 credit hours, Growth and Development of Horticultural Crops. A biochemical and physiological examination of the relationships between photosynthetic carbon assimilation, electron transport, water relations, and temperature stress tolerance as determinants in horticultural crop productivity. 11 hours lecture. Fall 1987-Spring 1995.

AGR 630, 3 credit hours, Experimental Techniques in Plant Physiology/Biochemistry. Principles of radioactivity and application of radioactive isotopes in biological research. 16 hours lecture and laboratory. Summer 1986, 1988, 1990.

BIO 106, 3 credit hours, Plant Biology. Thermodynamics, respiration, and photosynthesis. 15 hours lecture. Fall 1992.

HOR 601, 2 credit hours, Physiological Mechanisms in Horticultural Plants. Survey course of research in horticulture. 3 hours lecture. Fall 1994.

BIO 773, 1 credit hour, Plant Physiology/Biochemistry Seminar Series. Fall 1986 - Spring 1987.

Teaching Assistant, Michigan State University, Department of Horticulture, Horticulture 801, Research Procedures in Plant Science, Winter 1978, 1979.

Teaching Assistant, Michigan State University, Department of Horticulture, Horticulture 457, Cool Season Vegetable Crops, Fall 1979.

VIII. COMMITTEE ASSIGNMENTS

A. Departmental

Chair, Safety Committee, 1999-present
Internal Review Committee, 1993-present
Graduate Studies Committee, 1990-present
Project Review Committee, 1989-present
Chair, Search and Screening Committee, Molecular Biology Position, 1995-1998
Advisory Committee to Chair, 1994-1995
Chair, Research Committee, 1991-1995
Search and Screening Committee for Department Chair, 1989-1990
Chair, Search and Screening Committee for Molecular Biology Position, 1991-1992
Search and Screening Committee for Stress Physiology Position, 1991-1992

Co-Director, Seminar Series, Dept of Horticulture & Landscape Architecture, 1992

B. Interdepartmental Organizations

Executive Committee, Plant Physiology/Biochemistry/Molecular Biology Program, 1992-present
Member, Plant Physiology/Biochemistry/Molecular Biology Program - 1985-present
Search & Screening Committee, Biochemistry Position, Department of Agronomy, 1997-1999
Co-Chair, Plant Physiology/Biochemistry/Molecular Biology Program Seminar Committee, Fall 1986, Spring 1987

C. College

Chair, Regional Project, NC-1142 Regulation of Photosynthetic Processes, 2006
Review Committee, KTRDC, 2006
Member, Advisory Committee for Beckman Undergraduate Research Scholars Program
Chair, Advisory Committee for Appointment, Promotion and Tenure, 2004-2005
Appointed by the Dean to the College Strategic Planning Committee, 2003.
Advisory Committee for Appointment, Promotion and Tenure, 2002-2005
Member, Search Committee, Molecular Genetics position in Agronomy, 2002
Academic Scholarship Review Committee, Fall 2002
Chair, Agricultural Biotechnology Coordinating Committee, 1999-present
Member, Agricultural Biotechnology Coordinating Committee, 1990-present
Agriculture Plant Sciences Committee, 1997-1998
Agriculture Faculty Council (elected position), 1995-1997
Faculty Appeals Committee, 1993, 1997
Agricultural Biotechnology Coordinating Committee, 1990-present
College of Agriculture Library System Committee, 1991-1994
Agricultural Experiment Station Project Committee, 1994-1997
Gamma Sigma Delta, Outstanding Graduate Student Award Committee, Chair, 1996-1997
Gamma Sigma Delta, Outstanding Graduate Student Award Committee, 1995-1996

D. University

Program Review Panel, UK Intellectual Property, 2006
Fellowship Review Panel, UK Woman's Club Fellowship, 2006
Fellowship Review Panel, Presidential Fellowships, 2006
Elected Member, University Senate
Review Panel, Council of Southern Graduate Schools' Thesis Competition, December, 2005
Major Research Equipment Review Committee, 2002
Presidential Task Force on Computer Security and Resource Allocation Committee, 2002
Beckman Undergraduate Scholars Program Advisory Committee, 2001-present
Chair, Plant Science Technical Advisory Committee, Tobacco and Health Research Institute, 1998, 1999
Member, Research Committee Grants Review Panel, 1999
Howard Hughes Medical Institute, Undergraduate Research Committee, 1992-1994; 1997
Chair, University Faculty Senate Research Committee, 1996-1997
Technical Advisory Committee, Tobacco and Health Research Institute, 1993-1995
Research Committee Grants Review Panel, 1992

IX. PUBLIC SERVICE

Invited Speaker, Fayette County Master Gardener Association, "Genetically Modified Crops and You." February 24, 2001.
Science Demonstration Project - 5th Grade science classes (4 sessions), Strode Station Elementary School, Winchester, KY. "Electron Transport and Photosynthesis, Chemiluminescence." September 2000.

Invited Speaker, Fayette County Master Gardener Association. “The Future of Biotechnology.” January 23, 2000.

Invited Speaker, Extension Agents Training, Horticultural Concepts. “Transgenic Plants.” March 23, 1999.

"Biotechnology in Horticulture," presented at the 1988 133rd annual meeting of the Kentucky State Horticultural Society.

"Global atmospheric CO_2, problem or benefit?," presented to the Daughters of the American Revolution, Lexington Chapter, October 14, 1988.

Effects of Trickle Irrigation on Bell Pepper Yields, 1987. Investigators: Robert L. Houtz and John G. Strang. "Trickle Irrigation Installation for Horticultural Crops," presented a short course at the University of Kentucky research farm (South Farm) on March 24, 1987.

Evaluation of Foliar Nitrogen and Cytokinin on Bell Peppers. Investigators: Robert L. Houtz and John G. Strang. Presented at the 132nd Annual Meeting of the Kentucky State Horticultural Society, 1987.

Two Year's Results on the Effects of Trickle Irrigation, Black Plastic Mulch, Raised Beds, and Plant Density on Two Varieties of Bell Peppers. Investigators: Robert L. Houtz and John G. Strang. Presented at the 131st Annual Meeting of the Kentucky State Horticultural Society, 1986.

Reduced Tillage Sweetcorn. Investigators: Dean E. Knavel and Robert Houtz. Horticulture Field Day, South Farm, Lexington, 1985

Strang, J. G., R. L. Houtz. Effects of trickle irrigation, black plastic mulch, raised beds, and plant density on two varieties of bell peppers. 130th annual winter meeting of the Kentucky Horticultural Society, December 9-10, 1985.

CURRICULUM VITAE

Bruce A. Webb

EDUCATION AND PROFESSIONAL APPOINTMENTS

1995, 1997, 2001	Assistant Associate and Full Professor, Dept. of Entomology University of Kentucky, Lexington, KY
2005 -	Director Agricultural Biotechnology Program University of Kentucky, Lexington KY
1991-1994	Assistant Professor, Department of Entomology Rutgers University, New Brunswick, NJ
1988-1990	Postdoctoral research with Dr. Max Summers Texas A&M University, College Station, TX
1983-1988	Ph.D. Zoology, University of Washington, Seattle WA
1981-1983	M.S. Entomology, University of Kentucky, Lexington, KY
1978-1981	B.A. Biology, University of Virginia, Charlottesville, VA

AWARDS AND APPOINTMENTS

University of Kentucky, College of Agriculture, Comm. Exec. 2010-.
University of Kentucky Intellectual Property Committee, 2009-
University of Kentucky Intellectual Property Committee, Chair 2011-
University of Kentucky, Provost's Dist. Professor, 2011.
University of Kentucky, Distinguished Research Professor, 2003
Co-Founder and President, ParaTechs Corp., Lexington, KY, 2004-.
Panel Manager, USDA:NRI, Insects suborganismal panel 2002
Thomas Poe Cooper Distinguished Research Award, University of Kentucky, College of Agriculture, 2000
Editorial Board, Journal of General Virology, 1997-2001
National Institutes of Health FIRST Award, 1992-1996
National Institutes of Health Postdoctoral Fellowship, 1988-1990
National Institutes of Health competitive training grant, 1985-1988
Research and teaching assistantship, University of Washington, 1983-1985
Jeffrey Fellowship, University of Kentucky 1983 (declined)
Research assistantship, University of Kentucky, 1981-1983

PROFESSIONAL SOCIETIES

Gamma Sigma Delta, 1983- , Sigma Xi, 1983-, American Association for the Advancement of Science, 1985- , Entomological Society of America, 1982- , American Society for Virology 1988-present, Society for Inv.Path.(2000-).

PUBLICATIONS : over 75 research publications

GRANT AND CONTRACT SUPPORT. ~6M in competitive research grant support from USDA, NSF and NIH.

PANEL MEMBER SERVICE; USDA:ARS NP-304 Programmatic Review and NRI, NSF:MCB Eukaryotic Genomics, EPA:STAR, NIH:NIAID SBIR

CURRICULUM VITAE

NAME Subba Reddy Palli
ADDRESS Department of Entomology
University of Kentucky
Lexington, KY 40546
rpalli@uky.edu

EDUCATION

Ph.D 1984-87, University of Western Ontario
London, Ontario, Canada with Dr. M. Locke

POSTDOCTORAL RESEARCH EXPERIENCE 1988-1992
University of Washington
Seattle, WA 98195 U.S.A with Dr. L.M. Riddiford

WORK EXPERIENCE

RESEARCH SCIENTIST 1992-1998: Great Lakes Forestry Centre
Canadian Forest Service
1219 Queens Street East
Sault Ste. Marie, Ontario, Canada

SENIOR RESEARCH SCIENTIST 1998-2002: RheoGene LLC
Rohm and Haas Company
727 Norris Town Road
Spring House, PA 19477

ASSISTANT PROFESSOR 2002-2005: Department of Entomology
University of Kentucky
Lexington, KY 40546

ASSOCIATE PROFESSOR: 2005-2008: Department of Entomology
and Graduate Center for Toxicology
University of Kentucky
Lexington, KY 40546

PROFESSOR: 2008: Department of Entomology
and Graduate Center for Toxicology
University of Kentucky
Lexington, KY 40546

Co-Director 2013- NSF I/UCRC on Center for Arthropod pest management

HONORS AND AWARDS

1997: Recipient of Research Award for Foreign Specialists administered by National Institute of

Sericulture and Entomological Science, Tsukuba, Japan.
2008: Thomas Cooper Research award, University of Kentucky.
2009: Bobby Pass Excellence in Grantsmanship Award, University of Kentucky.
2010: University Research Professor, University of Kentucky.
2011: High Impact Research/Extension Award, University of Kentucky.
2012: President, Physiology, Biochemistry and Toxicology section of Entomological Society of America.
2013: President, Bluegrass Indo-American Cultural Society.
2013: ESA recognition award in Insect Physiology, Biochemistry and Toxicology.
2013: Prestigious Research Paper Award, University of Kentucky.

JOURNAL PUBLICATIONS:

125. Shukla, J.N., Palli, S.R. (2013) *Tribolium castaneum* transformer-2 regulates sex determination and development in both males and females. Insect Biochem. Mol. Biol. 42, 1125-1132.
124. Xu J, Sheng Z, Palli S.R. (2013) Juvenile hormone and insulin regulate trehalose homeostasis in the red flour beetle, *Tribolium castaneum*. PLoS Genet. 9, e1003535.
123 Parthasarathy R., Farkas, R. and Palli, S.R. (2012) Recent Progress in Juvenile hormone analogs (JHA) research. Adv. Insect Physiol. 43, 353-436.
122. Zhu F, Moural TW, Shah K, Palli SR (2013) Integrated analysis of cytochrome P450 gene superfamily in the red flour beetle, *Tribolium castaneum.* BMC Genomics. 14,174-182.
121. Zhu F, Gujar H, Gordon JR, Haynes KF, Potter MF, Palli SR (2013) Bed bugs evolved unique adaptive strategy to resist pyrethroid insecticides. Sci Rep. 3,1456.
120 Jindra, M., Palli, S.R., and Riddiford, L.M. (2013). The Juvenile Hormone Signaling Pathway in Insect Development. Ann. Rev. Entomol 58,181-204.
119. Xu, J., Baulding, J. & Palli, S. R. (2013) Proteomics of *Tribolium castaneum* seminal fluid proteins: Identification of an angiotensin-converting enzyme as a key player in regulation of reproduction, *Journal of proteomics.* 78C, 83-93.
118. Shukla, J.N. and Palli, S.R. Shukla JN, Palli SR (2012) Doublesex target genes in the red flour beetle, *Tribolium castaneum*. Sci Rep 2, 948.
117. Shukla, J.N., and Palli, S.R. (2012). Sex determination in beetles: Production of all male progeny by Parental RNAi knockdown of transformer. Sci Rep *2*, 602.
116. Deng H, Zhang J, Li Y, Zheng S, Liu L, Huang L, Xu WH, Palli, S.R, Feng Q.

(2012) Homeodomain pou and ABD-a proteins regulate the transcription of pupal genes during metamorphosis of the silkworm, *Bombyx mori*. Proc Natl Acad Sci *U S A*. 109, 12598-603.

115. Palli S.R. (2012) RNAi methods for management of insects and their pathogens. CAB reviews. 7,1-10.
114. Xu J, Raman C, Zhu F, Tan A, Palli SR. (2012) Identification of nuclear receptors involved in regulation of male reproduction in the red flour beetle, *Tribolium castaneum*. J Insect Physiol. 58, 710-717.
113 . Zhu F, Sams S, Moural T, Haynes KF, Potter MF, Palli SR. (2012) RNA interference of NADPH-cytochrome P450 reductase results in reduced insecticide resistance in the bed bug, *Cimex lectularius*. *PLoS One* 7, e31037.
112. Dinkins R, Tavva V, Palli SR, Collins G (2012) Mutant and overexpression analysis of a C2H2 single zinc finger gene of Arabidopsis. Plant Molecular Biology Reporter 30,99-110.
111. Sheng, Z., Xu, J., Bai, H., Zhu, F., Palli, S.R. (2011) Juvenile Hormone Regulates Vitellogenin Gene Expression through Insulin-like Peptide Signaling Pathway in the Red Flour Beetle, Tribolium castaneum. J Biol Chem 286, 41924-41936.
110. Bai H, Zhu F, Shah K, Palli S.R. (2011) Large-scale RNAi screen of G protein-coupled receptors involved in larval growth, molting and metamorphosis in the red flour beetle. BMC Genomics.12,388.
109. Parthasarathy, R. & Palli, S. R. (2011) Molecular analysis of nutritional and hormonal regulation of female reproduction in the red flour beetle, *Tribolium castaneum*, Insect Biochem Mol Biol. 41, 294-305.
108. Zhang, Z., Xu, J., Sheng, Z., Sui, Y. & Palli, S. R. (2011) Steroid receptor co-activator is required for juvenile hormone signal transduction through a bHLH-PAS transcription factor, methoprene tolerant, J Biol Chem. 286, 8437-47.
107. Zhu, F., Xu, J., Palli, R., Ferguson, J. & Palli, S. R. (2011) Ingested RNA interference for managing the populations of the Colorado potato beetle, *Leptinotarsa decemlineata*, Pest Manag Sci. 67, 175-82.107.
106. Singh AK, Tavva VS, Collins GB, and Palli SR. (2010) Improvement of ecdysone receptor gene switch for applications in plants: *Locusta migratoria* retinoid X receptor (LmRXR) mutagenesis and optimization of translation start site. FEBS J 277,4640-4650.
105. Xu J, Tan A, Palli S.R. (2010) The function of nuclear receptors in regulation of female reproduction and embryogenesis in the red flour beetle, *Tribolium castaneum*. J Insect Physiol. 56,1471-80.
104. Bai H, Palli S.R. (2010) Functional characterization of bursicon receptor and genome-wide analysis for identification of genes affected by bursicon receptor RNAi. Dev Biol. 344,248-258.
103. Parthasarathy R, Sheng Z, Sun Z, Palli S.R (2010) Ecdysteroid regulation of ovarian growth and oocyte maturation in the red flour beetle, *Tribolium castaneum* Insect Biochem. Mol. Biol. 40,429-439.
102. Bai, H., Gelman, D.B. and Palli, S.R. (2010) Mode of action of methoprene in affecting female reproduction in the African malaria mosquito, *Anopheles gambiae*. Pest management science 66,936-943.
101. Zhu, F., Parthasarathy,R., Bai, H., Woithe, K., Kaussmann,M., Nauen,R.,

Harrison,D.A. and Palli, S.R. (2010) A brain-specific cytochrome P450 responsible for the majority of deltamethrin resistance in the QTC279 strain of *Tribolium castaneum*. Proc Natl Acad Sci U S A 107,8557-62.

100. Parthasarathy, R., Sun, Z., Bai, H., Palli, S.R., (2010). Juvenile hormone regulation of vitellogenin synthesis in the red flour beetle, *Tribolium castaneum*. Insect Biochem. Mol. Biol. 40,405-14.
99. Zhu F, Wigginton J, Romero A, Moore A, Ferguson K, Palli R, Potter MF, Haynes KF, Palli SR (2010) Widespread distribution of knockdown resistance mutations in the bed bug, Cimex lectularius (Hemiptera: Cimicidae), populations in the United States. Arch Insect Biochem Physiol. 73, 245-257.
98. Tzertzinis G, Egaña AL, Palli SR, Robinson-Rechavi M, Gissendanner CR, Liu C, Unnasch TR, Maina CV (2010) Molecular evidence for a functional ecdysone signaling system in *Brugia malayi*. PLoS Negl Trop Dis. e625.
97. Bitra K, Palli S.R (2010) The members of bHLH transcription factor superfamily are required for female reproduction in the red flour beetle, *Tribolium castaneum*.J Insect Physiol. 56,1481-1489.
96. Zhang, Z and Palli, S.R. (2009) Identification of a cis-regulatory element required for 20-hydroxyecdysone enhancement of antimicrobial peptide gene expression in *Drosophila melanogaster*. J. Molec. Entomol. 18, 595-605
95. Bitra K, Tan A, Dowling A, Palli SR. (2009)Functional characterization of PAS and HES family bHLH transcription factors during the metamorphosis of the red flour beetle, *Tribolium castaneum*. Gene. 448,74-87
94. Parthasarathy, R., Tan A., Sun, Z., Chen, J., Rainkin, M. and Palli, S.R. (2009) Juvenile hormone regulation of male accessory gland activity in the red flour beetle, *Tribolium castaneum* Mech. Dev. 126, 563-579
93. Parthasarathy, R. and Palli, S.R. (2009) Molecular analysis of juvenile hormone analog action in controlling the metamorphosis of the red flour beetle, *Tribolium castaneum*. Arch Insect Biochem Physiol 70, 57-70.
92. Bitra K. and Palli S.R. (2009) Interaction of Proteins Involved in Ecdysone and Juvenile Hormone Signal Transduction. Arch Insect Biochem Physiol 69,1–13.
91. Lapenna S., Friz J., Barlow A., Palli S.R., Dinan L. and Hormann R.E. (2008) Ecdysteroid ligand–receptor selectivity – exploring trends to design orthogonal gene switches. . FEBS J 275,5785-5809
90. Flatt T., Heyland A., Rus F., Porpiglia E., Sherlock C., Yamamoto R., Garbuzov A., Palli S.R., Tatar M. and Silverman N (2008) Hormonal Regulation of the humoral innate immune response in *Drosophila melanogaster*. J. Exp. Boil. 211, 2712-2724.
89. Tan A. and Palli S.R. (2008) Edysone receptor isoforms play distinct roles in controlling molting and metamorphosis in the red flour beetle, *Tribolium castaneum* Mol Cell Endocrinol 291, 42-49.
88. Tavva V.S, Palli S.R, Dinkins R.D, Collins G.B. (2008) Improvement of a monopartite ecdysone receptor gene switch and demonstration of its utility in regulation of transgene expression in plants. FEBS J. 275, 2161-76.
87. Parthasarathy R, Tan A, Palli SR. (2008) bHLH-PAS family transcription factor methoprene-tolerant plays a key role in JH action in preventing the premature development of adult structures during larval-pupal metamorphosis. Mech Dev.

125, 601-616.
86. Parthasarathy, R. and Palli, S. R. (2008) Proliferation and differentiation of intestinal stem cells during metamorphosis of the red flour beetle, *Tribolium castaneum* Dev.Dyn. 237, 893-908.
85. Parthasarathy, R., Tan, A., Bai, H. and Palli, S. R. (2008) Transcription factor broad suppresses precocious development of adult structures during larval-pupal metamorphosis in the red flour beetle, *Tribolium castaneum*. Mech. Dev. 125, 299-313.
84. Tan A. and Palli S.R. (2008) Identification and characterization of nuclear receptors from the red flour beetle, *Tribolium castaneum*. Insect Biochem. Mol. Biol. 38, 430-439.
83. Li Y., Z. Zhang, Robinson G.E. and Palli S.R. (2007) Identification and characterization of a juvenile hormone response element and its binding proteins. J. Biol. Chem. 282, 37605-37617.
82. Panguluri S.K., Li B., Hormann R.E. and Palli S.R. (2007) Effect of ecdysone receptor gene switch ligands on endogenous gene expression in 293 cells. The FEBS J.. 274, 5669-5689.
81. Dhadialla T.S., Dat L., Palli S.R., Raikhel, A and Carlson G.R. (2007) Characterization of a non-steroidal ecdysone agonist photoaffinity compound, RH-131039. Insect Biochem. Mol. Biol. 37:865-875.
80. Bai H., Parthasarathy R. and Palli S. R. (2007) Identification and characterization of juvenilehormone esterase gene from the yellow fever mosquito, *Aedes aegypti.* Insect Biochem. Mol. Biol. 37,829-837.
79. Tavva V.S., Dinkins R.D, Palli S.R. and Collins G.B. (2007) Development of a tightly regulated and highly inducible ecdysone receptor gene switch for plants through the use of retinoid X receptor chimeras. Transgenic Research 16, 599-612.
78. Doucet D., Frisco C. , Cusson M., Bauce E, Palli S.R., Tomkins W, Arif B., Retnakaran A. (2007) Diapause disruption with tebufenozide for early-instar control of the spruce budworm, *Choristoneura fumiferana*. Pest Manag. Sci. 63, 730-736.
77. Tavva V.S., Palli S.R., Dinkins R.D and Collins G.B. (2007) Applications of EcR gene switch technology in functional genomics. Archiv. Insect Physiol. Biochem. 65, 164-169.
76. Parthasarathy, R. and Palli, S.R. (2007) Stage- and cell-specific expression of ecdysone receptors and ecdysone-induced transcription factors during midgut remodeling in the yellow fever mosquito, *Aedes aegypti*. J. Insect Physiol.. 53, 216-229.
75. Parthasarathy, R. and Palli, S.R. (2007) Developmental and hormonal regulation of midgut remodeling in a lepidopteran insect, *Heliothis virescens.* MecH. Dev. 124, 23-34.
74. Ponguluri, S.K., Kumar, P and Palli, S.R. (2006) Functional characterization of ecdysone receptor gene switches in mammalian cells. FEBS J. 273, 5550-5563.
73. Wu, Y., Parthasarathy R., Bai, H. and Palli,S.R. (2006) Mechanisms of midgut remodeling: juvenile hormone analog methoprene blocks midgut metamorphosis by modulating ecdysone action. Mechanisms of Development 123, 530-547.

72. Margam, V. M., Gelman, D. B., Palli, S. R. (2006) Ecdysteroid titers and developmental expression of ecdysteroid-regulated genes during metamorphosis of the yellow fever mosquito, *Aedes aegypti* (Diptera: Culicidae). J Insect Physiol 52**,** 558-568.
71. Yang D.H., Makhmoudova A., Arif B.M., Feng Q., Retnakaran A., Palli, S.R., Kamalova D and Krell P.J. (2006) Protein versus DNA immunisation for production of monoclonal antibodies against *Choristoneura fumiferana* ecdysone receptor (CfEcR). Vaccine 24**,** 3115-26
70. Kethidi D.R., Li Y. and Palli S.R. (2006) Protein kinase C Mediated Phosphorylation Blocks Juvenile Hormone Action. Mol.Cell.Endocrinol*.* 247**,** 127-34.
69. Tavva V.S., Dinkins R.D, Palli S.R. and Collins G.B. (2006) Development of a highly sensitive ecdysone receptor gene switch for applications in plants. The plant J. 45:457-469.
68. Palli, S.R., Kapitskaya, M.Z and Potter D.W. (2005) The influence of heterodimer partner ultraspiracle/retinoid X receptor on the function of ecdysone receptor. FEBS J. 272:5979-5990.
67. Perera, S. C., Zheng, S., Feng, Q. L., Krell, P. J., Retnakaran, A. & Palli, S. R. (2005) Heterodimerization of ecdysone receptor and ultraspiracle on symmetric and asymmetric response elements, Arch Insect Biochem. Physiol. 60,55-70.
66. Dai, X., Willis, L. G., Palli, S. R. and Theilmann, D. A. (2005) Tight transcriptional regulation of foreign genes in insect cells using an ecdysone receptor-based inducible system, Protein Expr Purif. 42,236-245.
65. Palli, S.R., Hormann, R.E., Schlattner U. and Lezzi, M. (2005) Ecdysteroid receptors and their applications in agriculture and medicine. Vitamins and Hormones 73, 59-99
64. Palli, S. R. (2005) Gene switches for regulated expression of biopesticide genes. Biopesticides International 1, 1-12.
63. Kethidi, D.R., Xi, Z. and Palli, S.R. (2005) Developmental and hormonal regulation of juvenile hormone esterase gene in *Drosophila melanogaster*. J. Insect Physiol. 51:393-400.
62. Palli, S. R., Tice, C. M., Margam, V. M. & Clark, A. M. (2005) Biochemical mode of action and differential activity of new ecdysone agonists against mosquitoes and moths, Arch Insect Biochem Physiol. 58, 234-42.
61. Kumar, M.B., Potter, D.W., Hormann, R.E., Edwards, A., Tice, C.M., Smith, H.C., Dipietro, M.A., Polley, M., Lawless M., Wolohan, P.R.N., Kethidi D.R. and Palli S.R. (2004) Highly Flexible Ligand-Binding Pocket of Ecdysone Receptor: A single amino acid change leads to discrimination between two groups of non-steroidal ecdysone agonists. J. Biol. Chem. 279,27211-8.
60. Kethidi, D. R., Perera, S. C., Zheng, S., Feng, Q.-L., Krell, P. J., Retnakaran, A. & Palli, S. R. (2004) Identification and characterization of a JH response region in the juvenile hormone esterasse gene from the spruce budworm, *Choristoneura fumiferana*, J Biol Chem. 279, 19634-42.
59. Wu, X., Hopkins, P. M., Palli, S. R. & Durica, D. S. (2004) Crustacean retinoid-X receptor isoforms: distinctive DNA binding and receptor-receptor interaction with a cognate ecdysteroid receptor, Mol Cell Endocrinol. 218, 21-38.

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BOOKS EDITED

Ishaaya, I, Palli, S.R and Horowitz, A.R. (2012) Advanced technologies for managing insect pests. Springer

PATENTS ISSUED

1. **Palli S. R**., Arif B., Sohi S. S. and Retnakaran A. Transgenic viruses for pest control. An US patent (# 5,891,431) issued in 1999.
2. Weinstein B., Keller L. H. and **Palli S. R**. Methods for identifying products employing gene expression. US Patent # 6,576,422 B1 issued in June 2003.
3. **Palli, S. R**; Kapitskaya, Marianna Zinovjevna; Cress, Dean Ervin Ecdysone receptor-based inducible gene expression system. US Patent # 7,091,038 issued August 2006.
4. **Palli, S**.R. and Sigh, A (2012) Expression Modulation System For Use In Plants And Method For Modulating Gene Expression In Plants. US. Patent No. 8,115,059, issued February 2012.

PATENT APPLICATIONS PUBLISHED

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2 20050266457 Palli, Subba Reddy; Kumar, Mohan Basavaraju Mutant receptors and their use in a nuclear receptor-based inducible gene expression system.

3 20050228016 Michelotti, Enrique; Tice, Colin M.; Palli, Subba Reddy; Thompson, Christine S; Dhadialla, Tarlochan S. Tetrahydroquinolines for modulating the expression of exogenous genes via an ecdysone receptor complex.

4 20040235097 Zhang, Jianzhong ; Cress, Dean Ervin; Palli, Subba Reddy; Dhadialla, Tarlochart Singh Whitefly ecdysone receptor nucleic acids, polypeptides, and uses thereof.

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8 20020110861 Dhadialla, Tarlochan Singh; Cress, Dean Ervin; Carlson, Glenn Richard; Hormann, Robert Eugene; Palli, Subba Reddy; Kudla, Arthur John ; Herzig, Ronald Phillip JR; Philip, Mohan Multiple inducible gene regulation system.

GRANTS AWARDED:

1992-1998: Canadian Forest Service: PI and Co-PI on grants ($1,200,000) received from Canadian government agencies (Canadian Biotechnology Strategy Fund, Science and Technology Fund and Engineering and Natural Sciences Research Council) and Industries (Rohm and Haas and American Cyanamid).

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2002- Current: University of Kentucky:

1. Studies on EcR-based gene switch:To develop ecdysone receptor-based gene switches for use in medicine. PI: S.R. Palli, Agency; RheoGene Inc., Award:$196,000 for two years (09/01/2002 to 08/30/2004).

2. 20-hdryoxyecdysone suppression of juvenile hormone action: To study the cross-talk between 20E and JH. PI: S.R. Palli, Agency:NSF, Award:$482,296 for four years (08/01/2004 to 07/31/2008).
3. Characterization of EcR-based gene switches: To understand the functioning of ecdysone receptor-based gene switches. PI: S.R. Palli, Agency; RheoGene Inc., Award: $196,000 for two years (09/01/2004 to 08/30/2008).
4. Molecular analysis of juvenile hormone action in *Heliothis virescens*: To identify and characterize critical genes involved in JH action in Heliothis virescens. Agency: USDA-NRI, Award:$260,033 for three years (12/1/2004-11/30/2007).
5. HATCH: Molecular Analysis of Pest Development and Resistance to Insecticides.
6. Micro array analysis of JH-response: To conduct pilot studies on JH-response in Drosophila L57 cells. PI: S.R. Palli, Agency:UK micro array core facility, Award: $5,000.
7. Development of ligand inducible gene switches for simultaneous and independent regulation of expression of two genes in transgenic tobacco plants. PI: S.R.Palli, Co-PIs: Drs. Collins and Dinkins of Agronomy department. Agency: KTRDC, Award: $119,643 for two years (01/01/2003 to 06/30/2005).
8. Identification of juvenile hormone receptors: Research award from UK VP research, $15,000. (11/01/03-10/30/04).
9. Molecular analysis of juvenile hormone action. . To identify molecules involved in juvenile hormone action. PI: S.R.Palli, Agency: National Institute of Health Award: $1,020,000 for five years (2/1/2005-1/31/2010).
10. Development of tightly regulated gene switches for trait improvement, pest resistance and functional genomics applications in tobacco plants. To develop and test tight gene switches for use in agriculture. PI: S.R.Palli, Co-PI: Dr. Collins of Agronomy department. Agency: Kentucky Tobacco Research and Development Center. Award: $ 116,382 for two years (07/01/2005 to 06/30/2007).
11. Evaluation methoxyfenozide as geneswitch legend. To evaluate formulations for methoxyfenozide for use as gene switch ligands. PI: S.R.Palli, Co-PI: Dr. Collins of Agronomy department. Agency: Dow AgroSciences Award: $32,000 (01/01/2005 to 5/31/2005).
12. Novel active insecticidal compounds from Kentucky native plants. To screen natural products against insect pests. PI: S.R.Palli, Agency: Neprogenix Inc. Award: $ 51,000 (01/01/2006 to 12/31/2006).
13. Development of tightly regulated ecdysone receptor-based gene switches. To develop two-hybrid gene switch so that background activity in the absence of ligand and ligand sensitivity are improved. PI: S.R.Palli, Co-PI: Dr. Collins of Agronomy department. Agency: Consortium for Plant Biotechnology Research, Award: $162,000 for two years (01/01/2006 to 12/31/2007).
14. Development of tightly regulated ecdysone receptor-based gene switches. This Dow AgroSciences match for CPBR project. PI: S.R.Palli, Co-PI: Dr. Collins of Agronomy department. Agency: Dow AgroSciences Inc. Award: $50,000 for two years (01/01/2006 to 12/31/2007).
15. 20-hdryoxyecdysone suppression of juvenile hormone action: NSF supplement to attract high school students into science. . PI: S.R. Palli, Agency: NSF,

Award:$6,000 (07/01/2006-06/30/2008).

16. Functional genomics on nuclear receptors: Target sites for insecticide development and resistance management. To characterize nuclear receptors and develop screening assays for identifying new insecticides as well as for fighting insecticide resistance development. PI: S.R.Palli. Agency: USDA-NRI. Award: $ 567,944 for four years (01/01/08 to 12/31/11).
17. Molecular analysis of juvenile hormone action. . To identify molecules involved in juvenile hormone action. PI: S.R.Palli, Agency: National Institute of Health Award: $820,000 for four years (2/1/2010-1/31/2014).
    As of August 2013, $445,584 balance left in this grant. I anticipate getting no cost extensions to carry this project for 2-3 more years until 2016.
18. 20-hdryoxyecdysone suppression of juvenile hormone action: To study the function and JH regulation of accessory gland proteins. PI: S.R. Palli, Agency:NSF, Award:$450,000 for four years (08/01/2010 to 07/31/2014).
19. Molecular Insect Physiology: Basic science to applications: To organize a symposium at ESA meeting. P.I S.R. Palli, Agency: USDA, Award: $10,000 (01/01/2010-12/31/2010).
20. Molecular mechanisms of synthetic pyrethroid resistance: To identify genes responsible for synthetic pyrethroid resistance in the bed bugs. PIs: S.R. Palli, K.F. Haynes and M. F. Potter, Agency: Bayer, $100,000. (2010-2013)
21. Molecular Analysis of Xenobiotic Response: To study role of P450s in xenobiotic response of Colorado potato beetle. PI: S.R.Palli. Agency: USDA-AFRI. Award: $ 499,000 for four years (02/14/2011 to 02/14/2015).
    As of August 2013, $459,129 balance left in this grant. I anticipate getting no cost extensions to carry this project for 2-3 more years until 2017.
22. Planning grant to establish National Science Foundation Industry/University Collaborative Research Center on Arthropod Management Technologies. PI: S.R.Palli. Agency: NSF. Award: $ 11,582 (08/22/2012 to 07/31/2013).
23. P450 Inhibition Assays. PI: S.R.Palli. Agency: USDA-ARS. Award: $ 80,918 (02/1/2013 to 08/30/2014).
24 Ecdysteroid Signaling in Filarial Parasite PI: Thomas Unnasch Co-PI: S.R.Palli. Agency: NIH. Award: $ $275,000 for two years (08/15/2013 to 07/31/2015). $32,666 is amount sub-contracted to my laboratory.
24. Center for Arthropod Management Technologies. To administer UK part of CAMTech. PI: S.R.Palli. Agency: NSF. Award: $ 360,000 (08/01/2013 to 07/31/2018).
25: Research Experience for Undergraduates. To train two undergraduate students during summer. PI: S.R.Palli. Agency: NSF. Award: $ 8,000 (08/01/2013 to 07/31/2014).
26. Center for Arthropod Management Technologies. PI: B. Bonning Co-PI: S.R.Palli. Agency: 7 Industrial members including Monsanto, Dupont, Poineer Hybrid, Bayer, BASF, Dow AgroSciences, and Futuragene contribute $50,000/year. Award: $ 1,850,000 (08/01/2013 to 07/31/2018). These funds will be allotted to research projects at ISU and UK. I anticipate getting one project funded at $50,000/year to a total of $250,000 for five years.

MEMBER OF EDITORIAL BOARD

Journal of Insect Physiology (1998-)
The Canadian Entomologist, Associate Editor (2002-)
Biopesticides International (2004--)
Archives of Insect Biochemistry and Physiology, Associate Editor (2005-)
Psyche-A journal of Entomology (2007-)
The Open Anatomy Journal (2008-)
BMC Developmental Biology, Associate Editor (2009-)
Insect Biochemistry and Molecular Biology (2009-)
Insects (2010---)
PLoSOne (2011--)

MEMBER GRANT REVIEW PANELS

USDA-NRI (2005, 2006, 2008)
NIH-VECTOR BIOLOGY (2005, 2006, 2009, 2010, 2011, 2012, 2013)
NIH-MCE (2009)
NSF-BIO-IOS (2009)

MEMBERSHIP IN SCIENTIFIC SOCIETIES

1. American Society for Cell Biology (1989-93)
2. Entomological Society of America (1988-91, 1998-)
3. American Society for Microbiology (1998-2002)
4. American Society for Gene Therapy (1999- 2002)

ORGANIZATION AND CHAIRING SESSIONS AT SCIENTIFIC MEETINGS

1. Along with Dr. A. Retnakaran organized a symposium on Insect Metamorphosis at the XX International Congress of Entomology, Firenze, Italy, August 25-31, 1996.
2. Chaired Insect Metamorphosis symposium at the XX International Congress of Entomology, Firenze, Italy, August 25-31, 1996.
3. Chaired a round table on ecdysteroid action at the XII Ecdysone Workshop. Barcelona, Spain, July 22-26, 1996.
4. Along with Dr. A. Retnakaran organized a symposium on Biotechnology for forest pest management at the XXI International Congress of Entomology, Iguassu Falls, Brazil, August 2000.
5. Chaired Biotechnology for forest pest management symposium, at the XXI International Congress of Entomology, Iguassu Falls, Brazil, August 2000.
6. Chaired Student competition presentations at the 51st annual meeting of the Entomological Society of America, October 26-29, 2003.
7. Chaired brainstorming session on future metamorphosis research at Molting and Metamorphosis symposium, Kyoto, Japan, March 3-7, 2005.
8. Chaired session 1 at the NIAS/COE symposium on lepidopteran genomics, Tsukuba, Japan March 2005.
9. Organized and chaired genomics technologies workshop at the 53rd annual meeting of the Entomological Society of America, Ft. Lauderdale, December 2005.
10. Chaired plenary session at the 93rd Indian Science Congress, Hyderabad, January 2006.
11. Member Organizing Committee, 16th International Ecdysone Workshop, July 10-14, 2006 Ghent, Belgium.
12. Co-organized a symposium “Impact of hormone research on science and society: A

symposium to honor Lynn M. Riddiford" at 54th annual meeting of the Entomological Society of America, Indianapolis, November, 2006.

13. Co-guest editor for a special volume of Insect Biochemistry and Molecular Biology in honor of Lynn M. Riddiford.
14. Member Organizing Committee: International symposium on midgut biology, April 7-11, 2008, Guangzhou, China.
15. Member Advisory Board, 17th International Ecdysone Workshop, July 20-24, 2008 Ulm, Germany.
16. Co-organized a symposium "Insect Molecular Physiology: Basic science to applications to honor Judy Willis" at the 57th annual meeting of the Entomological Society of America, Indianapolis, November, 2009.
17. Guest editor for a special volume of Journal of Insect Physiology in honor of Judy Willis, 2010.
18. Co-organized a symposium "Hormones as targets for insect control: insights about juvenile hormone action" at the 58th annual meeting of the Entomological Society of America, San Diego, 2010.
19. Co-organized a symposium "Basic science to applications for management of bed bug populations" at the 59th annual meeting of the Entomological Society of America, Reno, 2011.
20. Member Organizing Committee: International symposium on midgut biology, September, 2012, Guangzhou, China
21. Member Program Committee, 59th annual meeting of the Entomological Society of America, Reno, 2011.
22. Member Program Committee, 60th annual meeting of the Entomological Society of America, Knoxville, 2012.
23. Member organizing committee, International Insect Hormone (19th Ecdysone) Workshop 2013, July 22-26.
24. Member organizing committee, International conference on Juvenile hormones, May 2014, Tsukuba, Japan.

TEACHING:

1996-2002: Canadian Forest Service and Rohm and Haas Company

Trained 11 students and nine postdoctoral fellows. Most of them are employed and are conducting research at universities, government laboratories and private companies. Seven students and eight postdoctoral fellows published refereed journal articles with me as a co-author.

Trained students and post-doctoral fellows

Name	Years supervised	Degree completed	Title of Research Project	Present Position
Ravi Kothapalli	2	PDF	Cloning and Characterization of CfEcR	Research Associate at The university of Southern Florida
Hong Cheng	1	PDF	Cloning CHR75	Research Associate Agriculture Canada
Andrea Ricci	2	Coop, B.Sc	Diapause Associated	Graduate Student at The University of

			Proteins	Western Ontario
John Barrett	2	PDF	Recombinant Viruses	Research scientist Univ. Western Ontario
Imran Mangrue	1	Research Assistant	Molecular Entomology	Graduate student Univ. Toronto
Qili Feng	3	PDF	JH receptors	Professor, South China Normal University
M. S. Sundaram	2	PDF	Ecdysteroid Mimics	Scientist, BiomedTechnologies
Anjali Perera	3	PDF	EcRs	Research Associate GLFC-CFS
Cathy Goiten	2	Research Assistant	Defensin	Gradute student Univ. Toronto
Mohan Kumar	2	PDF	EcR Mutagenesis	PDF, University of Toronto
Masha Kapitskaya	2	M.Sc scientist	RXR Modifications	Scientist, Merck&Co
Youlin Wang	1	Research Assistant	Yeast Assay	Scientist, Merck & Co.
Dominic Titone	1	Research Assistant	EcR gel shifts	Research Assistant LSB Inc.
Peter White	1	PDF	EcR co-activators	Scientist, University of Pennsylvania

2002- Current: University of Kentucky

Courses Taught

ENT 567 Applications of Molecular Genetics (taught once)
ENT 635 Internal morphology and Insect Physiology (taught twice)
ENT 690 Molecular Entomology (taught twice)
ENT 635 Insect Physiology (taught three times)
ENT 636 Molecular Entomology (taught twice)
ABT460 Advanced Molecular Genetics (taught four times)

GRADUATE STUDENT ADVISING

Major Advisor

1. Margam Venumadahan, completed M.Sc. joined Perdue University for Ph.D.
2. Zhang, Zhaolin, completed Ph.D. Research associate in Northwestern University
3. Kavita Bitra, completed Ph.D. PDF at University of Georgia
4. Hua Bai, completed Ph.D. , PDF at Brown University
5. Sun Zhiyuan, completed M.Sc Facility manager, University of Pittsburgh
6. Robert Miller (GCT rotation student)
7. Aline Mackert Santos (visiting Ph.D. student from Brazil, spent four months at UK).
8. John Wigginton, Ph.D. student

9. Megha Kalsi, Ph.D. student
10. Hemant Gujar, Ph. D. student
11. Sunny Yoon, Ph.D. student
12. Neuhaus, Kaylee, GCT rotation student

Served on the advisory committees of two M.Sc and 10 Ph.D. students.
Serving on the advisory committees of 12 Ph. D. students

POST-DOCTORAL SCHOLARS TRAINED

1. Sumistha Das
2. Yun Jin Cui
3. Jay Shukla
4. Jingjing Xu
5. Fang Zhu (left after five year stay, Research professor, WSU)
6. Zhantao Sheng (left after 2 year stay, Research associate, University of Chicago)
7. Raman Chnadrasekhar (left after two year stay, Research Associate, KSU)
8. Yipeng Sui (left after 2 years training, PDF at UKY)
9. Parthasarathy R (Left in 2009 after 5 year stay and joined Monsanto Company)
10. Sresty Tavva (left in 2008 after 4 year stay, works for Dupont)
11. Anjian Tan (left in 2008 after 4 year stay, professor at Chinese academy of sciences)
12. Ajay Singh (left in 2008 after 2 year stay, Principal scientist, ICAR)
13. Damu Kethidi (left in 2006 after 4 years stay)
14. Wu Yu (left in 2006 after one year stay, professor in Sun-Yat-Sun University)
15. Siva Kumar P (left 2007 after 2 years stay, Instructor University of Louisville)
16. Yiping Li (left in 2007 after 2 years stay, Research Assistant professor at WSU)

UNDERGRADUATE STUDENTS WHO DID RESEARCH IN PALLI LAB

1. Megan Dillery
2. Elizabeth Berlin
3. Clay Turner
4. Rachel Ward
5. Ali More
6. Perdan Erica
7. Zeltner Mathew
8. Zhang Zijing
9. Reiya Heyden
10. James Baldwing
11. Fariba Kanga
12. Mathew Testa
13. Anciro Ashlee

Advising an average of 3-6 Agricultural Biotechnology undergraduate students per year during the past 10 years.

HIGH SCHOOL STUDENTS

A number of high school students including Kim Ferguson, Ryan Will, Roshan Palli and Joseph Ferguson conducted research for Science Fair projects in Palli lab and won awards at district, regional, state and International science fair competitions.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Yuan, Ling	Associate Professor of Plant Biology
eRA COMMONS USER NAME (credential, e.g., agency login) lyuan3	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Jinan University, Guangzhou, China	B.S.	07/83	Biology
University of Texas	Ph.D.	07/89	Biochemistry and molecular biology
University of California, San Francisco	Postdoctoral	01/89	Pharmaceutical chemistry

A. Personal Statement

My expertise is in plant biochemistry and molecular biology. I have more than 20 years of experience working on analysis, characterization and engineering of plant compounds. At UK, I teach graduate-level plant biochemistry and conduct research in metabolic engineering of plants, including, but not limited to, tobacco. After my postdoc training at University of California at San Francisco in 1993, I joined the biotech company, Calgene (subsequently acquired by Monsanto), as a principal scientist. My research focus was plant oil biosynthesis. My work was highlighted by a paper, published in the journal *Nature Biotechnology*, and is considered to be the first example of utilizing a protein-engineered enzyme to alter a metabolic pathway in a crop plant. In 1997, I became a program manager at Maxygen, Inc., where I led a number of research projects on plant biochemistry and bioengineering. Since joining UK in 2003, my research interests are centered in several main areas: (i) modification of tobacco leaf chemistry by understanding regulation of biosynthesis of leaf surface compounds and using novel technology (e.g. TransActivator-Like Endo-Nuclease, or TALEN) for precision-mutagenesis of targeted genes, (ii) mechanistic study of transcription factors (TFs) for plant metabolic pathway regulation, and (iii) improvement of bioenergy production through engineering plants to produce high-density biofuels and engineering enzymes for novel functions in biomass conversion. The research addresses key issues in molecular biology and protein biochemistry, and contributes to the development of new-crop opportunities and bioenergy, two important areas in the agricultural economies of Kentucky and the nation. In summary, I have extensive experience in conducting research and managing projects related to plant chemistry and biochemistry.

B. Positions and Honors

Positions and Employment

03/1993- 07/1997 Principal Scientist, Calgene, Inc., Davis, CA
07/1997- 07/2003 Program Manager, Maxygen, Redwood City, CA
07/2003- Associate Professor, Department of Plant and Soil Sciences, University of Kentucky

Other Experience and Professional Memberships

2003- Member, American Society for Plant Biology

International Conference Organizer

- Session chair, Institute of Biological Engineering, Annual Meeting, March 2014
- Session chair (4 consecutive years), Plant and Animal Genome XVI Conference; workshop on plant metabolic pathway regulation and drug discovery. San Diego, 2008-11
- Session chair, Conference of International Drug Discovery Science and Technology. Shanghai, May 2007

Advisory Appointment

- Visiting professor, South China Normal University, Guangzhou, China, June 2011-present
- Visiting professor, Wuhan Botanical Garden, Chinese Academy of Sciences. June 2010-present
- Visiting professor, University of Chinese Medicine, Guangzhou, China, July 2008-present
- Advisory board member, Key Laboratory of Gene Engineering, Zhongshan University, Grangzhou, China. May 2001- April 2010.

C. Selected Peer-reviewed Publications (Selected from 42 peer-reviewed publications)

1. Sanjay K Singh; Chamroeun Heng; Jay D Braker; Victor Chan; Charles C Lee; Douglas B Jordan; **Ling Yuan** and Kurt Wagschal (2013) Directed evolution of GH43 β-xylosidase XylBH43 thermal stability and L186 saturation mutagenesis. Journal of Industrial Microbiology & Biotechnology. (in press)
2. Barunava Patra, Sitakanta Pattanaik and **Ling Yuan** (2013) Proteolytic degradation of the flavonoid regulators, TRANSPERENT TESTA8 and TRANSPERENT TESTA GLABRA1 in *Arabidopsis* is mediated by ubiquitin/26S proteasome system. *Plant Signal & Behavior*. 8(10): e25901.
3. Barunava Patra, Craig Schluttenhofer, Yongmei Wu, Sitakanta Pattanaik, and **Ling Yuan** (2013) Transcriptional regulation of secondary metabolism. *Biochim Biophys Acta.* 1829(11): 1236-1247.
4. Patra, B. Pattanaik, S. and **Ling Yuan** (2013) Ubiquitin protein ligase 3 mediates the proteasomal degradation of GLABROUS3 and ENHANCER OF GLABROUS 3, regulators of trichome development and flavonoid biosynthesis in Arabidopsis. *The Plant Journal* 74:435-437.
5. Que Kong, Sitakanta Pattanaik, Antje Feller, Joshua R. Werkman, Chenglin Chai, Yongqin Wang, Erich Grotewold, and **Ling Yuan** (2012). A regulatory switch enforced by bHLH and ACT domain-mediated dimerization of the maize transcription factor R*. Proceeding of National Academy of Sciences, U.S. A.* 109: E2091-2097
6. Suttipanta, N., Pattanaik, S., Kulshrestha, M., Patra, B., Singh, S.K. and **Yuan, L.** (2011) The transcription factor CrWRKY1 positively regulates terpenoid indole alkaloid biosynthesis in *Catharanthus roseus. Plant Physiology* 157: 2081-2093.
7. Jordan, D.B., Wagschal, K., Fan, ZM., **Yuan, L.**, Braker, J.D. and Heng, C. (2011) Engineering lower inhibitor affinities in beta-D-xylosidase of Selenomonas ruminantium by site-directed mutagenesis of Trp145. *Journal of Industrial Microbiology and Biotechnology*. 38: 1821-1835
8. Pattanaik, S., Kong, Q., Zaitlin, D., Werkman, JH, Xie, CH, Patra, B., and **Yuan, L**. (2010) Isolation and functional characterization of a floral tissue-specific R2R3 MYB regulator from Tobacco. *Planta*. 231:1061-1076.
9. Fan, ZM and **Yuan, L.** (2010) Production of multifunctional chimaeric enzymes in plants. *Plant Biotechnology Journal*. 8:308-315.

10. Pattanaik, S., Kong, Q., Zaitlin, D., Werkman, JH, Xie, CH, Patra, B., and **Yuan, L.** (2010) Isolation and functional characterization of a floral tissue-specific R2R3 MYB regulator from Tobacco. *Planta*. 231:1061-1076.
11. Fan, ZM, Werkman, JH and **Yuan, L** (**2009**) Engineering a multifunctional hemicellulase. *Biotechnology Letters* 31： 751-757
12. Bai, Y., Pattanaik, S., Patra, B., Werkman, J.R., Xie, CH., and **Yuan, L.** (2011) Flavonoid-related basic helix-loop-helix regulators, NtAn1a and NtAn1b, of tabacco have originated from two ancestors and are functionally active. *Planta*. 234: 363-375
13. Fan, ZM*, Wagschal, K., Chen, W., Montross, MD, Lee, CC., and **Yuan, L.** (2009) Multimeric hemicellulases facilitate biomass conversion. *Applied and Environmental Microbiology*. 75: 1754-1757
14. **Yuan, L**., B. A. Nelson,* and G. Caryl. (1996) The Catalytic Cysteine and Histidine in the Plant Acyl-ACP Thioesterases. *Journal of Biological Chemistry* 271: 3417-3419.
15. **Yuan, L.**, S. P. Craig, J. H. McKerrow, and C. C. Wang. (1992) Steady State Kinetics of the Hypoxanthine-guanine Phosphoribosyltransferase of *Schistosoma mansoni*. *Biochemistry* 31: 806-810.

D. Research Support

<u>Ongoing Research Support</u>

US Department of Energy Christer Jansen (PI) 02/01/1-1/31/14
FOLIUM: developing tobacco as a platform for foliar synthesis of high-density liquid fuels.
The goal of this project is to produce high-density hydrocarbons including alkanes and terpenes in plants. The hydrocarbon fuels thus synthesized have characteristics of petroleum.
Role: co-PI

US Department of Agriculture Yuan (PI) 5/1/12-4/30/16
Tall fescue biochemical characterization.
The goal is to provide analytical support of constituent composition of forage plants.
Role: PI

The Council for Burley Tobacco Yuan (PI) 09/113/09-08/31/14
Topping-triggered sucker control system.
The goal is to develop an inducible gene expression system for the control of axillary shoots.
Role: PI

Kentucky Tobacco Research and Development Center Yuan (PI) 7/1/13-6/31/14
Tobacco Surface Chemistry: engineering of glandular trichome secretion.
The project aims to modification and analysis of tobacco leave chemicals.
Role: PI

<u>Completed Research Support</u>

USDA Yuan (PI) 02/01/02-01/31/05
Directed evolution of hemicellulosic hydrolases for bioconversion of corn fiber for the production of biofuels and bioproducts.
The goal is to engineer a hemicullulase for improved catalytic properties using directed evolution technologies.
Role: PI

DOE Chatterjee (PI) 09/01/06-08/31/07

Novel approach to microbial hydrogen production
The goal of this project was to increase hydrogen production in E.coli by altering the metabolic pathway.
Role: co-PI

Kentucky Science and Technology Foundation Yuan (PI) 11/1/10-10/31/12
Directed evolution of transposons”
The goal is to engineer a transposon for increase efficiency in plant gene transformation.
Role: PI

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Craig W. Vander Kooi	Associate Professor of Biochemistry
eRA COMMONS USER NAME (credential, e.g., agency login) CRAIG.VANDERKOOI	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION		DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Wheaton College	Wheaton, IL	B.S.	1997	Chemistry and Biology
University of Michigan	Ann Arbor, MI	M.S.	1999	Chemistry
Vanderbilt University	Nashville, TN	Ph.D.	2004	Biochemistry
Johns Hopkins University	Baltimore, MD	Postdoctoral		Biophysics

A. Personal Statement

The overarching goal of the laboratory focuses on determining the mechanism of physical interactions underlying human disease-associated biological processes at an atomic level and translate these insights into the development of specific inhibitors. The major focus of the lab is the interaction and regulation of cell surface receptors by circulating cytokines, growth factors, and hormones. One major research focus of the laboratory is the essential endothelial cell surface receptor Neuropilin, which is essential for both physiological and pathological VEGF-dependent angiogenesis.

B. Positions

1998 Research Aid, Argonne National Laboratory
1998-2000 Graduate Student, University of Michigan
2000-2004 Graduate Student, Vanderbilt University
2005-2008 Postdoctoral Fellow, Johns Hopkins University
2008-2013 Assistant Professor, University of Kentucky
2013-present Associate Professor, University of Kentucky

Honors and Awards

1994 Anton Hofstead Memorial Science Scholarship
1994-1997 President's Scholarship, Wheaton College
1998 Outstanding Chemistry Student Award, American Institute of Chemists Foundation
1998-2000 Regents Fellowship, University of Michigan
2000-2002 NIH Molecular Biophysics Training Grant
2006-2009 Leukemia and Lymphoma Society Fellow
2008-2012 Charles Wethington Research Excellence Award, UK College of Medicine

C. Selected peer-reviewed publications (34 total)

1) Guo H-F., Li X., Parker M.W., Waltenberger J., Becker P.M., **Vander Kooi C.W.‡** (2013) Mechanistic Basis for the Potent Anti-angiogenic Activity of Semaphorin 3F. Biochemistry, 52, 7551-7558. PMCID: In progress

2) Parker M.W., Linkugel A.D., **Vander Kooi C.W.‡,** (2013) Effect of C-Terminal Sequence on Competitive Semaphorin Binding to Neuropilin-1, J. Mol. Biol, 425, 4405-4414 PMCID: In progress

3) Bohnert K.A., Grzegorzewska A.P., Willet A.H., **Vander Kooi C.W.**, Kovar D.R., Gould K.L. (2013) SIN-dependent phosphoinhibition of formin multimerization controls fission yeast cytokinesis. Genes Dev. 27, 2164-2177. PMCID: In progress

4) Meekins D.A., Guo H-F., Husodo S., Paasch B.C., Bridges T.M., Santelia D., Kötting O., **Vander Kooi C.W.‡**, Gentry M.S.‡ (2013) Structure of the Arabidopsis Glucan Phosphatase LIKE SEX FOUR2 Reveals a Unique Mechanism for Starch Dephosphorylation. Plant Cell, 25, 2302-14. PMCID: PMC3723627

5) Jeoung M., Abdelmoti L., Jang E.R., **Vander Kooi C.W.**, Galperin E. (2013) Functional Integration of the Conserved Domains of Shoc2 Scaffold. PLoS One 8, e66067. PMCID: PMC3689688

6) Goel, H., Pursell, B., Chang, C., Shaw, L.M., Mao, J., Simin, K., Kumar, P., **Vander Kooi, C.W.**, Shultz, L.D., Greiner, D.L., Norum, J.H., Toftgard, R., Kuperwasser, C., & Mercurio, A.M., (2013) Gli1 Mediates Autocrine Signaling Involving Neuropilin-2 and the α6β1 Integrin that Contributes to Breast Cancer Initiation. EMBO Mol Med, 5, 488-508. PMCID: PMC3628099

7) Zhang W., Sviripa V., Chen X., Shi J., Yu T., Hamza A., Ward N.D., Kril L.M., **Vander Kooi C.W.**, Zhan C.G., Evers B.M., Watt D.S., Liu C. (2013) Fluorinated N,N-Dialkylaminostilbenes Repress Colon Cancer by Targeting Methionine S-Adenosyltransferase 2A. ACS Chem Biol, 8, 796-803. PMCID: PMC3631441

8) Parker, M.W., Guo, H-F., Li, X., Linkugel, A.D., **Vander Kooi C.W.**‡ (2012) Function of the Neuropilin Family as Essential Pleiotropic Cell Surface Receptors. Biochemistry, 51, 9437-9446. PMCID: PMC3510667

9) Parker M.W., Xu P., Guo, H-F., **Vander Kooi C.W.**‡ (2012) Mechanism of Selective VEGF-A Binding by Neuropilin-1 Reveals a Basis for Specific Ligand Inhibition PLoS ONE, 7, e49188, doi:10.1371/ journal.pone.0049177. PMCID: PMC3493496

10) Parker M.W., Li X., Gou H-F., Xu P., **Vander Kooi C.W**.‡ (2012) Structural Basis for VEGF-A Isoform Specific binding to Neuropilin. JBC 287, 11082-11089. PMCID: PMC3322888

11) Fulkerson Z, Wu T, Sunkara M, **Vander Kooi C.W.**, Morris AJ, Smyth SS. (2011) Binding of autotaxin to integrins localizes lysophosphatidic Acid production to platelets and Mammalian cells. J. Biol. Chem. 286, 34654-34663. PMCID: PMC3186383

12) Ren L., McLean J.R., Hazbun T.R., Fields S., **Vander Kooi C.W.**, Ohi, M.D., Gould K.L. (2011) Systematic Two-Hybrid and Comparative Proteomic Analyses Reveal Novel Yeast Pre-mRNA Splicing Factors Connected to Prp19. PLoS ONE 6(2):e16719. PMCID: PMC3046128

13) Hausmann J., Kamtekar S., Christodoulou E., Day J.E., Wu T., Fulkerson Z., Albers H.M., van Meeteren L.A., Houben A.J., van Zeijl L., Jansen S., Andries M., Hall T., Pegg L.E., Benson T.E., Kasiem M., Harlos K., **Vander Kooi C.W.**, Smyth S.S., Ovaa H., Bollen M., Morris A.J., Moolenaar W.H., Perrakis A. (2011) Structural basis of substrate discrimination and integrin binding by autotaxin. *Nat Struct Mol Biol.* 18, 198-204. PMCID: PMC3064516

14) Parker M.W., Hellman L.M., Xu P., Fried M.G., & **Vander Kooi C.W.**‡ (2010) Furin processing of semaphorin 3F determines its anti-angiogenic activity by regulating direct binding and competition for neuropilin. *Biochemistry* 49, 4068-4075. PMCID: PMC2868107

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16) **Vander Kooi C.W.**‡, Ren L., Xu P., Ohi M.D., Gould K.L., & Chazin W.J.‡ (2010) The Prp19 WD40 domain contains a conserved protein interaction region essential for its function. *Structure* 18, 584-593. PMCID: PMC2871033

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19) Mori M., **Vander Kooi C.W**., Leahy D.J., & Yue, D.T. (2008) Structure of the CaV2 IQ domain in complex with Ca2+/calmodulin: High-resolution mechanistic implications for channel regulation by Ca2+ *Structure,* **16**, 607-620. PMCID: PMC2363160

20) **Vander Kooi C.W.**, Jusino M.A., Perman B., Neau D.B., Bellamy H.D., & Leahy D.J. (2007) Structural basis for ligand and heparin binding to neuropilin B domains. *Proc Natl Acad Sci USA.* **104**, 6152-7. PMCID: PMC1851056

21) **Vander Kooi C.W.**, Ohi M.D., Oldham M.L., Newcomer M.A., Gould K.L., & Chazin W.J. (2006) The Prp19 U-box crystal structure suggests a common dimeric architecture for a class of oligomeric E3 ubiquitin ligases. *Biochemistry* **45**, 121-30. PMCID: PMC2570371

‡ Corresponding author

D. Research Support

Ongoing Research Support

R01 GM094155 (Vander Kooi, PI, 30% effort) 09/06/10-06/30/15
NIH/NIGMS
Mechanism of Neuropilin Dependent Angiogenesis
The major goals of this grant are to determine the mechanisms underlying neuropilin dependant angiogenesis. Coupled structural and functional studies will define the physical interactions required to activate the angiogenic signaling complex. Novel modes of inhibition will be developed in order to target neuropilin-dependent tumor angiogenesis and tumor metastasis.
Role: PI

R01 NS070899 (Gentry, PI, 10% effort) 07/01/10-06/30/15
NIH/NINDS
Regulation, signaling, and dynamics of glucan phosphatases
The major goals of this grant are to characterize the function, regulation, and structure of laforin and sex4 glucan phosphatases.
Role: Co-PI

Completed Research Support

Kentucky Lung Cancer Research Foundation (Vander Kooi, PI) 12/01/09-11/31/11
Physical mechanisms of VEGF receptor activation and novel modes of inhibition.
The major goal of this study is to develop novel inhibitors of angiogenesis.
Role: PI

P20 RR020171 (Hersh, PI) 03/17/08-06/30/11
NIH/NCRR
Project lead: Structural Studies of Neuropilin Signaling.
This study focuses on determining the interaction of neuorpilin with its ligands VEGF and semaphorin and determining the basis for neuropilin activation of axon guidance.
Role: Co-PI

Leukemia and Lymphoma Society (Vander Kooi, PI) 07/01/06-06/30/09

Structural studies of Flt3 activation and inhibition in AML.
This study focused on understanding the mechanisms of activation of Flt3 in AML and examining the binding of antibodies in clinical development.
Role: PI - Career Development Award

ABT Research Mentors

Plant & Soil Science
Joe Chappell
Randy Dinkins
David Hildebrand
Art Hunt
David McNear
Sharyn Perry
Todd Pfeiffer
Olga Tsyusko
Luke Moe

Anatomy & Neurobiology
Guoying Bing
Luke H. Bradley
Marilyn Duncan
Lothar Jennes

Animal Science
Laurie Lawrence
James Matthews

Molecular & Cellular Biochemistry
Trevor Creamer
Robert Dickson
Rebecca Dutch
Matthew Gentry
Michael Mendenhall
Carole Moncman
Kevin Sarge
Qingjun Wang
Craig VanderKooi
Haining Zhu

Biological Sciences
Phillip Bonner
Robin Cooper
D. Nicholas McLetchie
Edmund Rucker
S. Randal Voss

Entomology
Stephen Dobson
James Harwood
Charles Fox
Reddy Palli
Xugou Zhou
Bruce Webb

Horticulture
Seth DeBolt
Lynnette M.A. Dirk
Bruce Downie
Bob Houtz

Infectious Disease
Richard Greenberg

Internal Medicine
J. Scott Bryson
Nancy R. Webb

Kentucky Tobacco Research & Development Center
Ling Yuan
Indu B. Maiti

Microbiology & Immunology
Anthony Sinai
Robert Geraghty
Brett T. Spear
Brian Stevenson
Susan Straley

Molecular & Biomedical Pharmacology
John Littleton

College of Dentistry, Orthodontics
Sarandeep Huja

College of Dentistry, Restorative Dentistry
Michelle Steffen
Richard Mitchell

OHP Oral Diagnosis
Craig Miller

Center for Oral Health
Jeffrey Ebersole

Anesthesiology
Ivan Horvath

Obsterics & Gynecology
Misung Jo

Neurosurgery
David Yurek

Toxicology
Isabel Mellon

Pediatrics
John D'Orazio

Physiology
Karyn Esser
Ming C. Gong
Karin High
Mariana Nikolova-Jarakashian
Melinda Wilson

College of Pharmacy
Younsoo Bae
Esther Penni Black
Wooin Lee
Steve Van Lanen

Plant Pathology
Mark Farman
Michael Goodin
Aardra Kachroo
Peter Nagy
Christopher Schardl
Lisa Vaillancourt

Veterinary Science
Ernest Bailey
Udeni B. R. Balasuriya
Thomas M. Chambers
Kathyrn Graves
David W. Horohov
Daniel K. Howe
Charles Issel

Psychology
Susan Barron

(Updated 12/3/2013)

ABT Student Publications/Presentations

Professional Publications (2007-present):

Crum, M.R., Nadolski, J., Robinson, A.*, Burns, E., Robinson, M.M., DeCastro, L. and Cooper, R.L. (2013) Physiological effects of acute hypercalcemia in a crayfish model: behavior, cardiac, neurophysiology, gastrointestinal. (In preparation).

Tori B. Dunlap, Erik C. Cook, Julie Rumi-Masante, Hannah G. Arvin*, Terrence E. Lester and Trevor P. Creamer. 2013. The distal helix in the regulatory domain of calcineurin is important for domain stability and enzyme function. *Biochemistry*, in press.

Magnani, R., Chaffin, B., Dick, E.*, Bricken, M.L., Houtz, R.L., and Bradley, L.H. 2012. Utilization of a calmodulin lysine methyltransferase co-expression system for the generation of a combinatorial library of post-translationally modified proteins. *Protein Expression & Purification,* 86: 83-88. http://dx.doi.org/10.1016/j.pep.2012.09.012. PMID: 23036357

Fletcher, A. M.*, Kowalczyk, T. H., Padegimas, L., Cooper, M. J., and Yurek, D. M. 2011. Transgene Expression in the Striatum Following Intracerebral Injections of DNA Nanoparticles Encoding For Human Glial Cell Line-Derived Neurotrophic Factor *Neuroscience* 194, 220–226.

Shridas, P., Bailey, W.M., Talbott, K.R.*, Oslund, R.C., Gelb, M.H., and Webb, N.R. 2011. Group X secretory phospholipase A_2 enhances TLR4 signaling in macrophages. J Immunol. 187:482-9. PMCID: PMC3119755.

Bandyopadhyay, A., Kopperud, K.*, Anderson, G., Martin, K., and Goodin, M. 2010. An integrated protein localization and interaction map for potato yellow dwarf virus, type species of the genus *Nucleorhabdovirus.* Virology. Jun 20; 402(1):61-71.

Fox, C. W., Bush, M. L.*, and Messina, F.J. 2010. Biotypes of the seed beetle *Callosobruchus maculatus* have differing effects on the germination and growth of their legume hosts. Agricultural and Forest Entomology 12: 353-362. doi: 10.1111/j.1461-9563.2010.00484.x

Stork, J., Harris, D., Griffiths, J., Williams, B.*, Beisson, F., Li-Beisson, Y., Mendu, V., Haughn, G., and DeBolt, S. 2010. CELLULOSE SYNTHASE9 serves a non-redundant role in secondary cell wall synthesis in Arabidopsis epidermal testa cells. Plant Physiol. 10.1104/pp.110.154062.

Legan, S.J., Franklin, K.M., Donoghue, K.M.*, and Duncan, M.J. 2009. Phenobarbital blockade of the preovulatory LH surge: Association with phase-advanced circadian clock and altered suprachiasmatic nucleus *Period1* gene expression. Am. J. Physiol. Regul. Integr. Comp. Physiol. 296: R1620-1630. PMCID: PMC2689824

Martin, K., Kopperud, K.*, Chakrabarty, R., Banerjee, R., Brooks, R.*, and Goodin, M.M. 2009. Transient expression in Nicotiana benthamiana fluorescent marker line provides enhanced definition of protein localization, movement and interactions in planta. Plant J. 59, 150–162.

Crowdus, C.A.*, A.E. Marsh, W.J. Saville, D.S. Lindsay; J.P. Dubey, D.E. Granstrom, and D.K. Howe. 2008. SnSAG5 is an alternative surface antigen of Sarcocystis neurona strains that is mutually exclusive to SnSAG1. Veterinary Parasitology 158:36-43.

Firestine, Angela M.*, Chellgren, Veronique M., Rucker, Shelly J., Lester, Terrence E., and Creamer, Trevor P. 2008. Conformational properties of a peptide model for unfolded alpha- helices. *Biochemistry* 47, 3216-3224.

Dirk, L. M., Flynn, E.M.*, Dietzel, K., Couture, J.F., Trievel, R.C., and Houtz, R.L. 2007. Kinetic manifestation of processivity during multiple methylations catalyzed by SET domain protein methyltransferases. Biochemistry. 46:3905-3915.

Goodin, M.M., Chakrabarty, R., Yelton, S., Martin, K., Clark, A., and Brooks, R.* 2007. Membrane and protein dynamics in live plant nuclei infected with Sonchus yellow net virus, a plant-adapted rhabdovirus. J. Gen Virol. 88:1810-1820.

Morford, L.A., Davis, C.*, Jin, L., Dobierzewska, A., Peterson, M.L., and Spear, B.T. 2007. The oncofetal gene glypican 3 is regulated in the postnatal liver by zinc fingers and homeoboxes 2 in the regenerating liver by alpha-fetoprotein regulator 2. Hepatology. [Epub ahead of print] PMID: 17668883 [PubMed - as supplied by publisher].

Wilson, M.E., K.F. Allred, E.M. Kordik, D.K. Jasper*, A.N. Rosewell, and A.J. Bisotti. 2007. Gender-specific effects of HIV protease inhibitors on body mass in mice. AIDS Res. Ther. 4:8.

Student Journal Publications:

Houtz, Philip L.* Mentor: Professor David Atwood. "The Agricultural Footprints on the Environment." Kaleidoscope: University of Kentucky Journal of Undergraduate Research. 8.1 (2009) pp. 30-35.

Dick, D.E.* Mentor: Dr. Luke Bradley. "Screening Synthetic Combinatorial Protein Libraries for Changes in Calmodulin Binding Specificity." Kaleidoscope: Vol. 10, Article 8.

*****denotes Agricultural Biotechnology student

Oral Presentations:

Entomological Society of America Annual Meeting (2013) Rebecca Wente

National Conference on Undergraduate Research (2013) Emerson Dick

National Conference on Undergraduate Research (2013) Raquel Hegge

National Conference on Undergraduate Research (2013) Rebecca Wente

Showcase of Undergraduate Scholars (2013) Rebecca Wente

2nd International Symposium on the Molecular Detection of Trophic Interactions (2013) Rebecca Wente

National Conference on Undergraduate Research (2012) Alyssa Fountain

Undergraduate Representative for Bluegrass Chapter of Society of Neuroscience (2011-2012) Alyssa Fountain

University of Kentucky Showcase of Undergraduate Scholars (2012) Ashlee Anciro

The Kentucky Academy of Science Annual Meeting (2012) Emerson Dick

7th Annual Showcase of Undergraduate Scholars, University of Kentucky (2012) Ariel Robinson

Spring Neuroscience Day, University of Kentucky (2012) Ariel Robinson

Annual meeting of the society for Neuroscience (2012) Ariel Robinson

American Arachnological Society Annual Meeting (2012) Rebecca Wente

Entomological Society of America Annual Meeting (2012) Rebecca Wente

National Conference on Undergraduate Research (2011) Philip Houtz

6th Annual Showcase of Undergraduate Scholars, University of Kentucky (2011) Ariel Robinson

Annual meeting of the Society of Neuroscience Bluegrass Chapter (2011) Ariel Robinson

Annual meeting of the Society for Neuroscience (2011) Ariel Robinson

The Kentucky Academy of Science Annual Meeting (2011) Ariel Robinson

The Kentucky Academy of Science Annual Meeting (2011) Emerson Dick

National Conference on Undergraduate Research (2010) Philip L. Houtz

Discovery Seminars Program Showcase, University of Kentucky (2009) Philip Houtz

3rd place award 23rd Annual Forum Undergraduate Student Paper Competition Ohio Valley Entomological Association (2008) James Baulding

Poster Presentations

University of Kentucky Showcase of Undergraduate Scholars (2013) Ashlee Anciro

Third Place in the Animal Science Association Joint Annual Meeting (JAM) Undergraduate Poster Competition (2012) Raquel Hegge

Society of Invertebrate Pathology Annual Meeting's Outstanding Student Poster Presentation: Honorable Mention (2011) Philip Houtz

44th Annual Meeting of the Society of Invertebrate Pathology (2011) Philip Houtz

Undergraduate Student Competition Poster: Entomological Society of America (ESA) Annual Meeting (2010) Philip Houtz

Student Competition Poster: Entomological Society of America (ESA) Annual Meeting (2009) Philip Houtz

Posters at the Capital

2013

Emerson Dick – *High-throughput Platform for Monitoring Protein Binding Specificity*

Jessica Gambrel – *In vivo Screen to Measure the Role of Post-translational Modification on Protein Binding Specificity*

Rebecca Wente – *Effects of Intraguild Cues on Ground-dwelling and Foliage-dwelling Spiders on Lady Beetle Oviposition and Aphid Suppression*

2011

Philip Houtz – *The Characterization of a Novel Cypovirus in a Parasitoid-Host Relationship*

Taylor Lloyd – *Seed Maturation Protein (SMP): Regulating Seed Behavior Following Temperature Shock*

2010

Alyssa Fountain – *Enzymatic Investigation of the Anti-apoptotic Properties of DNSP – 11*

Philip Houtz – *Persistence of Campoletis sonorensis ichnovirus in vivo and TAIL PCR Method in Junction Site Determination.*

2009

Mark Adams – *Molecular Elucidation of Carabid Beetle Foraging Behavior in Alfalfa*

Lesley Mann – *In situ Protein Localization in Endophytic Fungi during Benign Plant Colonization and Stromata Development*

College of Agriculture
Interdepartmental Program in Agricultural Biotechnology (B.S. program)
Program Assessment

Mission Statement

The mission of the Agricultural Biotechnology degree program is to recruit and train students in modern methods and principles of biotechnology research including cellular and molecular biology, genetic engineering, and protein science, and to graduate students who will contribute to the economic development of Kentucky through enhancement of a knowledge-based research and technology-driven economy.

Statement of Learning Outcomes

1. Agricultural Biotechnology graduates will acquire knowledge about the range of approaches to manipulate and improve plants, animals and microorganisms.

2. Agricultural Biotechnology graduates will demonstrate the ability to interpret, evaluate and communicate their assessment of modern biotechnology approaches for the purposes cited in Learning Outcome 1.

3. Agricultural Biotechnology graduates will evaluate how their experience in the Agricultural Biotechnology program has influenced their outlook on the relationship between society and biotechnology, and how their personal philosophies and values have been influenced as a consequence of the program.

4. Agricultural Biotechnology students will participate in research projects including the requirements of the independent study course ABT 395, or experiential learning course ABT 399. Presentation (oral and written) is an integral part of their research program and they will demonstrate their ability to communicate about science through these presentations. ABT students will have the opportunity to become authors and co-authors on suitable outlets for communication of their research results including abstracts presented at professional meetings, and where possible peer-reviewed scientific research publications.

Curriculum Map for Agricultural Biotechnology

Courses		Outcomes			
		Outcome 1	**Outcome 2**	**Outcome 3**	**Outcome 4**
	Pre-major requirements	I /R	I/R		
	ABT101	I	I	I	I
	ABT201W	R	R	R	R
	ABT301W	A	A	A	E/A
	Other major requirements: BIO308/209, BIO304, BCH401G, STA291 or 570	R/E	R/E		
	ABT460	E	E		
	ABT461	E	E		
	ABT495		E		E
	ABT395/399	A	E	A	A
	Specialty Support courses	E/A	E/A		

I=Outcome is Introduced; R=Outcome is Reinforced; E=Outcome is Emphasized; A=Outcome is Applied

Program Assessment Methods and Procedures

The basic strategy for program level assessment is similar for all four learning outcomes. All students, both transfer students from other programs and students who initiate their college career at UK as ABT students, take ABT201. A small writing assignment is part of this course. This will serve as the initial assessment point. All ABT students perform independent research projects (ABT395 or 399) culminating in a public presentation. This will serve as an exit assessment point. The papers from ABT201 will be electronically archived and a sampling (at least three papers) assessed using the attached rubric by a subset of the ABT coordinating committee in April-May of each year. For the presentations, a similar rubric (please see below) will be provided to the members of the coordinating committee and other faculty of ABT in attendance to collect data. This will occur in May of each year. Following, the data will be assessed to compare performance in ABT201 to 395/399, summarized, circulated to the coordinating committee and entered into Blackboard by a UGS.

Assessment strategy for Outcome 1:

A great deal of basic and specialized knowledge is inherent in biotechnology. The papers/presentations from ABT201 and 395 will be evaluated for basic understanding of the science behind the questions and approaches addressed.

Assessment strategy for Outcome 2:

Not only is basic knowledge important but also the ability to explain the background knowledge as well as the ability to interpret and evaluate approaches to addressing problems and questions in biotechnology. The papers/presentations will be assessed for LO2 for the clarity of explanation of the background material and the pros and cons of the scientific approaches to address remaining questions.

Assessment strategy for Outcome 3:

Exercises throughout the ABT curriculum require students to consider the societal value of first others, and later their own research programs. For this learning outcome the papers/presentations from ABT201 and 395 will be assessed for the how well the value of the research (others research in 201 and the students' own projects in 395) to society is presented.

Assessment strategy for Outcome 4:

This outcome is evaluated in part in ABT395/399 that culminates in a final report. General quality of communication (written in 201 and oral in 395/399) will be assessed to document students increased (or not) ability to communicate about science. Participation beyond the 395/399 project is measured by manuscripts co-authored by ABT students and published in peer reviewed scientific journals. Because this most often occurs later (after the student graduates), this is an indirect measure.

Assessment Cycle: Outcomes 1 and 2 will be evaluated the first year of the assessment cycle, Outcome 3 the second year, and Outcome 4 the third year. Assessment will be performed by a subset of the coordinating committee in the Spring of each year (after the final presentations for the 395/399 projects – May). Results will be circulated to the coordinating committee and an improvement plan will be agreed upon at a meeting or by an email consensus. A/the UGS for the program will enter data into Blackboard.

Targets/Benchmarks: For the initial cycles we will collect baseline data. However the goal is for an average overall evaluation score to be above 3.5 for students graduating from the program.

Scoring systems for the learning outcomes for the ABT201 papers:

Criteria	**Deficient**	**Low**	**Medium**	**High**	**Excellent**
score:	**1**	**2**	**3**	**4**	**5**
Outcome 1: e.g., is it clear that the student understands the question/problem and approaches to address the question?					
Outcome 2: e.g., can the student address pros and cons of approaches and describe caveats to interpretation?					
Outcome 3: e.g., is the student able to clearly explain why the research is worth doing? Should taxpayer money fund such research and why?					
Outcome 4: e.g., what is the overall quality of communication?					

Additional comments:

ABT 395 Student Presentation Evaluations

Please provide comments and a numerical score (1 = deficient, 2 = low, 3 = medium, 4 = high, 5 = excellent) for the following:
A) Does the student understand the research question/problem and the experimental approaches to address the question?
B) Is it apparent that the student is aware of the pros/cons of different experimental approaches and limitations to their data interpretations?
C) Has the student explained the study rationale and justifications?
D) How well has the student communicated their research project?

In addition to the comments and numerical scores, please give a final ranking of the student's presentation relative to others during the session. This ranking will be used to select the recipient of the Glenn Collins Research Achievement Award in ABT.

Final Ranking	**Student Name**	**Comments and scoring**
		A) = B) = C) = D) =
		A) = B) = C) = D) =
		A) = B) = C) = D) =
		A) = B) = C) = D) =
		A) = B) = C) = D) =

		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =

UNIVERSITY OF KENTUCKY®

Annual Student Learning Outcomes Report

College of Agriculture, Food and Environment
Agricultural Biotechnology - Bachelor
Spring 2010 Agricultural Biotechnology.b

Student Learning Outcome(s) Assessed

agbiotch.b: Interpret & Evaluate Agricultural Biotechnology graduates will demonstrate the ability to interpret and evaluate modern biotechnology approaches to the manipulation and improvement of plants, animals, microorganisms, and the control of agricultural pests and diseases.

agbiotch.b: Relationship Agricultural Biotechnology graduates will evaluate how their experience in the Agricultural Biotechnology program has influenced their outlook on the relationship between society and biotechnology, and how their personal philosophies and values have been influenced as a consequence of the program.

agbiotch.b: Acquire Knowledge Agricultural Biotechnology graduates will acquire knowledge about the range of approaches to manipulate and improve plants, animals and microorganisms.

agbiotch.b:Communicate about research: ABT students will demonstrate their ability to communicate about science via oral presentations and written papers. For example, all Agricultural Biotechnology students participate in research projects including the requirements of the independent study course ABT 395, or experiential learning course ABT 399. Presentation (oral and written) is an integral part of this research requirement. The administration of the ABT program is very proud that many of the ABT students will have the opportunity to become authors and co-authors on suitable outlets for communication of their research results including abstracts presented at professional meetings and peer-reviewed scientific research publications.

Assessment Methods and Tools

Final term papers from ABT201 and ABT395 were compared with respect to four learning outcomes for ABT. Three term papers from each of ABT201 and ABT395 were chosen at random and provided to an independent evaluation committee for assessment.

C1. papers from ABT201W and 395 were evaluated for basic understanding of the science behind the questions and approaches addressed

C2. the ability to explain the background knowledge as well as the ability to interpret and evaluate approaches to addressing problems and questions in biotechnology.

C3. clarity of explanation of the background material

C4. pros and cons of the scientific approaches

C5. how well the value of the research to society is presented.

C6. General quality of writing

Results

C1. ABT395 reports were uniformly more complex than those of ABT201, demonstrating that students developed a deeper comprehension of science
C2. ABT395 reports all had detailed formal introductions and the data presented was supported by statistical analyses not present in ABT201 papers
C3. All 395 papers randomly selected for the review committee were excellent with respect of clarity of explaining background material
C4. Varied and appropriate scientific approaches relevant to each research question were used and evaluated in all 395 papers
C5. Research on pharmaceuticals, obesity, anti-venom production and other socially relevant issues were presented in both 201 and 395 papers
C6. In all aspects of writing, there was marked improvement in 395 papers compared to 201 papers

Interpretation of Results

The ABT students demonstrated increased basic knowledge in areas relevant to biotechnology and use of this knowledge to think creatively about scientific problems of importance to society. They improved in ability to interpret and evaluate information and communicate effectively with others.

Improvement Action

Recommendations are to maintain the current, and exceptional, high quality of instruction in the ABT program, which consistently places many students in high caliber graduate programs, medical-, and related, schools, as well as providing many with refereed journal publications.

Instructors of ABT201 and ABT395 will be presented with the impartial results of this evaluation so that they may, as necessary, make any required improvements to their exceptionally high quality courses.

Reflection

No specific actions were recommended in this first IAP other than to maintain the current, high quality instruction in the ABT program. Given that the following two years attracted a record number of merit scholars (20 in 2011 and 18 in 2012), the program is clearly seen as excellent training by entering students to help them fulfill their career goals.

Attachments

No Attachments

UNIVERSITY OF KENTUCKY

Annual Student Learning Outcomes Report

College of Agriculture, Food and Environment
Agricultural Biotechnology - Bachelor
ABT Assessment LO3 2011

Student Learning Outcome(s) Assessed

agbiotch.b: Relationship Agricultural Biotechnology graduates will evaluate how their experience in the Agricultural Biotechnology program has influenced their outlook on the relationship between society and biotechnology, and how their personal philosophies and values have been influenced as a consequence of the program.

Assessment Methods and Tools

Final term papers from ABT201 and public presentations from ABT395/399 were evaluated with respect to four learning outcomes for ABT (presented above). For 395, a rubric was provided to each ABT committee members in attendance to evaulate each presenter. For 201, random papers (3) were selected and evaluated using a rubric by members of the committee. Data was compiled and average scores calculated.

For LO 3: Exercises throughout the ABT curriculum require students to consider the societal value of first others, and later their own research programs. For this learning outcome the papers/presentations from ABT201 and 395 will be assessed for the how well the value of the research (others' research in 201 and the students' own projects in 395) to society is presented.

Results

Papers/presentations were scored for each LO. 1=deficient; 2=low; 3=medium; 4=high; 5=excellent. For LO3 committee members were asked to rate how well the student explained the study rationale and justification for the 395/399 presentations of which there were 15 in Spring 2011. ABT201 papers were assessed for LO3 by asking the reviewers to indicate how well the student explained why the research is important.

The average score for LO3 was 2.8 (SD, 0.7) for the ABT201 papers indicating the students did poorly (low = 2) to mediocre (medium =3) at explaining why the research should be performed. The score for this LO was much improved in the 395/399 presentations with an average score of 3.9 (SD, 0.8). This indicates high quality explanation of the value of the research to society. There is a significant improvement between 201 and 395/399 for this LO.

Interpretation of Results

The average score for LO3 was 2.8 (SD, 0.7) for the ABT201 papers indicating the students did poorly (low = 2) to mediocre (medium =3) at explaining why the research should be performed. The score for this LO was much improved in the 395/399 presentations with an average score of 3.9 (SD, 0.8). This indicates high quality explanation of the value of the research to society. There is a significant improvement between 201 and 395/399 for this LO.

Scores for the other outcomes also indicated improvement in 395/399 compared to 201 and will be reported in the appropriate year.

Improvement Action

The ABT program attracts and retains excellent students. A measure of this is the high number of merit scholars entering the program in 2011 (twenty merit students will enter the program in Fall 2011). The students while in the program receive many prestigious awards and honors including two Goldwater scholarships and the Astronaut scholarship in 2011. Many of the students co-author peer-reviewed scientific manuscripts from their independent study projects. ABT consistently places graduates in high caliber graduate and professional programs.

An assignment will be added to ABT201 that will help students develop an outline early in the semester to address the topic and importance of the topic. In the past, students provided peer review of each others papers, revised as appropriate, and the final paper was submitted to the instructor. Addition of this assignment will allow the instructor to provide feedback earlier in the semester.

Reflection

The ABT program has continued to attract excellent students. In 2011, 20 merit students entered the program. In 2012, 18 entering ABT students were advised during the merit weekends. In the 2011 IAP, plans were stated to add an assignment to ABT201 in which students were asked to identify the topic of their research paper earlier in the semester and justify importance of the topic. This was done to improve their performance on Outcome 3: Evaluate how their ABTexperience has influenced their personal philosophies of society and biotechnology. Assessment of the papers will occur soon allowing determination of whether this assignment improved performance on this learning outcome or not.

Attachments

No Attachments

UNIVERSITY OF KENTUCKY®

Annual Student Learning Outcomes Report

College of Agriculture, Food and Environment
Agricultural Biotechnology - Bachelor
Spring 2012 ABT

Student Learning Outcome(s) Assessed

agbiotch.b:Communicate about research: ABT students will demonstrate their ability to communicate about science via oral presentations and written papers. For example, all Agricultural Biotechnology students participate in research projects including the requirements of the independent study course ABT 395, or experiential learning course ABT 399. Presentation (oral and written) is an integral part of this research requirement. The administration of the ABT program is very proud that many of the ABT students will have the opportunity to become authors and co-authors on suitable outlets for communication of their research results including abstracts presented at professional meetings and peer-reviewed scientific research publications.

Assessment Methods and Tools

Final term papers (n=3) from ABT201 and public presentations from ABT395/399 were evaluated with respect to four learning outcomes for ABT (data is collected for all 4 outcomes but only LO4 is addressed in this cycle). For 395, a rubric was provided to each ABT committee members in attendance to evaulate each presenter. For 201, random papers (n = 3) were selected and evaluated using a rubric by members of the committee. Data was compiled and average scores calculated. Papers/presentations were scored for each LO. 1=deficient; 2=low; 3=medium; 4=high; 5=excellent. For LO4, ABT committee members were asked to rate how well the student explained the study rationale and justification for the 395/399 presentations of which there were 11 in Fall 2011 and 8 in Spring 2012 for a combined sample size of n = 19. ABT201 papers were assessed for LO4 by asking the reviewers to indicate how well the student explained why the research is important.

Results

The average score for LO4 was 3.0 for the ABT201 papers indicating the students did poorly (low = 2) to mediocre (medium =3) at explaining why the research should be performed (one facet of being involved in research that can be scored between 201 and 395/399). The score for this LO was much improved in the 395/399 presentations with an average score of 4.5. This indicates high quality explanation of the value of the research to society. Based on this sampling, it is clear that the students made much improvement between 201 and 395/399 for LO4.

Interpretation of Results

Details on the process of collecting and assessing the data are described in Methods. Members of the coordinating committee in attendance at the Fall 2011 and Spring 2012 395/399 presentations used the rubric to score the presentations. The co-directors of undergraduate studies (M.Goodin and S.Perry) and Dr. D. Howe (chair of the coordinating committee) scored the 201 papers. Data analysis was performed by M. Goodin and recommendations agreed upon by M. Goodin, D. Howe and S. Perry.

The scores for LO4 increased from an average of 3 (medium) to 4.5 (high to excellent) from the 201 to the 395 experience.

The ABT students continue to excel in their research pursuits. Several were awarded prestigious external scholarships to support their research in the past year including the Astronaut, Goldwater and Beckman scholarships as well as an American Society of Plant Biologists Summer Undergraduate Research Fellowship (ASPB-SURF) award.

The ABT program continues to attract and retain excellent students. A measure of this is the high number of merit scholars entering the program in 2012 (18 merit students will enter the program in Fall 2012). The Vice- and President of the Student Body 2011 were both ABT students. Many of the students co-author peer-reviewed scientific manuscripts from their independent study projects. ABT consistently places graduates in high caliber graduate and professional programs.

Improvement Action

A guide to preparing quality written and oral presentations will be provided to students in all relevant ABT courses (ABT101, 201, 301 and 395) that will help students develop project outlines early in the semester and throughout their undergraduate tenure. Additional incentive to spur student attention to quality presentations will be to encourage participation in the Alltech Young Scientist Program, which requires a 3500 word essay, and which awards a $5000 scholarship to the winner (http://www.alltech.com/education/alltech-young-scientist/about). We will track the numbers of students enrolled in the "pipeline" of presentation-oriented courses in the ABT program (ABT101, 201, 301 and 395), as an indicator of how mentoring in presentation skills contributes to overall success in the program. We will continue to quantify the quality of written and oral presentations, particularly between ABT201 and ABT395 as this should reflect the most significant transition from inexperienced writers to polished presenters in the ABT program.

Summary IAP over the years and uses of results, Oct. 29, 2012:

Over the period of assessment, data has been collected to demonstrate that students progress in their ability to communicate about their and others' research and the value of particular areas of research to society with number of years of their program completed. Therefore we used these results to introduce assignments and resources to support development of these skills earlier in their degree program. Specifically, an assignment was added to ABT201, a course normally taken in the Fall of the Sophomore year, to have students identify the topic of their paper and justify the importance of the research question or problem to society (e.g. why should tax dollars be spent to support a particular research area?).To help students develop effective written and oral presentations, guidelines are provided in multiple core courses throughout their time at UK. At the initiative of a faculty member, a new course has been developed ABT120: Genetics and Society, in which second semester freshmen will enroll. This course will provide hands on lab experience earlier in their degree program than currently available. Because the course will enroll not only ABT students but also non-science majors (the course is an approved UK Core course for Inquiry in Natural, Physical and Mathematical Sciences), students will gain experience communicating about science with a broader population than only other science-oriented students. The course includes a number of written and oral debate exercises to help develop our students' skills in these areas as well. Finally a number of other initiatives have been taken to strengthen our program. Students are made aware of broadening opportunities available to them such as Education Abroad, or the ability to perform research or internships nationally as well as internationally. These, as well as other opportunities are presented in ABT101 and 201.

Reflection

Over the period of assessment, data has been collected to demonstrate that students progress in their ability to communicate about their and others' research and the value of particular areas of research to society with number of years of their program completed. Therefore we used these results to introduce assignments and resources to support development of these skills earlier in their degree program. Specifically, an assignment was added to ABT201, a course normally taken in the Fall of the Sophomore year, to have students identify the topic of their paper and justify the importance of the research question or problem to society (e.g. why should tax dollars be spent to support a particular research area?).To help students develop effective written and oral presentations, guidelines are provided in multiple core courses throughout their time at UK. At the initiative of a faculty member, a new course has been developed ABT120: Genetics and Society, in which second semester freshmen will enroll. This course will provide hands on lab experience earlier in their degree program than currently available. Because the course will enroll not only ABT students but also non-science majors (the course is an approved UK Core course for Inquiry in Natural, Physical and Mathematical Sciences), students will gain experience communicating about science with a broader population than only other science-oriented students. The course includes a number of written and oral debate exercises to help develop our students' skills in these areas as well. Finally a number of other initiatives have been taken to strengthen our program. Students are made aware of broadening opportunities available to them such as Education Abroad, or the ability to perform research or internships nationally as well as internationally. These, as well as other opportunities are presented in ABT101 and 201.

Attachments

No Attachments

UNIVERSITY OF KENTUCKY®

Annual Student Learning Outcomes Report

College of Agriculture, Food and Environment
Agricultural Biotechnology - Bachelor
2012-2013 ABT

Student Learning Outcome(s) Assessed

agbiotch.b : Interpret & Evaluate Agricultural Biotechnology graduates will demonstrate the ability to interpret and evaluate modern biotechnology approaches to the manipulation and improvement of plants, animals, microorganisms, and the control of agricultural pests and diseases.

agbiotch.b : Acquire Knowledge Agricultural Biotechnology graduates will acquire knowledge about the range of approaches to manipulate and improve plants, animals and microorganisms.

Assessment Methods and Tools

Papers from ABT201 and public presentations from ABT395/399 were evaulated with respect to the four learning outcomes. Data is collected on all four outcomes each year but LO1 and 2 are assessed this cycle. Because these outcomes (Interpret and evaulate modern biotechnology, LO2 and Aquire knowledge about approaches, LO1) are closely related, they will be assessed together in this analysis. For 395/399, a rubric was provided to each ABT committee member in attendance to evaulate each presentor (each Fall and Spring semester has approximately 10 presenters). For 201, random papers (n=3) are selected each year, students identifiers removed, and the papers evaluted using a rubric by the members of the committee. Data was compiled and average scores calculated. Papers/presentations were scored 1 = deficient; 2 = low; 3 = medium; 4 = high; and 5 = excellent. For LO1, evaluators were asked to assess if the student understands the question/problem and approaches to assess the question. For LO2 students were assessed for whether they understand the pros and and cons of approaches used and caveats of interpretation.

Results

For LO1, the average score compiled from ABT 201 papers from 2011 and 2012 was 2.9 (standard deviation of 0.7); and for LO2 was 2.5 (0.7) indicating a low to medium understanding of approaches to questions (LO1) and pro/cons of the approaches/caveats to interpretation (LO2). For the 395/399 presentations these scores were 4.3 (0.7) and 3.9 (0.7) respectively indicating improvement in these areas.

Interpretation of Results

The ABT program is successful at improving our students understanding of modern biotechnology and approaches to current health, agricultural, and enviromental challenges that can be met by biotechnology. Scores greatly improve between 201 and 395/399 which measure understanding early in the program and near completion. Scores are near (3.9) or above "high" (4) for all LO. The most recent scores (Spring 2013) for ABT395/399 for all LO's are 4.3 to 4.8. Thus we are meeting our target.

Data was collected by members of the ABT faculty/coordinating committee, compliled by co-directors for UGS M. Goodin and S. Perry. This report was generated by S. Perry with input from M. Goodin and D. Howe (Chair of the ABT Coordinating Committee).

Improvement Action

ABT is currently undergoing a Self Study process that will be followed by External Review that will provide an opportunity to reflect on our assessment process. As part of the self study, Admissions Committees and Associate Deans of Admissions of the UK Medical School and Pharmacy programs were contacted and asked for feedback on the ABT students who enter these programs after their B.S. Feedback on our graduates has been very positive with ABT students recognized as among the most prepared and once in the programs, among the most successful. ABT continues to attract excellent students with high numbers of Merit students entering the program, and while in the program, students receiving prestigious external scholarships to support research activities, and publishing their research in peer reviewed scientific journals.

ABT already has high expectations and our students excel in the program and once they graduate. Therefore the goal of the program is to maintain the current level of success.

Reflection

Attachments

No Attachments

ABT Student Awards

Undergraduate Research Awards

AMSTEMM Research Fellowship (Spring 2013) Jessica Gambrel

Undergraduate Research Fellowship (Summer 2013) Jessica Gambrel

AMSTEMM Research Fellowship (Fall 2012, Spring 2013, Fall 2013) Rebecca Wente

Office of Undergraduate Research Summer Creativity Grant (Summer 2012) Rebecca Wente

AMSTEMM Research Fellowship Research Fellowship (Fall 2011, Spring 2012) Ashlee Anciro

Summer Undergraduate Research Fellowship (summer 2011) Emerson Dick

Undergraduate Research Summer Creativity Grant (Summer 2012) Ashlee Anciro

AMSTEMM Undergraduate Research Fellowship (2011-2012) Alyssa Fountain

AMSTEMM Undergraduate Research Fellowship (Spring 2009, Summer 2009, Fall 2011) Philip Houtz

AMSTEMM Undergraduate Research Fellowship (Summer 2010) James Baulding

Undergraduate Summer Research Grant (Summer 2008, Summer 2009) Kristin Kopperud

AMSTEMM Research Fellowship (Fall 2008) Mark Adams

Travel Awards

American Society of Virology Travel Grant (Summer 2013) Joseph Wells

Office of Undergraduate Research Travel Grant to the 2013 National Conference for Undergraduate Research (NCUR) Raquel Hegge

Office of Undergraduate Research Travel Grants (Nov. 2012, April 2013, November 2013) Rebecca Wente

The American Arachnological Society Travel Grant (July 2012) Rebecca Wente

Barry M. Goldwater Scholarship

2011 Philip Houtz

2011 Taylor Lloyd

2009 Lesley Man

Astronaut Scholarship Foundation Award

2011 Taylor Lloyd

Summer Undergraduate Research Fellowship Award from the American Society of Plant Biologists

2011 Taylor Lloyd

Alltech Young Scientist Award Undergraduate Regional Winner

2013 Samuel Janes

Beckman Scholars

2010-2011 Philip Houtz

2009-2010 Jessica Houtz

2009-2010 Laura Crawford

2008-2009 Lesley Mann

Chellgren Scholars

2009 Philip Houtz

2009 Zachary Willard

2012 Jessica Gambrel

Gates Cambridge Scholar

2010 Lesley Mann

Wethington Fellowship

2010 Laura Crawford

Outstanding Senior in the UK College of Agriculture

2009 Jessica Houtz

Outstanding Junior in the UK College of Agriculture

2010 Philip Houtz

The Oswald Research & Creativity Award

2013 Raquel Hegge

The Glenn Collins Undergraduate Research Achievement Award in Agricultural Biotechnology

Spring 2013 Raquel Hegge

Fall 2012 Joseph Wells

Spring 2012 Abby Rowland

Fall 2011 Damon Revelette

Spring 2011 Philip Houtz

Fall 2010 Micah Fielden

Spring 2010 Anita Fletcher

Fall 2009 Emily Cottrell

Spring 2009 Cassie Modahl and Elyse Tinker

Fall 2008 Reega Purohit

Spring 2008 Erika Namay

Fall 2007 Taylor Ashley and Carolyn Crowdus

Spring 2007 Aaron McNulty and Jeremy Bonzo

Special Awards and Recognitions

Elizabeth S. Moore, the Veterinary Investigator Program at Cornell University for (Summer 2008)

Devin Henry, Cornell Summer Research Program (Summer 2013)

Claci Ayers, Football Homecoming Queen (Fall 2013)

Micah Fielden, President of the University of Kentucky Student Government Association (Fall 2011 - Spring 2012)

Nicole Hunt, Vice-President of the University of Kentucky Student Government Association (Fall 2011 - Spring 2012)

Micah Fielden, Outstanding Greek Man (2010) Nicole Hunt, Outstanding Greek Woman (2011)

Comments from Dr. Carol Elam, Associate Dean for Admissions and Institutional Advancement, University of Kentucky College of Medicine:

"I believe the ABT program is the one of the most rigorous degree programs that undergraduate students can pursue at the University of Kentucky. Students complete demanding coursework, and have opportunities to pursue research in leading edge laboratories. I consider the advising for this program as well as the available support services through the College of Agriculture to be outstanding. For students who are considering work in the science fields, this degree can lead to many different careers. (And the College of Agriculture does an outstanding job in helping students learn of the range of possible positions and meet recruiters.) For ABT graduates who choose to come to medical school, I have found them to be well prepared, excellent time managers, and frankly… just nice people.

Some information about the performance of students who entered the UKCOM from 2008-2013 follows:

From this six year period, we matriculated 11 students who completed Agricultural Biotechnology majors. Four of these individuals are currently M2 or M3 students. Seven students are currently M4 or have graduated. Three of the 7 have been named Alpha Omega Alpha, and three of the remaining 4 were AOA eligible... *meaning they were in the top quarter of the class*. (Alpha Omega Alpha is the national medical honorary that requires outstanding academic performance as well as leadership and service. It is the most prestigious honor society in medicine.)

I have also attached the unedited comments from our medical school admissions committee members regarding the two questions that we agreed to pose to them in our earlier emails."

1. **How would you characterize their academic preparation at the time of their application to medical school?**

   Can't recall interviewing any.

   No useful data. I do not recall interviewing or working with them.

   I can't recall any specific candidates. Students seem to be well prepared.

   I know two of your students from their MS3 clerkship and both are doing quite well so I feel the Ag Bio program is doing a fine job.

2. **Do you have suggestions what the ABT program could do to enhance the academic preparation of students who may choose to apply to medical school?**

   Take immunology course

   No suggestion for change

A great program-student we admit does very well. I work primarily with admissions and I see a number that have not had proper counseling about the admissions process early in their undergrad years.

ABT faculty should become aware of the AAMC core entry level competencies and changes in the MCAT and adjust curriculum accordingly.

Overall opinion of ABT program is favorable and would be a good choice by pre-meds.

I have no suggestions on how to improve since I think they compare well with other well- prepared students.

Comments from Dr. Penni Black, University of Kentucky College of Pharmacy:

“I think I can speak for most of my colleagues in Pharm Sci that the students from Ag Biotech are among our most prepared students. I cannot recall an instance of a struggling student who began their academic career with you all, because I usually ask. I am aware that a few of our better students were Ag Biotech majors. I'm sure there are cases in between too.

Sorry I can't be more data-driven.”

ABT alumni survey

SurveyMonkey

1. In what month and year did you graduate?

	Response Count
	35
answered question	**35**
skipped question	**0**

2. What is your current status (student in graduate or professional school, employment position, etc.)?

	Response Count
	35
answered question	**35**
skipped question	**0**

3. How effective was the teaching within the ABT major?

	Response Percent	Response Count
Extremely effective	**48.6%**	**17**
Very effective	**48.6%**	**17**
Moderately effective	2.9%	1
Slightly effective	0.0%	0
Not at all effective	0.0%	0
answered question		**35**
skipped question		**0**

4. How effective was the teaching outside your major at the University of Kentucky?

		Response Percent	Response Count
Extremely effective		8.8%	3
Very effective		41.2%	14
Moderately effective		**50.0%**	**17**
Slightly effective		0.0%	0
Not at all effective		0.0%	0
		answered question	**34**
		skipped question	**1**

5. How helpful was your academic advisor?

		Response Percent	Response Count
Extremely helpful		**54.3%**	**19**
Quite helpful		22.9%	8
Moderately helpful		8.6%	3
Slightly helpful		8.6%	3
Not at all helpful		5.7%	2
		answered question	**35**
		skipped question	**0**

6. Were you employed full-time upon graduation?

	Response Percent	Response Count
Yes	22.9%	8
No	**77.1%**	**27**
	answered question	**35**
	skipped question	**0**

7. Did you attend graduate or professional school in the academic year immediately following graduation?

	Response Percent	Response Count
Yes	**80.0%**	**28**
No	20.0%	7
	answered question	**35**
	skipped question	**0**

8. Overall, were you satisfied with your experience as an Ag Biotechnology major, neither satisfied nor dissatisfied with it, or dissatisfied with it?

	Response Percent	Response Count
Extremely satisfied	**71.4%**	**25**
Moderately satisfied	20.0%	7
Slightly satisfied	5.7%	2
Neither satisfied nor dissatisfied	0.0%	0
Slightly dissatisfied	0.0%	0
Moderately dissatisfied	2.9%	1
Extremely dissatisfied	0.0%	0
answered question		**35**
skipped question		**0**

9. What were your most favorite experiences as an Ag Biotechnology major?

	Response Count
	29
answered question	**29**
skipped question	**6**

10. What were your least favorite experiences as an Ag Biotechnology major?

	Response Count
	25
answered question	**25**
skipped question	**10**

11. How could the student experience in Ag Biotechnology be improved?

	Response Count
	26
answered question	26
skipped question	9

12. Do you have any general comments about the Ag Biotechnology degree program?

	Response Count
	27
answered question	27
skipped question	8

Q1. In what month and year did you graduate?		
1	May 2007	Nov 25, 2013 6:29 PM
2	May 2008	Nov 21, 2013 3:06 PM
3	May 2007	Nov 15, 2013 7:49 PM
4	5/2003	Nov 14, 2013 2:26 PM
5	May 2013	Nov 13, 2013 4:36 PM
6	May 2010	Nov 13, 2013 3:32 PM
7	May 2012	Nov 13, 2013 12:14 PM
8	May 2007	Nov 13, 2013 10:34 AM
9	December 2001	Nov 12, 2013 7:13 PM
10	December 2011	Nov 12, 2013 3:07 PM
11	May 2007	Nov 12, 2013 2:09 PM
12	March 2000	Nov 12, 2013 1:48 PM
13	May 2008	Nov 12, 2013 1:11 PM
14	May 2003	Nov 12, 2013 12:43 PM
15	5/11	Nov 12, 2013 11:59 AM
16	May 2012	Nov 12, 2013 10:29 AM
17	May 2007	Nov 12, 2013 9:53 AM
18	05/2007	Nov 12, 2013 9:10 AM
19	May 2001	Nov 12, 2013 9:00 AM
20	May 2010	Nov 12, 2013 8:55 AM
21	May 2007	Nov 12, 2013 8:54 AM
22	December 2004	Nov 12, 2013 8:51 AM
23	5/11	Nov 12, 2013 8:32 AM
24	May 2013	Nov 12, 2013 7:51 AM
25	May 2002	Nov 12, 2013 7:45 AM
26	12/2011	Nov 12, 2013 7:37 AM
27	May 2008	Nov 12, 2013 7:27 AM

Q1. In what month and year did you graduate?		
28	June 2005	Nov 12, 2013 7:03 AM
29	May 2006	Nov 12, 2013 6:53 AM
30	May 2001	Nov 12, 2013 6:46 AM
31	May 2003	Nov 12, 2013 6:26 AM
32	May 2013	Nov 12, 2013 6:21 AM
33	May 2010	Nov 12, 2013 6:18 AM
34	May 2008	Nov 12, 2013 6:15 AM
35	May 2010	Nov 12, 2013 6:09 AM

Q2. What is your current status (student in graduate or professional school, employment position, etc.)?		
1	Completed MS in Physician Assistant Studies, working as Physician Assistant in Orthopedic Surgery	Nov 25, 2013 6:29 PM
2	Pharmacist	Nov 21, 2013 3:06 PM
3	Pharmacy Manager	Nov 15, 2013 7:49 PM
4	Employed as a physician at Baptist Health lexington	Nov 14, 2013 2:26 PM
5	Graduate School	Nov 13, 2013 4:36 PM
6	Graduate student	Nov 13, 2013 3:32 PM
7	Professional School - Pharmacy	Nov 13, 2013 12:14 PM
8	Third year medical resident at Baylor College of Medicine Ob/gyn	Nov 13, 2013 10:34 AM
9	Technician Specialist, Battelle Biomedical Research Center	Nov 12, 2013 7:13 PM
10	Dental School Student	Nov 12, 2013 3:07 PM
11	Grad Student at UK Law	Nov 12, 2013 2:09 PM
12	Gastroenterologist	Nov 12, 2013 1:48 PM
13	Residency- Urologic Surgery	Nov 12, 2013 1:11 PM
14	Construction Manager	Nov 12, 2013 12:43 PM
15	Uk medical school 3rd yr	Nov 12, 2013 11:59 AM
16	Graduate Student- Public Health	Nov 12, 2013 10:29 AM
17	MD - Dermatology Resident at Kansas University	Nov 12, 2013 9:53 AM
18	dentist	Nov 12, 2013 9:10 AM
19	Teacher- AP Biology, Biology, Anatomy, Department Chair and Program Coordinator for a Title I program at Rome High School	Nov 12, 2013 9:00 AM
20	Fourth Year Medical Student	Nov 12, 2013 8:55 AM
21	Postdoctoral Fellow, Vanderbilt University School of Medicine	Nov 12, 2013 8:54 AM
22	Postdoctoral Fellow	Nov 12, 2013 8:51 AM
23	3rd year of medical school at UK	Nov 12, 2013 8:32 AM
24	student in graduate school	Nov 12, 2013 7:51 AM
25	Full time Infection preventionist at hospital	Nov 12, 2013 7:45 AM
26	Employment position	Nov 12, 2013 7:37 AM

Q2. What is your current status (student in graduate or professional school, employment position, etc.)?		
27	student in MD/PhD program	Nov 12, 2013 7:27 AM
28	Lab manager	Nov 12, 2013 7:03 AM
29	Pediatrician in private practice	Nov 12, 2013 6:53 AM
30	Assistant Professor of Biology	Nov 12, 2013 6:46 AM
31	Assistant Director for Research Markey Cancer Center University of Kentucky	Nov 12, 2013 6:26 AM
32	Student in optometry school	Nov 12, 2013 6:21 AM
33	Professional school	Nov 12, 2013 6:18 AM
34	Intellectual Property Attorney	Nov 12, 2013 6:15 AM
35	Student in professional school - dental school	Nov 12, 2013 6:09 AM

Q9. What were your most favorite experiences as an Ag Biotechnology major?		
1	I liked the small college feel at a big university	Nov 25, 2013 6:29 PM
2	The ABT genetic courses	Nov 21, 2013 3:06 PM
3	Genetics, Dr. Collins, working in the lab	Nov 15, 2013 7:49 PM
4	Collage of Ag was great. Class were great. I worked in a lab for Dr. Collins. That was probably my favorite experience that and my last biotech class? I can't remember what the number was now like 401 Dr. Chappell taught it. It was lab based. Lots of fun.	Nov 14, 2013 2:26 PM
5	The experience that you get when doing lab research, I found in my masters program that I had been exposed to a broader amount of material than most others.	Nov 13, 2013 4:36 PM
6	ABT 495	Nov 13, 2013 3:32 PM
7	One of my favorite experiences with the Ag biotech program are the close relationships that I formed with classmates. Especially when you reach your 3rd and 4th year you begin to have classes with the same people both ABT and some of the larger classes. I really liked when we had the cookout so you could see the professors and relax with friends. Having small classes such as ABT 495, genetics, and such allow you to get to know the professors well and form a better relationship with them.	Nov 13, 2013 12:14 PM
8	Knowing the people i had classes with, reaearch experience, rigorous work that was employable/applicable whether i wanted to work or go to grad school	Nov 13, 2013 10:34 AM
9	Meeting other people in the Ag school and learning about other disciplines. (I was not from an Ag background and had no idea there were majors like ag econ or Ag Journalism.)	Nov 12, 2013 7:13 PM
10	I really enjoyed my experience as a whole. The science classes taught in the Ag department prepared me very well for the graduate and professional school classes I have taken. One of my favorite classes in the program was agronomy.	Nov 12, 2013 3:07 PM
11	The ABT Lab w/ Dr. Chappell was fantastic, I also really enjoyed Biochem w/ Dr. Watt, that may have been my favorite class. He was brilliant. My research and subsequent presentation was also a lot of fun. I also really enjoyed the flexibility of the Major. I was able to get my Sustainability Minor and that was great.	Nov 12, 2013 2:09 PM
12	Broad education in a field that is useful in itself. It is also an excellent training program for further study.	Nov 12, 2013 1:48 PM
13	Round up day, biotech labs, the close friendships I made with others in the biotech program	Nov 12, 2013 1:11 PM
14	Working thru my internship. It was the only opportunity I had to see the real world application of Biotechnology.	Nov 12, 2013 12:43 PM
15	Small class sizes and the ability to get to know professors.	Nov 12, 2013 10:29 AM
16	Small classes, great instructors, demanding workload	Nov 12, 2013 9:53 AM

Q9. What were your most favorite experiences as an Ag Biotechnology major?		
17	Working in Dr. Houtz's lab and all of the upper level courses.	Nov 12, 2013 9:00 AM
18	I appreciated that I was only one of a handful of students assigned to my academic advisor. She had loads of personally tailored advice and suggestions for me -- often without my even asking.	Nov 12, 2013 8:55 AM
19	Having the opportunity to perform undergraduate research. I also felt that I was more/better prepared than the average student at UK to excel in graduate or professional school. I was accepted into top 10 PhD programs because of my undergraduate research experience and scientific literacy.	Nov 12, 2013 8:54 AM
20	I thought it was very important (and fulfilling) that the degree required research for graduation. This was invaluable in preparing me for my move to graduate school. If I had decided to go straight into the workforce, I think it would have been equally as valuable. I also thought the genetics courses were strong as well as the lab class taught by Dr. Chappelle, although I can't remember the name of the course.	Nov 12, 2013 8:51 AM
21	I enjoyed the broad approach to the sciences and the required curriculum	Nov 12, 2013 8:32 AM
22	I loved being in a smaller biology major where everyone got to know everyone and was participating in research. And as much as I hated preparing for the independent project presentation, it is probably the number one thing that has helped me both in applying to grad school, and in working in grad school. If anyone continues in the sciences, they will have to give presentations like that, and it provides an opportunity to practice before it REALLY matters. Oh, and being part of the Ag school (picnic and great advisers) was nice too.	Nov 12, 2013 7:51 AM
23	Research	Nov 12, 2013 7:37 AM
24	I really loved my undergraduate research experience. I was in the same lab for three years, and I continue to communicate with my mentor regularly, even 6 years after graduation. I also really loved the capstone course. I also had a really excellent biotech adviser, who I also keep in touch with.	Nov 12, 2013 7:27 AM
25	I had a wonderful working relationship with my academic advisor who was instrumental in helping me find on-campus employment during the school year and internship opportunities during the summer. These research experiences were invaluable in helping me decide what I wanted to do after college.	Nov 12, 2013 6:46 AM
26	My research project	Nov 12, 2013 6:21 AM
27	Small class sizes and one on one help	Nov 12, 2013 6:18 AM
28	I enjoyed the hands-on lab work	Nov 12, 2013 6:15 AM
29	I really enjoyed my time working on my research project. I had an excellent mentor and learned a lot.	Nov 12, 2013 6:09 AM

Q10. What were your least favorite experiences as an Ag Biotechnology major?		
1	That the major required 12 more hours than other science degrees	Nov 21, 2013 3:06 PM
2	Nothing sticks out	Nov 15, 2013 7:49 PM
3	Ag Biotech is a great major. I didn't have any bad experiences	Nov 14, 2013 2:26 PM
4	I began in August 2008 and the one thing that I disliked was the way that ABT 101 was run. It just seemed sporadic and not very supportive of the students (possibly because there were many students in the class compared to many of the other ABT classes) and I felt that this turned some students away from a great program. I think that over the past few years this class has formed into a better overview of the program.	Nov 13, 2013 12:14 PM
5	Population genetic equations	Nov 13, 2013 10:34 AM
6	None.	Nov 12, 2013 3:07 PM
7	My classes were super difficult!! But it really prepared me well for law school	Nov 12, 2013 2:09 PM
8	Extra hours	Nov 12, 2013 1:48 PM
9	None	Nov 12, 2013 1:11 PM
10	Joe Chappell's class. It was too specific to what he did, not what the Biotech industry offered. Much like the Program itself, it was only about research, and repeating his work.	Nov 12, 2013 12:43 PM
11	More guidance in the ABT 399 (independent research) would have been helpful.	Nov 12, 2013 10:29 AM
12	none	Nov 12, 2013 9:53 AM
13	NA- I may have thought some of the classes were hard back then, but as I look back now, I greatly appreciate my depth of understanding of cellular biology and genetics.	Nov 12, 2013 9:00 AM
14	I'm not sure I have any, to be honest!	Nov 12, 2013 8:55 AM
15	I loved everything about ABT	Nov 12, 2013 8:54 AM
16	When deciding on my courses each semester, sometimes I felt like I had a better idea of what I needed to take than my advisor. However, I think my advisor was fairly new to advising students at the time.	Nov 12, 2013 8:51 AM
17	I never really considered myself a lab rat, so I didn't enjoy the required research project as much as others, but I did learn a lot of practical skills through it.	Nov 12, 2013 8:32 AM
18	ABT 495 was really hard. Not because the material was hard, but because there were so many things being done that a) we always went over the class time (by 2 hours sometimes) b) it was difficult to keep up with what we were trying to learn from our experiments because they all overlapped c)because we were rushing, over half the experiments didn't work. I think the class could be much better if a few experiments were removed so more time could be taken to explain the results, in addition to the methodology.	Nov 12, 2013 7:51 AM

Q10. What were your least favorite experiences as an Ag Biotechnology major?		
19	Presentations	Nov 12, 2013 7:37 AM
20	I hated the way the general physics labs were run, but that's just a required course, and not one taught by biotech.	Nov 12, 2013 7:27 AM
21	The academic advising I was given was a complete joke. Not helpful at all.	Nov 12, 2013 7:03 AM
22	My advisor was terrible	Nov 12, 2013 6:21 AM
23	Research	Nov 12, 2013 6:18 AM
24	I did not enjoy the "independent research" project....I don't advocate doing away with it, but I felt there was very little guidance leading up to it, it was justkind of sprung on us and many of us found ourselves scrambling to find something that would satisfy the requirement, instead of trying to find something we truly were interested in, which I believe is part of the point.	Nov 12, 2013 6:15 AM
25	I was not particulary fond of the ABT lab taught by Dr. Chapell.	Nov 12, 2013 6:09 AM

Q11. How could the student experience in Ag Biotechnology be improved?		
1	see above	Nov 21, 2013 3:06 PM
2	Not sure	Nov 15, 2013 7:49 PM
3	I thought it was great.	Nov 14, 2013 2:26 PM
4	I think the Ag biotech program could be improved by possibly having a more guided approach to helping each student identify a lab to work in. This would really be helpful possibly in the second year or along with ABT 201. This could help people who do not know exactly what they are interested in possibly identify a lab and a mentor.	Nov 13, 2013 12:14 PM
5	I don't know what it is like now	Nov 13, 2013 10:34 AM
6	More emphasis on learning to read primary literature. After graduation, I always felt pretty lost when handed a journal article and was told to critique it, because I had nearly no experience with this as an undergrad. This would be a helpful skill for those heading into research (or even medicine).	Nov 12, 2013 7:13 PM
7	Having a student group would be beneficial for students looking for study partners.	Nov 12, 2013 3:07 PM
8	I would have liked more classes with the other ABT majors. The ABT lab w/ Dr. Chappell was so great b/c I finally got to see my other ABT students.	Nov 12, 2013 2:09 PM
9	More intensive career guidance may be helpful.	Nov 12, 2013 1:48 PM
10	None	Nov 12, 2013 1:11 PM
11	Be more proactive with job placement opportunities and discussion / introduction of various work in the Biotechnology Industry that was not lab specific. It was way too lab/research based. The Ag Biotech industry is very broad based as I have come to find out in recent years. In my opinion, the program was so focused on lab/research work. For a person like me that was not destined for a lab, I felt like I did not get the full array of instruction and help on what the Industry had to offer. I soon ended up in construction management, using little, if any of my education. I suppose I should have been an Ag business major?	Nov 12, 2013 12:43 PM
12	More exposure to different professional opportunities possible with the degree. ABT did a nice introduction of this, but it may be useful to have a "refresher" later in course.	Nov 12, 2013 10:29 AM
13	Maybe start a network with undergrads connecting to graduates in their respective fields. I'd be more than willing to mentor people.	Nov 12, 2013 9:53 AM
14	It was pretty small when I was there, I would have liked more social experiences for just Ag Biotech rather than the school of AG. I like AG people, but biotech majors tend to be a little different from the overall school, so it would have been nice.	Nov 12, 2013 9:00 AM
15	I would have liked to experience more events for Ag Biotech students outside the classroom. Even though it's a small community, I felt as if I only knew about half the students with whom I graduated.	Nov 12, 2013 8:55 AM

Q11. How could the student experience in Ag Biotechnology be improved?		
16	Increase awareness of external scholarships/internships.	Nov 12, 2013 8:54 AM
17	I think more molecular biology-based labs may be beneficial. The intro to biology labs (BIO 150 series) seemed a bit too broad for Ag Biotech.	Nov 12, 2013 8:51 AM
18	I think that it is a wonderful program. One suggestion I have is maybe having a group of research mentors for a group of students with set interests, for example, students with an interest in medicine could be matched with a preceptor who does research at the college of medicine.	Nov 12, 2013 8:32 AM
19	I think there should be more ABT specific classes that fulfill the major or specialty support requirements. My favorite part about these classes was that everyone in them was ABT, so by junior year there was an amazing sense of camaraderie (and occasionally commiseration). In the general bio classes, most of the students were pre-med and were not interested in actually learning the material (read very whiny and annoying). Also, ABT 460, 461, and 495 were the best taught classes I took at UK, and I think students would learn more/better if there were more classes like those.	Nov 12, 2013 7:51 AM
20	More variety in electives allowed to fulfill major. Like immunology or endocrinology or pharmacology courses	Nov 12, 2013 7:37 AM
21	I would have liked more biotech classes taught by the ABT faculty. I seem to remember there were only a couple in the beginning, and more towards the end.	Nov 12, 2013 7:27 AM
22	Get academic advisors that actually know what they are advising about and that actually care about what happens to the student.	Nov 12, 2013 7:03 AM
23	More opportunities to meet people within my major	Nov 12, 2013 6:21 AM
24	A lot of these students are wanting to go to professional school so maybe have a course where admissions from several of uk professional schools come in	Nov 12, 2013 6:18 AM
25	See above #11	Nov 12, 2013 6:15 AM
26	A large portion of the ABT students are pre-professional. It might be a good idea to try to organize "sub-groups" within ABT for each of the respective professional schools to which ABT students are applying.	Nov 12, 2013 6:09 AM

Q12. Do you have any general comments about the Ag Biotechnology degree program?		
1	Great option for pre-professional students, Ag Biotech degrees set them apart from biology degree students	Nov 25, 2013 6:29 PM
2	no	Nov 21, 2013 3:06 PM
3	It prepared me very well for my career. If I could do it all over again, I would definitely choose ABT again	Nov 15, 2013 7:49 PM
4	Great degree, I went on to medical school, so I haven't really used it but I would have been well if I had to find a position in the field. I would consider offering a Masters degree (If you guys haven't already) and really encourage people to work in the labs, That was the best experience.	Nov 14, 2013 2:26 PM
5	I thought the Ag. Biotech program was great and am so thankful this is what I majored in. After graduating and being in professional school here at UK, I have told people I graduated from the Ag. Biotech program and they have told me that they know students who graduate from the program are top students. I felt the program prepared me to think independently, solve problems, and be ready for professional school course work.	Nov 13, 2013 12:14 PM
6	That the program attracted and graduated some very hardworking and successful people who I am still friends with at this time.	Nov 13, 2013 10:34 AM
7	I felt the major was well designed and had a lot of helpful classes. A little more help in determining post-graduation options would have been nice. That was the job of the academic advisor I suppose, but they always seemed eager to push people toward grad school. There was never much discussion of employment opportunites without further education.	Nov 12, 2013 7:13 PM
8	I believe this is one of the best programs that UK offers. The classes and curriculum have me the tools necessary to succeed in a graduate masters program and professional school.	Nov 12, 2013 3:07 PM
9	It was a great foundation for my legal career, and any career for that fact. There is a lot of flexibility with the major, and I really enjoyed it. The major allows for a lot of flexibility with choosing classes which was very cool. It was also very hard and challenging, and is a great preparation for any future career or grad school.	Nov 12, 2013 2:09 PM
10	Excellent program.	Nov 12, 2013 1:48 PM
11	I was very well prepared for medical school and thought that the rigorous course load paid off.	Nov 12, 2013 1:11 PM
12	It has been a while since I graduated, but I can only hope that the program has or will begin to focus on the various aspects of Biotechnology instead of being so focused on just the research aspect. I am sure there are other students who like me are not destined to be lab rats and dedicate their careers to research. Not that there is anything wrong with that, but Ag Biotechnology to me is about way more than just research. I felt under-prepared for professional life upon the completion of my Collegiate career.	Nov 12, 2013 12:43 PM
13	Best program in the state and region	Nov 12, 2013 11:59 AM

Q12. Do you have any general comments about the Ag Biotechnology degree program?		
14	One of the best aspects of my time at UK!	Nov 12, 2013 10:29 AM
15	great!	Nov 12, 2013 9:53 AM
16	It was a wonderful experience and I would go back in a heartbeat!	Nov 12, 2013 9:00 AM
17	I would encourage all self-starting, motivated students interested in any of the sciences to consider Ag Biotech. The coursework and advising lay a strong foundation for any field you could choose to pursue after graduation.	Nov 12, 2013 8:55 AM
18	Becoming an ABT major was one of the best decisions I've made. I was extremely prepared to handle the workload and competitiveness of graduate school in a top 5 program. I will begin my faculty search within the next two years, and will definitely explore tenure track positions at the University of Kentucky.	Nov 12, 2013 8:54 AM
19	I thought the Ag biotech program prepared me well for my PhD program at a very prestigious institution. I was very happy with the program and was so happy I chose Ag Biotech over the traditional biology program in A&S.	Nov 12, 2013 8:51 AM
20	Great program, I'm so glad I switched freshman year. And I know I was well prepared by it because I got accepted to the grad schools I wanted to get into and was prepared to do the research I wanted to do.	Nov 12, 2013 7:51 AM
21	No	Nov 12, 2013 7:37 AM
22	Thank you, thank you. I had such a great experience, and I'm not sure I would have discovered (or been as prepared for) my current career path without it!	Nov 12, 2013 7:27 AM
23	The program really just gets you ready for another degree program. By itself it's pretty useless, I think the same of a degree for biology though for comparison. All of the advisors I had in the program were not helpful and did not care. I had to switch advisors myself when the person I was assigned knew nothing about the biotech curriculum. I never found anyone much better.	Nov 12, 2013 7:03 AM
24	I think the program prepared students very well for a variety of post-graduate opportunities -- graduate school, med school, vet school and the job market. It was a very challenging program but also very rewarding. In the midst of a very large university, the Biotech program provided a comfortable environment for learning and meeting a cohort of students on a similar academic journey.	Nov 12, 2013 6:46 AM
25	Great experience I wouldn't change my major!	Nov 12, 2013 6:18 AM
26	I think there should be a little more exposure/PR, as it is a great program. For example, the patent and trademark office (USPTO) does not recognize Ag Biotech as a technical degree on the same page as biology, chemistry, and engineering. Clearly that should change.	Nov 12, 2013 6:15 AM
27	I felt very prepared for my professional program. The ABT program does an excellent job ensuring that undergraduate students are exposed to the type of courses/experiences that are useful down the road. The faculty in the College of Ag are wonderful, and I greatly appreciated the smaller, more personal atmosphere of the ABT program.	Nov 12, 2013 6:09 AM

Summary of ABT Teaching and Course Evaluations

2008-2009

Course/Unit	Fall		Spring	
	Value of Course	Quality of Teaching	Value of Course	Quality of Teaching
ABT 101	3.2	3.3		
ABT 201	3.2	3.5		
ABT301	3.4 3.6	3.8 3.7	3.8	4.0
ABT460			3.0	3.0
ABT461			3.2	3.5
ABT495	3.5	3.4		
ABT overall	3.3	3.4	3.3	3.4
College	3.3	3.4	3.3	3.4
Provost area	3.3	3.4	3.3	3.4

2009-2010

Course/Unit	Fall		Spring	
	Value of Course	Quality of Teaching	Value of Course	Quality of Teaching
ABT 101	3.4	3.7		
ABT 201	3.6	3.6		
ABT301	3.2 3.3	3.2 3.7	3.8	4.0
ABT460			3.3	3.5
ABT461			3.0	3.3
ABT495	3.6	3.4		
ABT overall	n/a	n/a	3.5	3.6
College	3.3	3.4	3.4	3.4
Provost area	3.3	3.4	3.3	3.4

2010-2011

Course/Unit	Fall		Spring	
	Value of Course	Quality of Teaching	Value of Course	Quality of Teaching
ABT 101	3.7	3.6		
ABT 201	3.7	3.8		
ABT301	3.4 3.9	3.9 3.9	3.7	3.9
ABT360	3.4 3.2*	3.6 3.1*		
ABT460			2.9	3.1
ABT461			3.2	3.6
ABT495	3.5 3.5*	3.7 3.5*		
ABT overall	3.4	3.5	3.3	3.5
College	3.4	3.5	3.4	3.5
Provost area	3.3	3.4	3.3	3.4

2011-2012 (Spring, in class evaluations)

Course/Unit	Fall		Spring	
	Value of Course	Quality of Teaching	Value of Course	Quality of Teaching
ABT 101	3.8	3.8		
ABT 201	3.5	3.8		
ABT301	3.4	3.6	3.5	3.9
ABT460			3.2*	3.1*
ABT461			3.5	3.7
ABT495	3.5	3.7		
ABT overall	3.6	3.8	3.4	3.6
College	3.4	3.5	3.4	3.5
Provost area	3.3	3.4	3.3	3.4

2012-2013 (in class evaluations)

Course/Unit	Fall		Spring	
	Value of Course	Quality of Teaching	Value of Course	Quality of Teaching
ABT 101	n/a	n/a		
ABT120	2.5*	3.0*	3.7	3.8
ABT 201	3.6	3.7		
ABT301	3.2	3.6	3.8	4.0
ABT460			2.9	3.2
ABT461			3.0	3.6
ABT495	3.1	3.1		
ABT overall	3.3	3.5	3.2	3.6
College	3.4	3.4	3.5	3.5
Provost area	3.3	3.4	3.4	3.5

*first time the course was offered or first time a new faculty taught the course

Appendices

Agricultural Biotechnology Bachelor of Science Degree Program

Appendices:

A) ABT Program Manifesto
B) Faculty biosketches/curricula vitae
C) Research mentors
D) Student publications/presentations
E) ABT program assessment materials
F) Annual assessment results
G) Student awards
H) Comments from professional school admissions personnel
I) ABT alumni survey
J) Teacher/course evaluations

B.S. Degree in Agricultural Biotechnology
(Program Manifesto)

Biotechnology encompasses cellular and molecular approaches to the manipulation and improvement of agricultural plants, animals and microorganisms, and the control of agricultural pests and diseases. The primary purpose of the baccalaureate degree program in Agricultural Biotechnology is to train students in modern cellular and molecular biology and genetic engineering. Students are provided a firm foundation in the principles of genetics and molecular biology of both prokaryotic and eukaryotic organisms. Each student then specializes in an area appropriate to his or her interest and career objectives. Opportunities for specialization span across the Colleges at the University of Kentucky and include agricultural and biomedical technology pertaining to microbes, plants, invertebrates, and vertebrates. Central to the ABT curriculum is a research or internship experience that is developed (ABT 301) and conducted (ABT 395 or 399) by the student under the supervision of a faculty mentor. Students completing the ABT Bachelor of Science degree program will be prepared to assume government, university, and industry positions with research and technology applications to agriculture and food production. Graduates will also be well prepared to continue their training towards advanced degrees in graduate or professional school.

Administration of Program

Freshmen and transfer students will meet with one of the Administrators of the Agricultural Biotechnology Program (a Co-Director of Undergraduate Studies or the Steering Committee Chair) or the program's Academic Coordinator to be advised for course enrollment, career planning, part-time job opportunities. A permanent Academic Advisor will be assigned to students by their second semester. During their second year, students are expected to develop a plan of study with the help of their advisors, and to submit that plan of study to the Associate Dean for Instruction (N-6, Agricultural Science Center North). Also during the second year, students should begin seeking a research mentor. Third and fourth year students are expected to meet regularly with their advisor to discuss coursework and career goals. During the third year, students should select a research project and write a research proposal in ABT 301, Writing and Presentation in the Life Sciences. The independent research project proposal is reviewed and approved by the ABT 301 course instructor. Students should enroll in ABT 395, Independent Study in Biotechnology, for 2 to 4 credit hours (pending approval) during the semester that they expect to complete their independent research project. Students can repeat the course for a maximum of 6 credit hours (pending approval by the ABT 395/399 instructor). Students choosing to substitute an internship for the research experience should enroll in ABT 399, Experiential Learning in Biotechnology, for a maximum of 6 credit hours. A learning contract must be completed and approved prior to the internship. Both a written and oral report will be required upon completion of the ABT 399 internship or the ABT 395 research project and before any grade evaluation can be made. The members of the ABT Steering Committee will evaluate the oral reports during dead week each semester. Final grade assignment will be made by the course instructor of ABT 395/399, as outlined in the ABT 395/399 Class Information.

The Agricultural Biotechnology Steering Committee represents the breadth of the College of Agriculture, Food, and Environment (CAFE) and other participating colleges in the University of Kentucky. The committee consists of eight faculty members appointed to serve three-year terms (renewable) by the CAFE Associate Dean of Instruction. The ABT Steering Committee is responsible for ensuring that the curriculum is current and relevant, for responding to degree program reviews, for facilitating cooperation with the College's Advising Resource Center to ensure that students are receiving quality academic advising, for overseeing student internship/research participation projects, and for providing input to the Advising Resource Center for course scheduling.

All faculty members of the University of Kentucky are eligible to participate in the Agricultural Biotechnology program, and are especially encouraged to serve as Research Mentors for students in this program. Students are ultimately responsible for ensuring that they have satisfied all University and CAFE requirements for graduation. The Steering Committee will conduct periodic informational meetings for students and advisors to keep them appraised of their responsibilities and any policy/program changes, and will provide advising materials as needed.

Career Opportunities

Employment opportunities include research scientists, laboratory technicians or managers in university, government, industrial, or clinical laboratories using biotechnological tools for research and production. Examples of research areas include construction of novel pest and disease resistance genes, development of new immunological and nucleic acid-based diagnostic probes for plant and animal diseases, genetic engineering of microorganisms for the production of important pharmaceutical agents, and development of new bioengineered strains of microorganisms for fermentation and food production services. Students will also be prepared to enter graduate programs in many disciplines as well as professional programs such as Veterinary Medicine, Medicine, Dentistry and Law.

Agricultural Biotechnology Undergraduate Degree Program

Faculty

All faculty members of the University of Kentucky are eligible to participate in the Agricultural Biotechnology program and are especially encouraged to serve as Research Mentors for students in this program. The Agricultural Biotechnology Steering Committee represents the breadth of CAFE and other participating colleges in the University of Kentucky. The committee consists of eight faculty members appointed to serve three-year terms (renewable) by the CAFE Associate Dean of Instruction. The ABT Steering Committee is responsible for ensuring that the curriculum is current and relevant, for responding to degree program reviews, for facilitating cooperation with the College's Advising Resource Center to ensure that students are receiving quality academic advising, for overseeing student internship/research participation projects, and for providing input to the Advising Resource Center for course scheduling. The Academic Advisor serves as a guide for undergraduate students as they develop their plan of study and helps the student develop a program that is specific to his/her interests.

Administration:

Steering Committee Chair: Dr. Daniel Howe Email: dkhowe2@uky.edu Phone: (859) 257-4757 ext. 81113
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Agricultural Biotechnology Undergraduate Degree Program

Course Requirements

Students must satisfy the University and College requirements, and must complete the major, specialty support and elective course requirements outlined in the Program in Agricultural Biotechnology, including an independent research project relevant to the student's interest in biotechnology. A minimum of 128 credit hours is required.

UK CORE REQUIREMENTS

I.	Intellectual Inquiry in Creativity & the Arts	3
II.	Intellectual Inquiry in Humanities	3
III.	Intellectual Inquiry in Social Sciences	3-4
IV.	Intellectual Inquiry in Natural, Physical and Mathematical Sciences: CHE 105 and CHE 111	5
V.	Composition and Communication I: CIS110 or WRD110 (Or ENG ACT $\geq$ 32 or SAT I Writing Score $\geq$ 720, then complete CIS/WRD112)	3
VI.	Composition and Communication II : CIS111 or WRD111 (Or ENG ACT $\geq$ 32 or SAT I Writing Score $\geq$ 720, then complete CIS/WRD112)	3
VII.	Quantitative Foundations : MA123 or MA113/193 or MA137 (Or AP Calculus AB or BC score of 3, 4 or 5)	3-5
VIII.	Statistical Inferential Reasoning: STA210	3
IX.	Community, Culture and Citizenship in the USA: GEN100	3
X.	Global Dynamics	3

GRADUATION REQUIREMENT

Two years of the same foreign language in high school or two-semester sequence of one foreign language in college

COLLEGE REQUIREMENTS

A. GEN 100 (Fall semester) for first semester freshman

or

B. GEN 100 (Spring semester) for transfer students, upperclassmen who have not completed UK Core IX: Community, Culture and Citizenship in the USA 3

PRE-MAJOR REQUIREMENTS

BIO 148, BIO 152, BIO155	7
CHE 105, CHE 111	5
CHE 107, CHE 113	5
CHE 230, CHE 231	4
CHE 232, CHE 233	4
MA 113/193 OR MA 137 OR MA 123	4-5
PHY 211	5
PHY 213	5

MAJOR REQUIREMENTS

ABT 101 (transfers are exempt)	1
ABT 120 (transfers who are not freshmen are exempt)	3
ABT 201	1
ABT 301	2
BIO 308 or BIO 208	3
BIO 209	2
ABT 360 or BIO 304	3-4
ABT 460	3
ABT 461	3
STA 291 or STA 570 or STA580	3-4

BCH 401G	3
ABT 495 or BIO 510	4
ABT 395 or ABT 399	3

Note:
All students are expected to undertake an independent study project in an area of their interest for a minimum of 3 and a maximum of 6 credit hours. This requirement can be met by a research project or an internship that is agreed upon by a student's Research Mentor and approved by the instructors of ABT 301 and ABT 395/399. Both written and oral reports will be required upon completion of the project.

SPECIALTY SUPPORT REQUIREMENTS

(Students must take a minimum of 21 credit hours of specialty support courses and at least one course from category 1. A number of the courses listed here may have additional prerequisites. Courses not on this list may be used to meet this specific requirement if approved by the Coordinating Committee.)

1. CELL BIOLOGY AND PHYSIOLOGY

ASC 364 Reproductive Physiology of Farm Animals	4
BIO 315 Introduction to Cell Biology	4
BIO 350 Animal Physiology	4
BIO 430G Plant Physiology	4
BIO/PGY 502 Principles of Physiology	5

2. EXAMPLES OF OTHER SPECIALTY SUPPORT COURSES (This is not a complete list. Students may select other support courses that meet their specific needs and that provide instruction in biotechnology-related areas. Students are advised to check for course availability and new course offerings.)

PLANT & SOIL SCIENCE AND HORTICULTURE

PLS 404 Integrated Weed Science	4
PLS 502 Ecology of Economic Plants	3
PLS 470G Soil Nutrient Management	3
PLS 657 Seed Biology	3
PLS 566 Soil Microbiology	3
PLS 440 Plant Propagation	3

ANIMAL SCIENCES, VETERINARY SCIENCES, AND PHYSIOLOGY

ASC 362 Animal Genetics	4
ASC 378 Animal Nutrition/Feeding	4
ASC 410G Equine Sciences	3
VS 350 Introductory Anatomy, Physiology, and Animal Hygiene	3
VS 351 Principles of Animal Hygiene and Disease Control	3
PGY 412G Principles of Human Physiology	4
PGY417 Genomics and Epigenetics	2

BIOLOGY

BIO 303 Evolution	4
BIO 325 Ecology	4
BIO 351 Plant Kingdom	3
BIO 420G Taxonomy of Vascular Plants	4
BIO 425 Biology Seminar (various topics)	1
BIO 494G Immunobiology	3
BIO 520 Bioinformatics	3
BIO 529 Developmental Biology	3

CHEMISTRY

CHE 440G Intro Physical Chemistry	4
CHE 522 Instrumental Analysis	4
CHE 532 Spectrometric Identification of Organic Compounds	2
CHE 533 Qualitative Organic Analysis Laboratory	2

CHE 550 Biological Chemistry I	3
CHE 552 Biological Chemistry II	3
CHE 554 Biological Chemistry Lab	2
CHE 565 Environmental Chemistry	3

ENTOMOLOGY

ENT 300 General Entomology	3
ENT 320 Horticultural Entomology	3
ENT 340 Livestock Entomology	3
ENT/FOR 402 Forest Entomology	3
ENT/BIO 561 Insects Affecting Human & Animal Health	3
ENT/BIO 564 Insect Taxonomy	4

FOOD SCIENCE

FSC 434 Food Chemistry	4
FSC 530 Food Microbiology I	5
FSC 536 Advanced Food Technology	4
FSC 538 Food Fermentation and Thermal Processing	4
FSC 540 Food Sanitation	3

FORESTRY AND PLANT PATHOLOGY

PPA 400G Principles of Plant Pathology	3
PPA 500 Physiology of Plant Health and Disease	3
FOR 425 Forest Management	3
FOR 470 Interdependent Natural Resource Issues	3

PHARMACOLOGY

PHA 422G Pharmacology of Treating Human Disease	3

COMMUNICATIONS, SOCIOLOGY AND PHILOSOPHY

COM311 Patient-Provider Communication	3
PHI 305 Health Care Ethics	3
PHI 380 Death, Dying and Quality of Life	3
SOC 350, sections on Sociology of Health and Illness	3

ADDITIONAL ELECTIVES: to 128 credits 6-10

Special notes for satisfying the degree requirements:

1. Full time status is 12 hours.
2. You must complete Composition and Communication I and II and 30 credit hours before enrolling in ABT201.
3. A Plan of Study must be completed and submitted to the Office of Academic Programs for the Junior and Senior years.
4. You must complete 128 credit hours of approved course work with at least a 2.0 grade-point standing.
5. You must complete 45 credit hours of approved upper division (>300) course work.
6. 30 of the last 36 hours must be completed at UK.

Agricultural Biotechnology

Example Curriculum for Students starting Fall 2013

MA 109 in their first year

Fall year 1			Spring Year 1		
MA 109	College Algebra	3	CHE 107	General College Chemistry II	3
ABT 101	Intro to Biotechnology	1	CHE 113	General College Chemistry II Lab	2
GEN 100[1]	Issues in Ag -UK Core IX-	3	ABT 120	Genetics and Society	3
CIS 110[1]	Composition and Communication I -UK Core V-	3	MA 123[1]	Elementary Calculus and its Applications -UK Core VII-	4
CHE 105[1]	General College Chemistry I -UK Core IV-	4	CIS 111[1]	Composition and Communication II -UK Core VI-	3
CHE 111[1]	General College Chemistry I Lab 1 -UK Core IV-		UK Core[1]	I	3
Total		15	Total		18
Fall Year 2			Spring Year 2		
CHE 230	Organic Chemistry I	3	CHE 232	Organic Chemistry II	3
CHE 231	Organic Chemistry I Lab	2	CHE 233	Organic Chemistry II Lab	2
CHE 295	Organic Chemistry Workshop I	1	BIO 152	Principles of Biology II	3
BIO 148	Introductory Biology	3	UK Core[1]	III	3
BIO 155	Lab for Introductory Biology I	1	STA 291	Statistical Methods	3
STA 210[1]	Making Sense of Uncertainty: Intro to Stats -UK Core VIII-	3			
ABT 201	Scientific Method in Biotechnology (only after 30 hrs)	1			
UK Core[1]	II	3			
Total		17	Total		14
Fall Year 3			Spring Year 3		
PHY 211	General Physics I	5	PHY 213	General Physics II	5
ABT 360[3]	Genetics	3	BIO 308	General Microbiology	3
ABT 301	Writing & Presentation in the Life Sci	2	BIO 209	Introductory Microbiology Lab	2
UK Core[1]	X	3	ABT 461	Introduction to Population Genetics	3
SS[2] – 1	Specialty Support Course	3	SS[2] – 2	Specialty Support Course	3
Total		16	Total		16
Fall Year 4			Spring Year 4		
BCH 401	Fundamentals of Biochemistry	3	ABT 460	Introduction to Molecular Genetics	3
ABT 395	Independent Study in Biotechnology	3	SS[2] – 4	Specialty Support Course	3
ABT 495	Experimental Methods in Biotechnology	4	SS[2] – 5	Specialty Support Course	3
SS[2] - 3	Specialty Support Course	3	SS[2] - 6	Specialty Support Course	3
	Elective	2-3	SS[2] – 7	Specialty Support Course	3
Total		15-16	Total		15

MINIMUM TOTAL NEEDED = 128 credit hours

[1]UK Core—for list of acceptable courses, check the UK 2013-2014 Bulletin pgs 90-94
[2]Specialty Support course—for list of acceptable courses, check the UK Bulletin pg 97 and check with your advisor
[3]BIO 304 (4hrs) can substitute for ABT 360 (3hrs)

Math 123 in their first year

Fall year 1			Spring Year 1		
MA 123	Elementary Calculus and its Applications -UK Core VII-	4	CHE 107	General College Chemistry II	3
ABT 101	Intro to Biotechnology	1	CHE 113	General College Chemistry II Lab	2
GEN 100	Issues in Ag -UK Core IX-	3	ABT 120	Genetics and Society	3
CHE 105	General College Chemistry I -UK Core IV-	4	BIO 148	Introductory Biology I	3
CHE 111	General College Chemistry I Lab -UK Core IV-	1	BIO 155	Lab for Introductory Biology I	3
CIS 110	Composition and Communication I -UK Core V-	3	CIS 111	Composition and Communication II -UK Core VI-	3
Total		16	Total		15

Fall year 2			Spring Year 2		
CHE 230	Organic Chemistry I	3	CHE 232	Organic Chemistry II	3
CHE 231	Organic Chemistry I Lab	1	CHE 233	Organic Chemistry II Lab	1
CHE 295	Organic Chemistry I Workshop	1	(Optional Organic Chemistry II Workshop)		
BIO 152	Principles of Biology II	3	UK Core[1]	II	3
BIO 155	Lab for Introductory Biology I	1	UK Core[1]	III	3
STA 210	Making Sense of Uncertainty: Intro to Statistical Reasoning -UK Core VIII-	3	STA 291	Statistical Methods	3
			OR		
ABT 201	Scientific Method in Biotechnology (only after 30 hrs)	1	STA 570	Basic Statistical Analysis	4
			OR		
UK Core[1]	I	3	STA 580	Biostatistics I	3
Total		17	Total		13-14

Fall year 3			Spring Year 3		
PHY 211	General Physics I	5	PHY 213	General Physics II	5
BCH 401G	Fundamentals of Biochemistry	3	BIO 308	General Microbiology	3
ABT 360[3]	Genetics	3	BIO 209	Introductory Microbiology Lab	2
ABT 301	Writing & Presentation in the Life Sci	2	SS[2] – 1	Specialty Support Course	3
UK Core	X	3	SS[2] – 2	Specialty Support Course	3
Total		16	Total		16

Fall year 4			Spring Year 4		
ABT 495	Experimental Methods in Biotechnology	4	ABT 460	Introduction to Molecular Genetics	3
ABT 395	Independent Study in Biotechnology	3-4	ABT 461	Introduction to Population Genetics	3
SS[2] – 3	Specialty Support Course	3	SS[2] - 5	Specialty Support Course	3
SS[2] – 4	Specialty Support Course	3	SS[2] – 6	Specialty Support Course	3
	Elective 1	3	SS[2] – 7	Specialty Support Course	3-4
Total		16-17	Total		15-16

MINIMUM TOTAL NEEDED = 128 credit hours

[1]UK Core—for list of acceptable courses, check the UK 2011-2012 Bulletin pgs 90-94
[2]Specialty Support course—for list of acceptable courses, check the UK Bulletin pg 97 and check with your advisor
[3]BIO 304 (4hrs) can substitute for ABT 360 (3hrs)

MA 113 or MA 137 in their first year

Fall year 1		Spring Year 1	
MA 113 Calculus I -UK Core VII-	4	CHE 107 General College Chemistry II	3
MA 193 Calculus I Workshop	1	CHE 113 General College Chemistry II Lab	2
OR		CHE 197 General Chemistry II Workshop	1
MA 137 Calculus for the Life Sciences -UK Core VII-	4	ABT 120 Genetics an Society	3
		BIO 148 Introductory Biology I	3
ABT 101 Intro to Biotechnology	1	BIO 155 Lab for Introductory Biology I	1
GEN 100 Issues in Ag -UK Core IX-	3	CIS 111 Composition and Communication II -UK Core VI-	3
CHE 105 General College Chemistry I -UK Core IV-	4		
CHE 111 General College Chemistry I Lab -UK Core IV-	1		
CIS 110 Composition and Communication I -UK Core V-	3		
Total	15-16	Total	16

Fall year 2		Spring Year 2	
CHE 230 Organic Chemistry I	3	CHE 232 Organic Chemistry II	3
CHE 231 Organic Chemistry I Lab	2	CHE 233 Organic Chemistry II Lab	2
CHE 295 Organic Chemistry I Workshop	1	(Optional CHE 297 Organic Chemistry II Workshop)	
BIO 152 Principles of Biology II	3	UK Core[1] II	3
		UK Core[1] III	3
STA 210 Making Sense of Uncertainty: Intro to Statistical Reasoning - UK Core VIII-	3	STA 291 Statistical Methods	3
		OR	
		STA 570 Basic Statistical Analysis	4
ABT 201 Scientific Method in Biotechnology (only after 30 hrs)	1	OR	
		STA 580 Biostatistics I	3
UK Core[1] I	3		
Total	16	Total	14-15

Fall year 3		Spring Year 3	
PHY 211 General Physics I	5	PHY 213 General Physics II	5
BCH 401G Fundamentals of Biochemistry	3	BIO 308 General Microbiology	3
ABT 360[3] Genetics	3	BIO 209 Introductory Microbiology Lab	2
ABT 301 Writing & Presentation in the Life Sci	2	SS[2] – 1 Specialty Support Course	3
UK Core[1] X	3	SS[2] – 2 Specialty Support Course	3
Total	16	Total	16

Fall year 4		Spring Year 4	
ABT 495 Experimental Methods in Biotechnology	3	ABT 460 Introduction to Molecular Genetics	3
ABT 395 Independent Study in Biotechnology	3-4	ABT 461 Introduction to Population Genetics	3
SS[2] – 3 Specialty Support Course	3	SS[2] - 5 Specialty Support Course	3
SS[2] – 4 Specialty Support Course	3	SS[2] – 6 Specialty Support Course	3
Elective 1	3	SS[2] – 6 Specialty Support Course	3
		Elective 2 (if necessary)	3
Total	15-16	Total	15-18

MINIMUM TOTAL NEEDED = 128 credit hours

[1]UK Core—for list of acceptable courses, check the UK 2011-2012 Bulletin pgs 91-94
[2]Specialty Support course—for list of acceptable courses, check the UK Bulletin pg 97 and check with your advisor
[3]BIO 304 (4hrs) can substitute for ABT 360 (3hrs)

updated 6/3/13

Agricultural Biotechnology Undergraduate Degree Program

Information Sheet for Academic Advisors

The Academic Advisor serves as a guide for undergraduate students as they develop their plan of study and helps the student develop a program which is specific to his/her interests.

Incoming freshmen students will be advised by a member of the ABT program (Chair, Director of Undergraduate Studies, Academic Advisor, or the program Academic Coordinator) during the summer and fall advising conferences. Each student will meet with a member of the ABT program on a one-to-one basis or in a small group setting. The student is free to request an individual advising session. During the Spring semester, Academic Advisors are generally assigned before advising and registration conferences. Transfer students will meet with the Director of Undergraduate Studies for the program for their first semester in the ABT program and will then be assigned to a permanent Academic Advisor the next semester. The student should meet with their Academic Advisor at least once a semester; however, some students may need more assistance than others. Sophomore Students are also required to submit to the Associate Dean for Instruction an official **Plan of Study** (http://www.uky.edu/Ag/Biotechnology/UK_Core_check_2013_14.doc) for their Junior and Senior years. Upper division transfer students can submit their **Plan of Study** during the first semester they are enrolled in the ABT program. Advisors and students are encouraged to use the online APEX system to track degree progress. The ABT administration will continue to help all students with finding part-time and summer jobs, career planning and general support for the degree.

Each student is required to perform an independent research project or internship. During the second or third year, the student should select a Faculty Research Mentor. It is crucial that the student selects a Research Mentor prior to enrollment in ABT 301. It is the student's responsibility to contact potential Research Mentors about project opportunities. The Academic Advisor and the ABT 301 course instructor can work closely with the student to ensure that they find a Research Mentor. The Research Mentor may or may not be the same as the Academic Advisor. The student, working closely with the Research Mentor, must write a research proposal for ABT 301, which will be reviewed and approved by the ABT 301 instructor. The approved research project will be verified the ABT 395/399 instructor. The student will conduct an independent research project or internship, prepare a written report, and make an oral presentation summarizing the project. Students should enroll for 2 to 4 hours of credit for ABT 395 or ABT 399 (pending approval) during the semester that they expect to complete their research project or internship. ABT 395 or ABT 399 can be taken for a maximum of 6 credits (pending approval).

ABT 301 Independent Research Proposal: Each student must complete an independent research proposal for ABT 301. With assistance from the Research Mentor, the student will write, revise and then present their research proposal during the semester. The ABT 301 syllabus is available at: http://www.uky.edu/Ag/Biotechnology/ABT301/ABT%20301%20syllabus_2013_revised.pdf. It is the responsibility of each student to identify a Research Mentor before enrolling in ABT 301. The ABT 301 course instructor will approve the research project and maintain records that the student's research proposal was approved.

ABT 395 Independent Research Project: Students can begin working on their project as soon as they have the consent of their research mentor. The research mentor should carefully monitor the student's activities to ensure that an appropriate level of effort is directed toward the completion of the project. Students should sign up for 2 to 4 hours of credit for ABT 395/399 during the semester that they expect to complete their research project. They may repeat the course so that a maximum of 6 hours of credit is earned for the project (pending approval by the ABT 395/399 instructor). The ABT 395/399 instructor will verify that the independent research project was approved by the ABT 301 course instructor.

Written Report: Written reports will be used to evaluate students' performance and for assignment of grades. The research mentor is required to send his/her approval of the written report to the ABT 395/399 course instructor. The written report will be graded as outlined in the ABT 395/399 Class Information. The ABT 395/399 Class Information is available at: http://www.uky.edu/Ag/Biotechnology/Classinfo395_399.htm.

Oral Report: At the end of the semester that the independent study is completed, an oral report summarizing the project will be presented at a meeting of ABT students and faculty. The oral report should last about 12 minutes. Oral reports are given on the last Tuesday or Thursday of the semester at 1:00 p.m. as outlined by in the ABT 395/399 Class Information. Oral reports will be used to evaluate student performance and for assignment of grades.

Grades: Grade assignment will be made by the instructor of ABT 395/399 as outlined in the ABT 395/399 Class Information.

Agricultural Biotechnology Undergraduate Degree Program

Information Sheet for Research Mentors

Each student in the Agricultural Biotechnology Program is required to perform an independent research project or internship. This project will be carried out under the direction of a Research Mentor. The Research Mentor can be any university faculty member who agrees to serve in this role and who has an active research program. The Mentor is selected by the individual student after consultation with their Academic Advisor and may or may not be the same as the Academic Advisor. Working closely with the Research Mentor, the student must write a research proposal, perform an independent research project or internship, prepare a written report, and make an oral presentation summarizing the research project. The Research Mentor is encouraged to inform students of available stipends for doing research projects, e.g., HHMI, NSF, etc.

The purpose of the project is to allow the student to gain experience in developing, performing and reporting an independent research project. This means that the student should be actively involved in the design and execution of the project and not simply an observer of laboratory activities. Emphasis should be on careful development of a research plan and a literature review, creating and testing hypotheses, and analyzing and reporting results. The student should have a project, or part of an ongoing project, that he/she can perform thoroughly and independently and is not just an extra set of hands on a graduate student's project. The project should teach the student how to design and set up an experiment, analyze the data, troubleshoot if necessary, and end up with a thorough understanding of why the experiment worked and what the results suggest. It is better for the student to understand a narrow area or technique thoroughly than to be involved in a broad area with less depth of knowledge.

ABT 301 Independent Research Proposal: Each student must complete an independent research proposal for ABT 301. With assistance from the Research Mentor, the student will write, revise and then present their research proposal during the semester. The ABT 301 syllabus is available at: http://www.uky.edu/Ag/Biotechnology/ABT301/ABT%20301%20syllabus_2013_revised.pdf. It is the responsibility of each student to select a Research Mentor before enrolling in ABT 301. The ABT 301 course instructor will approve the research project and maintain records that the student's research proposal was approved.

ABT 395 Independent Research Project: Students can begin working on their project as soon as they have the consent of their Research Mentor. The Research Mentor should carefully monitor the student's activities to ensure that an appropriate level of effort is directed toward the completion of the project. Students should sign up for 2 to 4 hours of credit for ABT 395/399 during the semester that they expect to complete their research project. They may repeat the course for a maximum of 6 hours of credit is earned for the project (pending approval by the ABT 395/399 instructor). The ABT 395/399 instructor will verify that the independent research project was approved by the ABT 301 course instructor.

Written Report: Written reports will be used to evaluate student performance and for assignment of grades. The Research Mentor must approve the written report submitted to the ABT 395/399 course instructor. The written report will be graded as outlined in the ABT 395/399 Class Information. The ABT 395/399 Class Information is available at: http://www.uky.edu/Ag/Biotechnology/Classinfo395_399.htm.

Oral Report: At the end of the semester during which the independent study is completed, an oral report summarizing the project will be presented at a meeting of ABT students and faculty. The oral report should last about 12 minutes. Oral reports are given on the last Tuesday or Thursday of the semester at 1:00 p.m. as outlined by in the ABT 395/399 Class Information. Oral reports will be used to evaluate student performance and for assignment of grades.

Grades: Grade assignment will be made by the instructor of ABT 395/399 as outlined in the ABT 395/399 Class Information.

Agricultural Biotechnology Undergraduate Degree Program

Information Sheet for Students

First Year:

Incoming freshmen students will be advised by a member of the ABT program (Chair, Director of Undergraduate Studies, Academic Advisor, or the program Academic Coordinator) during the summer and fall advising conferences. Each student will meet with a member of the ABT program on a one-to-one basis or in a small group setting. The student is free to request an individual advising session. During the Spring semester, Academic Advisors are generally assigned before advising and registration conferences. Transfer students will meet with the Director of Undergraduate Studies for the program for their first semester in the ABT program and will then be assigned to a permanent Academic Advisor the next semester. The student should meet with their Academic Advisor at least once a semester; however, some students may need more assistance than others. Sophomore Students are also required to submit to the Associate Dean for Instruction an official **Plan of Study** (http://www.uky.edu/Ag/Biotechnology/UK_Core_check_2013_14.doc) for their Junior and Senior years. Upper division transfer students can submit their **Plan of Study** during the first semester they are enrolled in the ABT program. Advisors and students are encouraged to use the online APEX system to track degree progress. The ABT administration will continue to help all students with finding part-time and summer jobs, career planning and general support for the degree.

Communications:

Communication between the faculty and students in the Agricultural Biotechnology program are usually transmitted through e-mail. Students are required to establish an e-mail address as soon as possible and subscribe to the Biotechnology Listserv. For more information, contact the Academic Coordinator, Esther Fleming at (859) 257-3263, (efleming@uky.edu) or in room S-227 Agricultural Science Ctr. North.

Second Year:

With the help of your permanent Academic Advisor, formulate your **Plan of Study** during your Sophomore year. Your plan will need to satisfy all UK Core, College and Program requirements. Students are also required to submit an official plan of study to the Associate Dean for Instruction by the end of the advising period of their second year. It is the student's responsibility to deliver the plan of study to the Associate Dean for Instruction. The Plan of Study is a graduation requirement for CAFE.

During your second year, identify an area of interest in which you would like to do your independent research project or internship.

Third and Fourth Year:

Independent Research Project or Internship: During your third year and before you enroll in ABT 301, identify a Research Mentor and an independent research project. Your Research Mentor may or may not be the same as your Academic Advisor. Your Academic Advisor and the course instructor of ABT 301 may work with you to help you find a Research Mentor. Enroll in ABT 395 or ABT 399, 2-4 credit hours, for the semester(s) in which you plan to complete your research project or internship.

Students enrolled in ABT 399, (internship option) will be required to complete a learning contract (http://www.uky.edu/careercenter/themes/happy/pdf/ukcc-internship-blank-contract.doc), which must be approved by the Academic Advisor, the Chair of the Steering Committee, a counselor from the career center and a representative of the sponsoring agency. The learning contract must be completed and approved before the internship is started.

ABT 301 Independent Research Proposal: Each student must complete an independent research proposal for ABT 301. With assistance from the Research Mentor, the student will write, revise and then present their research proposal during the semester. The ABT 301 syllabus is available at: http://www.uky.edu/Ag/Biotechnology/ABT301/ABT%20301%20syllabus_2013_revised.pdf. It is the responsibility of each student to identify a Research Mentor before enrolling in ABT 301. The ABT 301 course instructor will review the research project and maintain records that the student's research proposal was approved.

ABT 395 Independent Research Project: Students can begin working on their project as soon as they have the consent of their Research Mentor. The Research Mentor should carefully monitor the student's activities to ensure that an appropriate level of effort is directed toward the completion of the project. Students should sign up for 2 to 4 hours of credit for ABT 395/399 during the semester that they expect to complete their research project. They may repeat the course for a maximum of 6 hours of credit is earned for the project (pending approval by the ABT 395/399 instructor). The ABT 395/399 instructor will verify that the independent research project was approved by the ABT

301 course instructor. Information regarding ABT 395/399 can be found at: http://www.uky.edu/Ag/Biotechnology/Classinfo395_399.htm

Written Report: Written reports will be used to evaluate student performance and for assignment of grades. The Research Mentor must approve the written report submitted to the ABT 395/399 course instructor. The written report will be graded as outlined in the ABT 395/399 Class Information.

Oral Report: At the end of the semester during which the independent study is completed, an oral report summarizing the project must be presented at a meeting of ABT students and faculty. The oral report should last about 12 minutes. Oral reports are given on the last Tuesday or Thursday of the semester at 1:00 p.m. as outlined by in the ABT 395/399 Class Information. Oral reports will be used to evaluate student performance and for assignment of grades. Details for the oral report are given in the ABT 395/399 Class Information.

Grades: Grade assignment of the independent research project will be made by the instructor of ABT 395/399 as outlined in the ABT 395/399 Class Information. Grades will be determined by the faculty Research Mentor's evaluation of the student's research performance, the written report, the oral presentation and the student's compliance with course instructions.

Graduation:

The student should continue to work with his/her academic advisor to ensure a timely completion of their degree. The semester before you intend to graduate, you must schedule an appointment with Susan Skees, the director of Academic Services, to complete a degree audit and apply for graduation. The dates for these appointments are located at: http://www.ca.uky.edu/students/current/graduation_info.asp or by contacting the College of Agriculture Office of Academic Programs, N-8 Agricultural Science Center North, phone 257-3468 or 257-3469.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Howe, Daniel Keith	Professor
eRA COMMONS USER NAME (credential, e.g., agency login) DANIEL.HOWE	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Western Illinois University	B.S.	05/88	Biology
Western Illinois University	M.S.	05/90	Parasitology
Purdue University	Ph.D.	12/92	Molecular Parasitology
Washington University School of Medicine	Postdoc	01/93-06/99	Microbial Pathogenesis

A. Personal Statement

My research interests have focused on the genetics and molecular biology of apicomplexan parasites, with a particular emphasis on the two-host coccidian (i.e., *Sarcocystis neurona, Toxoplasma gondii,* and *Neospora* spp.). My research program over the past decade has been focused heavily on gaining genetic information for *S. neurona* and developing molecular tools to investigate this parasite. To that end, we have conducted a project to sequence and annotate the genome for *S. neurona*, and to generate transcriptome information for different developmental stages of the parasite.

B. Positions and Honors

Professional Appointments:

1993-1999 Postdoctoral Fellow, Department of Molecular Microbiology, Washington University School of Medicine, Laboratory of Dr. David Sibley

1999–2005 Assistant Professor, Department of Veterinary Science, M.H. Gluck Equine Research Center, University of Kentucky

2005-2012 Associate Professor, Department of Veterinary Science, M.H. Gluck Equine Research Center, University of Kentucky

2009-present Director of Graduate Studies, Department of Veterinary Science, M.H. Gluck Equine Research Center, University of Kentucky

2012-present Professor, Department of Veterinary Science, M.H. Gluck Equine Research Center, University of Kentucky

Other Professional Activities and Honors:

1999-2001 Ad hoc reviews (3), The Wellcome Trust

2001 Ad hoc review, NIH/NIAID Parasitology and Vector Biology Training Grant

2001-2003 Editorial Board, Journal of Eukaryotic Microbiology

2004-present Amerman Family Equine Research Endowment

2004 Invited Speaker, Meeting of the Am. College of Veterinary Internal Med., Minneapolis, MN

2004 Faculty Futures Award, University of Kentucky

2005 Ad hoc review, Maryland Sea Grant NSI, Oyster Disease Research Program

2006-2010 Editorial Board, Veterinary Parasitology

2007 Invited Speaker, 4th Annual Workshop of the European COST, Porticcio, France

2008	Invited Speaker, Meeting of the Am. College of Veterinary Internal Med., San Antionio, TX
2009	Presiding Officer, Annual Midwestern Conference of Parasitologists, Delaware, OH
2010-2012	Wethington Award, University of Kentucky
2010-present	Co-Editor-in-Chief, Veterinary Parasitology
2011	Ad hoc review, Maryland Industrial Partnerships Program
2012	Invited Speaker, Advances in Equine Neurological Diseases Symposium, Lexington, KY
2012	Invited Speaker, International Conference on Equine Infectious Diseases, Lexington, KY
2012-present	Editorial Board, Infection and Immunity
2013	Invited Speaker, International Meeting on Apicomplexan Parasites in Farm Animals, Kusadasi, Turkey

C. Peer-reviewed Publications (past 3 years):

1. Gautam, A.*, J.P. Dubey, W.J. Saville, and **D.K. Howe**. 2011. The SnSAG merozoite surface antigens of *Sarcocystis neurona* are expressed differentially during the bradyzoite and sporozoite life cycle stages. Veterinary Parasitology 183:37-42.

2. Dangoudoubiyam, S.*, J. B. Oliveira, C. Víquez, A. Gómez-García, O. González, J. J. Romero, O. C. H. Kwok, J. P. Dubey, and **D.K. Howe.** 2011. Detection of antibodies against *Sarcocystis neurona, Neospora* spp., and *Toxoplasma gondii* in horses from Costa Rica. Journal of Parasitology 97(3):522-524.

3. Yeargan, M.R.*, and **D.K. Howe.** 2011. Improved detection of equine antibodies against *Sarcocystis neurona* using polyvalent ELISAs based on the parasite SnSAG surface antigens. Veterinary Parasitology 176:16-22.

4. Furr, M., **Howe, D.,** Reed, S., and Yeargan, M*. 2011. Antibody coefficients for the diagnosis of Equine Protozoal Myeloencephalitis. Journal of Veterinary Internal Medicine 25:138-142.

5. Andrews, E.S., P.R. Crain, Y. Fu, **D.K. Howe**, and S.L. Dobson. 2012. Reactive Oxygen Species Production and *Brugia pahangi* Survivorship in *Aedes polynesiensis* with Artificial *Wolbachia* Infection Types. PLoS Pathogens 8(12): e1003075. doi:10.1371/journal.ppat.1003075.

6. Arias, M., M. Yeargan*, I. Francisco, S. Dangoudoubiyam*, P. Becerra, R. Sánchez-Andrade, A. Paz-Silva and **D.K. Howe.** 2012. Exposure to *Sarcocystis* spp. in horses from Spain determined by Western blot analysis using *Sarcocystis neurona* merozoites as heterologous antigen. Veterinary Parasitology 185:301-304.

7. Yeargan, M.R.*, C. Alvarado-Esquivel, J.P. Dubey, and **D.K. Howe.** 2013. Prevalence of antibodies to *Sarcocystis neurona* and *Neospora hughesi* in horses from Mexico. Parasite 20: doi:10.1051/parasite/2013029.

8. Reed, S.M., **D.K. Howe**, J.K Morrow, A. Graves, M.R. Yeargan*, A.L. Johnson, R.J. MacKay, W.J.A. Saville, and N.M. Williams. 2013. Accurate antemortem diagnosis of equine protozoal myeloencephalitis (EPM) based on detecting intrathecal antibodies against *Sarcocystis neurona* using the SnSAG2 and SnSAG4/3 ELISAs. Journal of Veterinary Internal Medicine 27:1193-1200. doi:10.1111/jvim.12158.

9. Andersen, U.V., **D.K. Howe**, S. Dangoudoubiyam*, N. Toft, C.R. Reinemeyer, E.T. Lyons, S.N. Olsen, J. Monrad, P. Nejsum, and M.K. Nielsen. 2013. SvSXP: A *Strongylus vulgaris* antigen with potential for prepatent diagnosis. Parasites and Vectors 6:84. doi:10.1186/1756-3305-6-84.

10. Awinda, P.O., R.H. Mealey, L.B.A. Williams, P.A. Conrad, A.E. Packham, K.E. Reif, J.F. Grause, A.M. Pelzel-McCluskey, C. Chung, R.G. Bastos, L.S. Kappmeyer, **D.K. Howe**, S.L. Ness, D.P. Knowles, and M.W. Ueti. Serum antibodies from a subset of horses positive for *Babesia caballi* by competitive ELISA demonstrate a protein recognition pattern not consistent with infection. Clinical and Vaccine Immunology 20(11):1752-1757. doi:10.1128/CVI.00479-13.

D. Research Support

Research Support (past 3 years):

USDA/CSREES #2009-65109-05918 Howe (PI) 2009-2013
Genome Sequence for the Apicomplexan *Sarcocystis neurona*
This project will sequence, annotate, and conducted phyogenomic analyses of the genome from *Sarcocystis neurona*, an apicomplexan parasite and the primary cause of equine protozoal myeloencephalitis.
Role: PI

Bill and Melinda Gates Foundation Grant Dobson (PI) 2007-2012
Supplemental Lymphatic Filariasis Vector Intervention in the South Pacific
The goal of this study is to develop and deliver tools based on *Wolbachia* to accomplish population suppression and/or replacement of *Aedes polynesiensis*, a major vector of filarial worms in large regions of the South Pacific
Role: Co-Investigator

USDA/CSREES Award Schardl (PI) 2008-2011
Advanced Genetics Technologies
This grant provided funds for pilot projects utilizing genomic technologies in the University of Kentucky's College of Agriculture.
Role: Co-Investigator

BIOGRAPHICAL SKETCH

Sharyn Elaine Perry
Department of Plant and Soil Sciences, University of Kentucky, 1405 Veterans Dr., 307 Plant Science Bldg., Lexington, KY 40546-0312
Tel.: 859-257-5020 ext. 80732; FAX: 859-257-7125; e-mail: sperr2@uky.edu

a. Professional Preparation

Institution	Major/Area	Degree	Year
Univ. of Michigan-Dearborn	Biochemistry	B.S.	1983-1987
Univ. of Wisconsin-Madison	Cell and Molec. Biol.	Ph.D.	1987-1993
Univ. of Wisconsin-Madison	Molecular Biology	Postdoc.	1993-1998

b. Appointments

2009-present	Co-director of Undergraduate Studies for the Agricultural Biotechnology Program
2004-present	Associate Professor, Dept. of Plant and Soil Sciences, University of Kentucky
1998-2004	Assistant Professor, Dept. of Plant and Soil Sciences, University of Kentucky
1997-98	Research Associate, Department of Botany, University of Wisconsin-Madison
1994-97	National Science Foundation Postdoctoral Research Fellow in Plant Biology, University of Wisconsin-Madison
1993-94	Postdoctoral Fellow, training program in *Arabidopsis* signal transduction, DOE/NSF/USDA Collaborative Research in Plant Biology, University of Wisconsin-Madison
1987-93	Graduate Research Assistant, Program in Cell and Molecular Biology, University of Wisconsin-Madison
1989	Teaching Assistant, Cellular Biology, University of Wisconsin-Madison
1987-90	National Institutes of Health pre-doctoral training fellowship, Program in Cell and Molecular Biology, University of Wisconsin-Madison
1985-87	Undergraduate Research Assistant, Univ. of Michigan-Dearborn.

c. Products (publications) – Partial list of most current and relevant to current work.

1. Zheng, Q., Y. Zheng and S.E. Perry (2013). AGAMOUS-Like15 Promotes Somatic Embryogenesis in Arabidopsis and Soybean in Part by Control of Ethylene Biosynthesis and Response. *Plant Physiology* **161**, 2113-2127.
2. Zheng, Q., Y. Zheng, and S.E. Perry (2013). Decreased *GmAGL15* Expression and Reduced Ethylene Synthesis may Contribute to Reduced Somatic Embryogenesis in a Poorly Embryogenic Cultivar of *Glycine max. Plant Signaling & Behavoir* **8**, e25422.
3. Wang, F. and S.E. Perry (2013). Identification of Direct Targets of FUSCA3, a Key Regulator of Arabidopsis Seed Development. *Plant Physiology* **161**, 1251-1264.
4. Nayak, N.R., A.A. Putnam, B. Addepalli, J.D. Lowenson, T.S. Chen, E. Jankowsky, S.E. Perry, R.D. Dinkins, P.A. Limbach, S.G. Clarke, and A.B. Downie (2013). An Arabidopsis ATP-Dependent, DEAD-Box RNA Helicase Loses Activity upon IsoAsp Formation but Is Restored by PROTEIN ISOASPARTYL METHYLTRANSFERASE. *The Plant Cell* **25**, 2573-2586.
5. Zheng, Y., and S.E. Perry. (2011). Chapter 16: Chromatin Immunoprecipitation to Verify or to Identify in Vivo Protein-DNA Interactions. In MIMB volume **754**, 277-291.
6. T.S. Chen, N. Nayak, S.M. Majee, J. Lowenson, K.R. Schäfermeyer, A.C. Eliopoulos, T.D. Lloyd, R. Dinkins, S.E. Perry, N.R. Forsthoefel, S.G. Clarke, D.M. Vernon, Z.S. Zhou,

T. Rejtar, and A.B. Downie (2010) Substrates of the *Arabidopsis thaliana* PROTEIN ISOASPARTYL METHYLTRANSFERASE1 Identified Using Phage Display and Biopanning. *Journal of Biological Chemistry, 285(48)* 37281-37292.
7. Zheng, Y., N. Ren, H. Wang, A.J. Stromberg and S.E. Perry (2009). Global Identification of Targets of the Arabidopsis MADS Domain Protein AGAMOUS-Like15. *The Plant Cell* **21**, 2563-2577.
8. Nakaminami, K., K. Hill, S.E. Perry, N. Sentoku, J.A. Long, and D.T. Karlson (2009). Arabidopsis Cold Shock Domain Proteins: Relationships to Floral and Silique Development. *Journal of Experimental Botany* **60**, 1047-1062
9. Hill, K., H. Wang, and S.E. Perry. (2008). A Transcriptional Repression Motif in the MADS Factor AGL15 is Involved in Recruitment of Histone Deacetylase Complex Components*. The Plant Journal* **53**, 172-185.
10. Thakare, D., W. Tang, K. Hill, and S.E. Perry. (2008). The MADS-Domain Transcriptional Regulator AGAMOUS-LIKE15 Promotes Somatic Embryo Development in Arabidopsis and Soybean. *Plant Physiology* **146**, 1663-1672.
11. Wang, H., L.V. Caruso, A.B. Downie, and S.E. Perry. (2004). The Embryo MADS-Domain Protein AGAMOUS-Like 15 Directly Regulates Expression of a Gene Encoding an Enzyme Involved in Gibberellin Metabolism. *The Plant Cell* **16**, 1206-1219.
12. Zhu, C., and S.E. Perry. (2005). Control of Expression and Autoregulation of *AGL15*, a Member of the MADS-box Family*. The Plant Journal* **41**, 583-594.
13. Tang, W., and S.E. Perry. (2003). Binding Site Selection for the Plant MADS Domain Protein AGL15: an *In vitro* and *In vivo* Study. *The Journal of Biological Chemistry* **278**, 28154-28159.
14. Harding, E.W., W. Tang, K.W. Nichols, D.E. Fernandez, and S.E. Perry. (2003). Expression and Maintenance of Embryogenic Potential is Enhanced Through Constitutive Expression of *AGAMOUS-Like 15*. *Plant Physiology* **133***,* 653-663*.*
15. Wang, H., W. Tang, C. Zhu, and S.E. Perry. (2002). A Chromatin Immunoprecipitation (ChIP) Approach to Isolate Genes Regulated by AGL15, a MADS-Domain Protein that Preferentially Accumulates in Embryos. *The Plant Journal* **32**, 831-843.

d. Synergistic Activities

1. Developed and disseminated an approach for chromatin immunoprecipitation (ChIP) in plants. Requests from over 80 laboratories world-wide for a detailed protocol and/or advice on ChIP have been honored.
2. Served as a Panel Member for USDA NRICGP/AFRI, 2003, 2005, 2006 and 2010 and for the NSF 2009, 2011 and 2013.
3. Participant in a National Science Foundation funded program "Girls in Science" as a mentor to encourage girls from Appalachia to consider STEM careers. Organizer for a “Girls in Research” workshop for 6th grade girls from Southeastern Kentucky on Cell Biology that had three sections: comparison of plant and animal cells that I ran, isolation of plant DNA (run by Dr. M. Goodin, Plant Pathology or Dr. A.B. Downie, Horticulture), and transformation of plants (run by Mr. C. Redmond or Ms. J. Prather, Plant & Soil Sci.). Developed and ran a workshop for 5th grade students from Lexington schools examining how plants respond to environmental cues. This is a collaboration with Raven Run Nature Sanctuary and involved 300 students total (in groups of 25) in 2011 and 2012.
4. Trained numerous students, postdoctoral scholars, and staff in microscopy techniques and use of equipment in the facility for microscopy (room 344 PSB).
5. Co-editor with Dr. Ling Yuan for Methods in Molecular Biology volume 754: Plant Transcription Factors: Methods and Protocols, Humana Press (J.M. Walker, Series Editor), 2011.

BIOGRAPHICAL SKETCH: Michael M. Goodin

A. Professional Preparation
1985-1989: Brock University, St. Catharines, Ontario, Canada.
1989-1995: The Pennsylvania State University, State College, Pennsylvania.
1995-June 31, 2002: Post-doctoral research fellow, University of California-Berkeley

B. Appointments

July 1, 2008 – present:
Associate Professor, Department of Plant Pathology, University of Kentucky.

July 1, 2002 – June 30, 2008:
Assistant Professor, Department of Plant Pathology, University of Kentucky.

C1. Five publications most relevant to this proposal

Ganesan, U., Bragg, J.N., Deng, M., Marr, S., Lee, M.Y., Qian., S., Shi, M., Kappel, J., Peters, C., Lee, Y., Goodin, M.M., Dietzgen, R.G., Li, Z., Jackson, A.O. (2013) Construction of a Sonchus Yellow Net Virus minireplicon: a step toward reverse genetic analysis of plant negative-strand RNA viruses. J Virol. 87:10598-10611.

Anderson, G., Wang, R., Bandyopadhyay, A., and Goodin, M. (2012) The nucleocapsid protein of *Potato yellow dwarf virus*: protein interactions and nuclear import mediated by a non-canonical nuclear localization signal Front. Plant Sci. doi: 10.3389/fpls.2012.00014

Martin, K.M., Dietzgen, R.G., Wang, R., and Goodin, M.M. (2012) Lettuce necrotic yellows cytorhabdovirus protein localization and interaction map, and comparison with nucleorhabdoviruses. J Gen Virol. 93:906-914.

Min, B-E., Martin, K., Wang, R., Tafelmeyer, P., Bridges, M., and Goodin, M. (2010) A host-factor interaction and localization map for a plant-adapted rhabdovirus implicates cytoplasm-tethered transcription activators in cell-to-cell movement. MPMI. 23:1420-1432

Bandyopadhyay, A., Kopperud, K., Anderson, G., Martin, K., and Goodin, M. (2010) An integrated protein localization and interaction map for Potato yellow dwarf virus, type species of the genus Nucleorhabdovirus. Virology. 402:61-71.

Martin, K., K. Kopperud, R. Chakrabarty, R. Banerjee. R. Brooks, and M. M. Goodin. **(**2009) Transient expression in *Nicotiana benthamiana* fluorescent marker line provides enhanced definition of protein localization, movement and interactions *in planta.* Plant J. 59:150-162 .

C2. Other significant publications
Kormelink, R., Garcia, M.L., Goodin, M., Sasaya, T., Haenni, A.L. (2011) Negative-strand RNA viruses: the plant-infecting counterparts. Virus Res. 162:184-202.

Goodin, M., Martin, K., and Kopperud, K. (2010) Bimolecular fluorescence complementation: Simultaneous determination of protein interaction and localization in plant cells In Principles and Practice of Advanced Technology in Plant Virology Ed. Aiming Wang

Goodin, M.M., Chakrabarty, R., Yelton, S., Martin, K., Clark, A., Brooks, R. (2007) Membrane and protein dynamics in live plant nuclei infected with Sonchus yellow net virus, a plant-adapted rhabdovirus. J Gen Virol. 88:1810-1820.

Ghosh, D., Brooks, R. E., Wang, R., Lesnaw, J., and Goodin, M.M. (2008) Cloning and subcelluar localization of the phosphoprotein and nucleocapsid proteins of *Potato yellow dwarf virus*, type species of the genus *Nucleorhabdovirus.* Virus Research. *135:26-35*

Chakrabarty, C., Banerjee, R., Chung, S-M., Farman, M., Citovsky, V., Hogenhout, S.A., Tzfira, T., and Goodin, M.M. (2007) pSITE Vectors for Stable Integration or Transient Expression of Autofluorescent Protein Fusions in Plants: Probing *Nicotiana benthamiana*-Virus Interactions. MPMI. 20:740-750

Deng, M., Bragg, J.N., Ruzin, S., Schichnes, D., King, D., Goodin, M.M., Jackson, A.O. (2007) Role of the sonchus yellow net virus N protein in formation of nuclear viroplasms. J Virol. 81:5362-5374.

Whitham, S. A., Yang, C., Goodin, M. M. (2006) Global impact: elucidating plant responses to viral infection. MPMI. 19:1207-1215.

Senthil, G., Liu, H., Puram, V.G., Clark, A., Stromberg, A., Goodin, M.M. (2005) Specific and common changes in *Nicotiana benthamiana* gene expression in response to infection by enveloped viruses. J Gen Virol. 86:2615-2625.

D1. Graduate and Post Doctoral Advising (present lab members only)
Gavin Anderson (Doctoral Candidate)
Chanyong Jang (Doctoral Candidate)

D2. Undergraduate Research Assistant Advising (present lab members only)
Kendall Holscher (freshman), Devin Henry (sophomore), Joseph Wells (sophomore)

E. Graduate and Post Doctoral Advisors
C. Peter Romaine, The Pennsylvania State University, Graduate Advisor
Andrew O. Jackson, University of California-Berkeley, Postdoctoral Advisor

F. Synergistic activities
1. Goodin currently advises six undergraduates enrolled in the University of Kentucky Agricultural Biotechnology (UK-ABT) B.S. Degree Program, for which he serves as Co-Director of Undergraduate Studies. As part of their requirements for graduation, students enrolled in this program must complete an internship in a research lab. Since many of the ABT students are from eastern Kentucky (Appalachia), their involvement in the research proposed above certainly contributes to building interest in science and technology careers among populations typically underrepresented in the sciences.

2. Goodin is an editor for Annual Review of Virology, Molecular Plant Pathology and Frontiers in Plant-Microbe Interactions and has also recently reviewed manuscripts submitted to the Journal of Virology, Journal of General Virology, Molecular Plant-Microbe Interaction, Molecular Plant Pathology, Plant Physiology, Plasmid and Virus Research.

G. **Collaborators and other Affiliations** (at University of Kentucky unless noted)
Judith Brown (UofA-Tucson), Vitaly Citovsky (SUNY), Ralf Dietzgen (DPI, Australia), Rebecca Dutch, Randy Dinkins (USDA ARS-FAPRU), Mark Farman, Kamal Gajendran (NCGR), Said Ghabrial, Richard Hardy (Indiana University), Saskia Hogenhout (John Innes Center), Arthur Hunt, Andrew Jackson (UC-Berkeley), Sophien Kamoun (Sainsbury Lab), Steve Lommel (NCSU), Reddy Palli, Sharyn Perry, Naidu Rayapati (WSU), David Rogers, Arnold Stromberg, Bruce Webb, Steve Whitham (ISU).

Luke A. Moe, Ph.D.
Assistant Professor
Department of Plant & Soil Sciences
University of Kentucky
Date Appointed: November 1, 2009
DOE: 75% research, 25% teaching

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EDUCATION

— 2005 Ph.D., Department of Biochemistry, University of Wisconsin, Madison, WI

— 1999 B.S., Biochemistry, Washington State University, Pullman, WA

RESEARCH POSITIONS

— Assistant Professor: Department of Plant & Soil Sciences, University of Kentucky (November 1, 2009-present)

— USDA NRI Postdoctoral fellow**:** Advisor: Jo Handelsman, Departments of Bacteriology and Plant Pathology, University of Wisconsin-Madison (2006-2009)

— Postdoctoral researcher: Advisor: Rachel N. Austin, Department of Chemistry, Bates College, Lewiston, ME. Research performed in the lab of Brian G. Fox, UW-Madison (2006)

— Graduate research assistant: Advisor: Brian G. Fox, Department of Biochemistry, University of Wisconsin-Madison (1999-2005)

RESEARCH PROJECTS (Total funds at UK: $1,279,816)

Research in the Moe laboratory has been largely focused in the following areas:

— Structure and function of plant-associated microbial communities

— Genetics and biochemistry of model soil-dwelling and plant-associated bacteria

— Non-conventional environmental reservoirs for antibiotic resistance

Funded: nationally competitive and industrial grants (Total funds: $1,164,816)

— "*Plant-microbe communication in the* Medicago truncatula *rhizosphere: functional metagenomics, biochemistry, and community analysis"* USDA NIFA AFRI foundational program (program area: Microbial Communities in Soil) ($452,000 for 4 years duration, 2011-2015); **Luke Moe (PI)**, Seth DeBolt (Co-PI, UK Horticulture) and David McNear (Co-PI, UK Plant & Soil Sciences)

— *"The role of endophytic bacteria in TSNA accumulation"* An international corporation ($30,000 total for three years duration) Investigators: Colin Fisher, **Luke Moe**, Anne Jack, and Lowell Bush (UK Plant & Soil Sciences and KTRDC)

— *"A first look at the tobacco microbiome"* An international corporation ($227,500 total for three year duration, 2013-2016) **Luke Moe (PI)**, Co-investigators Anne Jack, Huihua Ji, Lowell Bush (UK Plant & Soil Sciences and KTRDC)

— "*Isolation and improvement of tobacco plant-associated microbes for the production of vanillin, organic acids and other flavor compounds*" An international corporation ($455,316 for three years duration 2013-16); Ling Yuan (PI, UK Plant & Soil Sciences), **Luke Moe (co-PI)**; (Approved, waiting for contract finalization)

Funded: regional grants (Total funds: $115,000)

— "*Metagenomic analysis of microbial urea transformation in soil"* Kentucky Water Resources Research Institute (Sponsored by US Geological Survey) ($5,000 for 1 year duration, 2011-2012); **Luke Moe (PI)**, Mark Coyne (Co-PI, UK Plant & Soil Sciences)

— "*Bacteria and bioethanol fermentation: characterizing the impact of bacterial contaminants and bacterial community structure on bioethanol fermentations across the US"* Kentucky Science and Engineering Foundation ($90,000 for two years duration, 2011-2013); **Luke Moe (PI)** Pat Heist (Co-PI, Ferm Solutions, Inc., Danville, KY)

— *"Harm reduction through enzymatic denitrosation of tobacco-specific ntirosamines"* Kentucky Tobacco Research and Development Center, 2012-2013 ($20,000 for 1 year duration**); Luke Moe (PI)**, Ling Yuan (Co-PI, UK Plant & Soil Sciences)

Funded/Approved: other proposals

— USDA NIFA Hatch proposal: "*Functional metagenomic analysis of soil-dwelling and plant-associated microbial communities*" has been approved (7/1/2011-6/30/2016)

— "*A Thermo Scientific BioMate 3 UV/Vis spectrophotometer for the ABT teaching laboratory*" UK College of Agriculture Teaching Incentive & Improvement Fund (TIIF) funds ($4,200 total funds).

Funded: prior to starting at UK

— "*Functional metagenomics of beta-lactamases and lactonases from topsoil on Wisconsin dairy farms"* USDA-NRI postdoctoral fellowship ($120,000 for two years duration, 2006-2008)

Proposals Submitted (Pending or Declined):

As PI:

— "*A functional metagenomic approach to identify biological recognition elements for biosensing applications"* Submitted to the NSF (Biosensors program) 3/3/2011 ($215,866 requested for 3 years duration); Declined 7/7/2011

— "*Microbial ecology of bioethanol fermentation*" Pre-proposal submitted to the DOE (Early Career Research Program) 9/1/2011($750,000 requested for 5 years duration); Not selected for full submission 10/3/2011.

— "*D-Amino acids as currency in the rhizosphere*" Submitted to the NSF (CAREER) 7/25/2011 ($622,764 requested for 5 years duration); Declined 12/10/2011.

— "*Expanding the explosives biosensing toolkit: identifying genetic circuits responsive to explosives through functional metagenomics*" Submitted to the Office of Naval Research 12/21/2011 ($510,000 requested for 3 years duration); Declined 3/28/2012.

— "*Functional genomics and metagenomics of D-amino acid metabolism among rhizosphere-dwelling bacteria*" Submitted to the NSF (CAREER) 7/23/2012 ($869,401 requested for 5 years duration); Declined 11/30/2012.

— "*Amino acids as a driver of rhizosphere microbial community structure and function*" Submitted to USDA NIFA AFRI (Understanding Plant-Associated Microorganisms and Plant-Microbe Interactions) 2/18/2013 ($500,000 requested for 4 years duration); Declined 9/27/2013

As Co-PI

— "*A versatile biomimetic membrane system for sensing and separation"* Pre-proposal submitted to NASA KY EPSCoR 1/9/2012 ($675,000 requested for 3 years) PI Yinan Wei (UK Chemistry); Co-PIs Dibakar Bhattacharya (UK Chemical Engineering), Yuguang Cai (UK Chemistry), Bruce Hinds (UK Materials Engineering), Luke Moe (UK Plant & Soil Sciences), Andrew Pohorille (NASA Ames Research Center); Not selected for full submission.

— "*Linking chronic exposure of environmental contaminants to gut microbiome composition and disease*" Pre-proposal submitted to the University of Kentucky Center for Clinical and Translational Science 2013 Pilot Grant Program ($50,000 requested for 18 months) 8/16/2013; (PIs) Dave McNear (UK Plant & Soil Sciences), Phillip Kern (UK Endocrinology and Molecular Medicine), (Co-PIs) Barnhard Hennig (UK Animal Sciences), Luke Moe (UK Plant & Soil Sciences); Pending

Publications (Since UK appointment):

*Note: * = graduate student in my lab, underline = postdoc or research staff in my lab, † = ABT undergraduate*

1. *Radkov, A.D., and **Moe, L.A**. (2013) "Amino acid racemization in *Pseudomonas putida* KT2440" *Journal of Bacteriology* (in press)
2. **Moe, L.A.** (2013) "Amino acids in the rhizosphere: from plants to microbes" *American Journal of Botany* **100**, 1692-1705. ***(Invited Review)***
3. Donato, J.J., **Moe, L.A.**, Converse, B.J., Smart, K.D., Berklein, F.C., McManus, P.S., and Handelsman, J. (2010) "Metagenomics reveals antibiotic resistance genes encoding predicted bifunctional proteins in apple orchard soil" *Applied and Environmental Microbiology* **76**, 4396-4401.

Submitted and under review:

4. Murphree, C.A., Heist, E.P., and **Moe, L.A.** "Antibiotic resistance among cultured

bacterial isolates from bioethanol facilities across the United States“ submitted to *Current Microbiology*

5. Murphree, C.A., *Li, Q., Heist, E.P., and **Moe, L.A.** “A multiple antibiotic-resistant *Enterobacter cloacae* strain isolated from a bioethanol fermentation facility” submitted to *Microbial Drug Resistance*
6. *Szoboszlay, M., †Lambers, J., †Chappell, J., Kupper, J.V., **Moe, L.A.**, and McNear, D.H., Jr. “Getting to the root of corn domestication: comparing root system architecture and rhizosphere processes of Balsas teosinte and domesticated corn cultivars” submitted to *Soil Biology and Biochemistry*

In preparation (listed projects ≥50% complete):

1. **Moe, L.A**., Allen, H.K, *An, R., Handelsman, J. “Antibiotic resistance in *E. coli* through acquisition of a transcription factor that modulates expression of a native antisense RNA: the curious case of the BLR16 metagenomic clone”
   — Work for this paper is ~80% finished
2. Law, A.D, Fisher, C., Jack, A., Bush, L.P., **Moe, L.A**. “Correlation between tobacco cure conditions, tobacco-specific nitrosamine content, and cured leaf microbial community”
   — Work for this paper is ~75% finished
3. *An, R., **Moe, L.A**. “Regulation of PQQ-dependent glucose dehydrogenase activity in the model rhizosphere-dwelling bacterium *Pseudomonas putida* KT2440”
   — Work for this paper is ~50% finished
4. *Radkov, A.D., **Moe, L.A.** “A multifunctional amino acid racemase involved in D-amino acid synthesis for peptidoglycan and D-amino acid catabolism”
   — Work for this paper is ~50% finished
5. White, A., *Szoboszlay, M., DeBolt, S., **Moe, L.A**., McNear, D.H., Jr., “Mutations in *Medicago truncatula* for plant symbioses alter the metabolomic profile of root exudates”
   — Work for this paper is ~50% finished
6. Law, A.D., Su, A., Moe, L.A. “Bacterial degradation of tobacco-specific nitrosamines”
   — Work for this paper is ~50% finished

Publications (Prior to UK appointment):

1. Allen, H.K., **Moe, L.A**., Rodbumrer, J., Gaarder A. and Handelsman, J. (2009) “Functional metagenomics reveals diverse β-lactamases in a remote Alaskan soil” *The International Society for Microbial Ecology Journal* 3, 243-251
2. Rozhkova-Novosad, E.A., Chae, J.-C., Zylstra, G.J., Bertrand, E.M., Alexander-Ozinskas, M., Deng, D., **Moe, L.A.**, van Beilen, J.B., Danahy, M., Groves, J.T., and Austin, R.N. (2007) “Profiling mechanisms of alkane hydroxylase activity *in vivo*

using the diagnostic substrate norcarane" *Chemistry & Biology* 14, 165-172.

3. Elsen, N.L., **Moe, L.A.**, McMartin, L.A., and Fox, B.G. (2007) "Redox and functional analysis of the Rieske ferredoxin component of the Toluene 4-Monooxygenase" *Biochemistry* 46, 976-986.
4. **Moe, L.A.**, McMartin, L.A., and Fox, B.G. (2006) "Component interactions and implications for complex formation in the multicomponent Toluene 4-Monooxygenase" *Biochemistry* 45, 5478-5485.
5. **Moe, L.A.**, Bingman, C.A., Wesenberg, G.E., Phillips, G.N., Jr., and Fox, B.G. (2006) "Structure of T4moC, the Rieske-type ferredoxin component of Toluene 4-Monooxygenase" *Acta Crystallographica section D – Biological Crystallography* 62, 476-482.
6. **Moe, L.A**. and Fox, B.G. (2005) "Oxygen-18 tracer studies of enzyme reactions with radical/cation diagnostic probes" *Biochemical and Biophysical Research Communications* 338, 240-249.
7. Bertrand, E., Sakai, R., Rozhkova-Novosad, E., **Moe, L.**, Fox, B. G., Groves, J. T., and Austin, R. N. (2005) "Reaction mechanisms of non-heme diiron hydroxylases characterized in whole cells" *Journal of Inorganic Biochemistry* 99, 1998-2006.
8. Kemner, K. M., Kelly, S. D., O'Loughlin, E. J., Khare, T., **Moe, L. A.**, Fox, B. G., Donnelly, M. I., Londer, Y., Schiffer, M., and Giometti, C. S. (2005) "XRF and XAFS analysis of electrophoretically isolated nondenatured proteins" *Physica Scripta* T115, 940-942.
9. **Moe, L. A.**, Hu, Z. B., Deng, D. Y., Austin, R. N., Groves, J. T., and Fox B. G. (2004) "Remarkable aliphatic hydroxylation by the diiron enzyme Toluene 4-Monooxygenase in reactions with radical or cation diagnostic probes norcarane, 1,1-dimethylcyclopropane and 1,1-diethylcyclopropane" *Biochemistry* 43, 15688-15701.
10. Skjeldal, L, Peterson, F. C., Doreleijers, J. F., **Moe, L. A.**, Pikus, J. D., Westler, W. M., Markley, J. L., Volkman, B. F., and Fox, B. G. (2004) "Solution structure of T4moC, the Rieske ferredoxin component of the Toluene 4-Monooxygenase complex" *Journal of Biological Inorganic Chemistry* 9, 945-953.
11. **Moe, L. A**. and Fox, B. G. "Rapid mixing techniques". *Ergito: Life Science Textbooks on the WWW*, 2004. Virtual text. 10 May, 2005. <http://www.ergito.com/main-lcd.jsp?bcs=TECH.12>
12. Luo, W., **Moe, L. A.**, Skjeldal, L., Pikus, J. D., Markley, J. L., and Fox, B. G. (2001) "Letter to the Editor: Assignment of H-1, C-13, and N-15 NMR signals from Toluene 4-Monooxygenase Rieske ferredoxin in its oxidized state" *Journal of Biomolecular NMR* 21, 73-74.

Peer-Reviewed Book Chapter:

Moe, L.A., McMahon, M.D. and Thomas, M.G. "Functional metagenomics as a technique for the discovery of novel enzymes and natural products." *Enzyme Technologies for Drug Discovery and Development, Volume I: Chemical Biology of*

Enzymes for Biotech and Pharmaceutical Applications. Eds. J.R. McCarthy, H.C. Yang and W.K. Yeh. Wiley, 2010

Teaching and Advising

Courses taught:

Fall 2010: ABT 495 "Experimental techniques in biotechnology"; 4 credits; 15 students. I team-taught this course with Professor Joe Chappell (UK Plant & Soil Sciences). I was responsible for 50% of the course.

Course #	Section #	**Course Mean**	Dept. Course Mean	Univ. Course Mean	College Course Mean	**Teaching Mean**	Dept. Teaching Mean	Univ. Teaching Mean	College Teaching Mean
ABT 495	001	**3.5**	3.5	3.3	3.4	**3.5**	3.6	3.4	3.5

Fall 2011: ABT 495 "Experimental techniques in biotechnology"; 4 credits; 21 students. I was fully responsible for the course (100%).

Course #	Section #	**Course Mean**	Dept. Course Mean	Univ. Course Mean	College Course Mean	**Teaching Mean**	Dept. Teaching Mean	Univ. Teaching Mean	College Teaching Mean
ABT 495	001	**3.5**	3.6	3.3	3.4	**3.7**	3.7	3.4	3.5

Spring 2012: ABT 460 "Introduction to molecular genetics"; 3 credits; 16 students. I was fully responsible for the course (100%)

Course #	Section #	**Course Mean**	Dept. Course Mean	Univ. Course Mean	College Course Mean	**Teaching Mean**	Dept. Teaching Mean	Univ. Teaching Mean	College Teaching Mean
ABT 460	001	**3.2**	3.4	3.3	3.4	**3.1**	3.4	3.4	3.5

Fall 2012: ABT 495 "Experimental techniques in biotechnology"; 4 credits; 16 students. I was fully responsible for the course (100%).

Course #	Section #	**Course Mean**	Dept. Course Mean	Univ. Course Mean	College Course Mean	**Teaching Mean**	Dept. Teaching Mean	Univ. Teaching Mean	College Teaching Mean
ABT 495	001	**3.1**	3.4	3.3	3.4	**3.1**	3.6	3.4	3.4

Fall 2013: ABT 495 "Experimental techniques in biotechnology"; 4 credits; 21 students. I am fully responsible for the course (100%). Teaching evaluations are not yet available.

Graduate Students Advised:

Graduate students in my laboratory:
— Atanas Radkov (Plant Physiology PhD student, 2010-present)
— Ran An (Soil Science PhD student, 2011-present)
— Marton Szoboszlay (Soil Science PhD student, 2011-present)
— Qing Li (IPSS MS student, 2012-present)

Graduate student committees (in addition to the students in my lab):
— Qian Chai (Chemistry)
— Derek Law (Geography)
— Shuang Liu (Soil Science)
— Linliang Yu (Chemistry; outside examiner)
— Matthew McErlean (Pharmaceutical Sciences)
— Zheng Cui (Pharmaceutical Sciences)

Postdoctoral scholars advised:
— Dr. Jeanne Rasbery (August 1, 2010—July 31, 2012)
— Dr. Alison White (shared with McNear lab, March 1, 2013—present)
— Dr. Muhammad Saleem (September 1, 2013—present)

Undergraduate students advised:
— I have been academic advisor for 11 Agricultural Biotechnology (ABT) students
— I have participated in summer academic advising for incoming ABT freshman during the summers of 2011, 2012, and 2013
— I have had 4 ABT students perform research in my lab

Service/Outreach:

— Manuscript reviewer: *Applied and Environmental Microbiology*, *Current Opinion in Microbiology*, *Plant and Soil, Trends in Biotechnology, Journal of Hazardous Materials*
— *Ad hoc* reviewer for *Kaleidoscope*, the UK undergraduate research journal
— Member of the following UK Plant & Soil Sciences departmental committees: (2010-2011) social committee, web page committee (2011-2012) plant biology seminar sub-committee, web page committee (2012-2013) web page committee
— Member of the coordinating committee for the ABT major at UK (2011-2014)
— I have also performed a variety of service-related roles for ABT including representing ABT at the Institute for Future Agricultural Leaders (IFAL) luncheon (2011, 2012), serving as the faculty advisor for the ABT club, and serving as the advisor for an ABT student's EXP396 course during the Fall 2013 semester
— I initiated and have organized the Soil Microbiology Interest Group (SMIG) from May 2012 until present
— Member of the *ad hoc* committee to write the job description for the Jason Unrine position

- *Ad hoc* reviewer for a departmental Hatch proposal
- I developed and ran an interactive lab exercise with 19 visiting KY Governor's scholars (6/18/13) entitled "assessing the impact of *CDO* gene mutations on the function of the CDO enzyme"
- Non-research, service-related presentations include:
    - "Life at the confluence of molecular biology, agriculture, and environmental science" Presentation to students in ABT 201 (Fall 2010)
    - "Metagenomics: everybody's doing it" Presentation to students in a graduate-level chemistry class (CHE 776) at UK (Spring 2011)
    - "Culture-independent analysis of microbial communities: what, why, how?" Presentation at the UK SMIG (Spring 2012)
    - Two separate presentations to the Floyd County Early College Academy and two Big Sandy Community and Technical College biology courses in Prestonsburg, KY (Fall 2012) describing opportunities available for students in the UK College of Agriculture

Professional Development

Invited research presentations (since UK appointment):

1. Invited speaker, Department of Microbiology, Miami University, Oxford, OH (October 12, 2011)
2. Invited speaker, Botanical Society of America meeting, Columbus, OH, July 10, 2012
3. Invited speaker, University of Kentucky Natural Products Consortium, Lexington, KY, August 16, 2012

Meetings attended (since UK appointment):

1. Emerging Frontiers in Rhizosphere Science workshop, March 16-17, 2011, Warrenton, VA
2. Plant and Animal Genome XX, January 14-18, 2012, San Diego, CA
3. American Society for Microbiology (ASM) annual meeting, June 16-19, 2012, San Francisco, CA
4. Botanical Society of America annual meeting, July 7-11, 2012, Columbus, OH
5. Kentucky Innovation and Entrepreneurship Conference, Louisville, KY, June 1, 2012
6. University of Kentucky Natural Products Consortium, Lexington, KY, August 16, 2012
7. ASA-CSSA-SSSA annual meeting, October 21-24, 2012, Cincinnati, OH
8. KY-TN regional ASM meeting, October 26-27, 2012, Maryville, TN
9. USDA NIFA AFRI Microbial Programs Awardee meeting, August 7-8, Washington, DC
10. University of Kentucky Natural Products Consortium, Lexington, KY, August 15, 2013
11. Kentucky Innovation and Entrepreneurship Conference, Lexington, KY August 29, 2013
12. 5th Argonne Soil Metagenomics Conference, Bloomingdale, IL, October 2-4, 2013

I. PERSONAL DATA

Name: Robert L. Houtz

Address: Department of Horticulture
401D Plant Science Building
1405 Veterans Drive
University of Kentucky, Lexington, KY 40546-0312
Phone: (859)257-1982 (day); (859)527-3850 (evening)

II. EDUCATION

Doctorate of Philosophy, 1984

Institution: Michigan State University, East Lansing, MI 48824
Major: Horticulture
Dissertation Title: Stimulation of Growth and Photosynthetic Carbon Metabolism in *Chlamydomonas reinhardtii* with Triacontanol

Master of Science, 1980

Institution: Michigan State University, East Lansing, MI 48824
Major: Horticulture
Thesis Title: Development and Characterization of an *In Vitro* System Responsive to 1-Triacontanol

Bachelor of Science (*magna cum laude*), 1977

Institution: University of Florida, Gainesville, FL 32611
Major: Horticulture

III. PROFESSIONAL EMPLOYMENT

Professor and Chair, Department of Horticulture, University of Kentucky, (60% research, 20% teaching, 20% extension), May 1, 2009-present.

Professor of Horticulture, University of Kentucky, Department of Horticulture, (70% research, 20% teaching, 10% administration), July 1, 1999-2009

Associate Professor of Horticulture, University of Kentucky, Department of Horticulture and Landscape Architecture, (85% research, 15% teaching), December 1, 1990-June 30, 1999

Assistant Professor of Horticulture, University of Kentucky, Department of Horticulture and Landscape Architecture, (90% research, 10% teaching), January 1, 1985 - November 30, 1990

Graduate Research Assistant, Michigan State University, Department of Horticulture, September 1977 - September 1984

IV. RESEARCH

Research Area: Structure/function studies and post-translational modifications in ribulose-1,5-bisphosphate carboxylase/oxygenase ; Chloroplast-localized co- and post-translational protein processing; Enzymology of SET domain protein N-methyltransferases. Functional significance of calmodulin methylation.

Significant Research Accomplishments:

- Provided evidence for the necessity of the N-terminal region of the large subunit of ribulose bisphosphate carboxylase/oxygenase for catalytic activity and identified this same region as the location of catalytic-dependent, conformational changes.

- Discovered all of the known post-translational modifications in the large subunit of ribulose bisphosphate carboxylase/oxygenase, including N-terminal removal of Met-1 and Ser-2, acetylation of Pro-3, and methylation of Lys-14.

- Provided the first evidence for species diversity in the post-translational modifications of the large subunit of ribulose bisphosphate carboxylase/oxygenase.

- Discovered the chloroplast-localized enzymatic activity responsible for one of the post-translational modifications in the large subunit of ribulose bisphosphate carboxylase/oxygenase.

- Provided the first reported DNA and protein sequence for a protein (lysine) $^{\prime}$N-methyltransferase enzyme.

- Discovered chloroplast-localized eukaryotic peptide deformylase

- Provided one of the first structural determinations of a SET domain protein methyltransferase.

- Demonstrated the potential commercial utility of peptide deformylase and peptide deformylase inhibitors as a new platform for selectable marker and broad-spectrum herbicide technology.

- Discovered the DNA and protein sequence for calmodulin lysine methyltransferase.

Patents:

Patent pending - Nucleotide and Amino Acid Sequences for Calmodulin Protein Methyltransferase, Inventor: Robert L. Houtz, Co-Inventors, Roberta Magnani, and Lynnette Dirk, U.S. Application No. 12/757,388 filed April 9, 2010.

Crystallization and Structure of a Plant Peptide Deformylase, Inventor: Robert L. Houtz, Co-Inventors, David Rodgers, Lynnette Dirk, and Mark Williams. Patent # 7,445,923 - issued November 4, 2008

U.S. Provisional Application Serial No. 60/468,966 - A Modified Rubisco Large Subunit $^{\varepsilon}$N-methyltransferase Useful for Targeting Molecules to the Active-site Vicinity of Ribulose-1, 5-Bisphosphate - Inventor Robert L. Houtz - Filed May 7, 2004.

Inhibitors of Plant Peptide Deformylase for Use as Broad-Spectrum Herbicides. Inventors Robert L. Houtz, Lynnette Dirk, and Mark Williams. Patent # 6,730,634 - issued May 4, 2004

Nucleotide sequence of cDNAs encoding Ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit $^{\prime}$N-methyltransferase from Spinach and method of inactivating Ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit $^{\prime}$N-methyltransferase activity. Patent #5,908,972 - issued June 1, 1999.

Nucleotide sequence of the gene for Ribulose-1,5-bisphosphate carboxylase/ oxygenase large subunit $^{\prime}$N-methyltransferase from tobacco. Continuation of patent below. Patent #5,866,394 - issued February 2, 1999.

Nucleotide sequence of a cDNA encoding for Ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ˈN-methyltransferase. Patent #5,723,752 - issued 3/15/98.

Grants:

06/09 – 07/13 Special Appropriations Grant, USDA NIFA, non-competitive, PI: R. Houtz, Crop Diversification and Biofuel Research and Education, $978,052.00

Date	Agency		Title	Duration	Amount	Status
Nationally Competitive - Extramural						
07/03	DOE OER Basic Energy Science Energy Bioscience (currently in 2 yr extension with $50,000 new funds)	PI: **R. Houtz** Co-PI: L. Dirk	Mechanism and Significance of Post-Translational Modifications in the Large and Small Subunits of Ribulose Bisphosphate Carboxylase/Oxygenase	4 yrs	$380,000.	Funded 7/03-6/08
07/02	NSF (currently in 2 yr no cost extension,	PI: **R. Houtz**, Co-PIs: L. Dirk M. Williams and A. Francis-Miller	Chloroplast-localized N-terminal protein processing by peptide deformylase	3 yrs	$300,000.	Funded 1/03-12/08
7/98	DOE OER Basic Energy Science Energy Bioscience (renewal)	PI: R Houtz Co-PI: none	Mechanism and Significance of Post-Translational Modifications in the Large and Small Subunits of Ribulose Bisphosphate Carboxylase/Oxygenase	3 yrs	$264,255	Funded 1/99-12/02
6/95	DOE OER Basic Energy Science Energy Bioscience (renewal)	PI: R Houtz Co-PI: none	Mechanism and Significance of Post-Translational Modifications of Ribulose Bisphosphate Carboxylase/Oxygenase	3.5 yrs	$264,119	Funded 6/95-12/98
6/92	USDA/ARS Cooperative Agreement	Co-PIs: R Houtz and S Crafts-Brandner	A Combination of Nuclear and Chloroplast Factors Determines Protein Stability in Tobacco Chloroplasts	2 yrs	$37,438	Funded 7/93-6/95
6/91	DOE Competitive Grants Program Division of Energy Biosciences	PI: R Houtz Co-PI: none	Mechanism and Significance of Post-Translational Modifications in the Large Subunit of Ribulose Bisphosphate Carboxylase/Oxygenase	3 yrs	$269,000	Funded 7/92-6/95
12/88	USDA Competitive Grants Program (Photosynthesis)	PI: R Houtz Co-PI: none	Mechanism and Significance of Post-Translational Modifications in the Large Subunit of Ribulose Bisphosphate Carboxylase/Oxygenase	2 yrs	$100,000	Funded 7/89-6/91

Date	Agency		Title	Duration	Amount	Status
Nationally Competitive - Extramural - Equipment						
1/01	NSF EPSCOR, Major Research Equipment Grant	PI: T Vanaman Co-PI: R Houtz, D Rodgers, T Creamer, P Speilman, M Oliveira	Center for Proteomics	3 yrs	$1,270,033	Funded 1/02-12/05
Competitive - Internal - Equipment						
5/96	UK, Major Research Equipment Grant		IAsys Optical Biosensor System (I was the lead PI on this application which had 7 other Co-PIs)		$87,035	Funded
9/89	UK, Major Research Equipment Grant		Low Pressure Liquid Chromatography System		$4,550	Funded
9/88	UK, Major Research Equipment Grant		High Performance Liquid Chromatography System		$6,780	Funded
9/87	UK, Major Research Equipment Grant		Ultra-Low Freezer, Liquid Scintillation Counter		$18,450	Funded
Competitive – Internal/local – Projects						
10/07	KSEF	PI: **R. Houtz** Co-PIs: MA Williams, Horticulture	Isolation and Identification of Plant-Specific Peptide Deformylase Inhibitors from Soil Micro-organisms for Use as Broad-Spectrum Herbicides and Selectable Markers	1 yr	$19,976	Funded 10/07-09/08
10/06	UK NPA (Natural Products Alliance)	PI: **R. Houtz** Co-PIs: MA Williams, Horticulture; R B Grossman, Chemistry; EM D'Angelo, Plant and Soil Science; and DW Rodgers, Biochemistry	Isolation and Identification of Plant-Specific Peptide Deformylase Inhibitors from Soil Micro-organisms for Use as Broad-Spectrum Herbicides and Selectable Markers.	2 yr	$40,000	Funded 01/07-12/08
11/04	KTRDC	PI: **R. Houtz**	Development and Utilization of Rubisco LSMT as a Molecular Vehicle for Targeting Enzymes to Rubisco	2 yrs	$100,000.	Funded 06/05-07/07
7/02	USDA New Crop Opportunities	PI: R Houtz Co-PI: B Rowell	Evaluation of High-Tunnels as a Seasonal Extending Technology	3 yrs	$60,020	Funded 7/02-6/05

Date	Agency		Title	Duration	Amount	Status
7/01	KTRDC	PI: M Williams Co-PI: R Houtz	Peptide Deformylase in Tobacco: A Novel Herbicide Target Amenable to Genetically Engineered Tolerance	2 yrs	$103,256	Funded 7/01-6/03
6/96	UK, Office of the Vice Chancellor for Research & Graduate Studies		Member, Plant Biotech-nology Initiative (joint proposal, majority effort held by Co-Chairs: Maelor. Davies, Director, Tobacco & Health Research Institute; and Dr. George Wagner, Agronomy.)	2 yrs	$100,000	Funded
Internal						
8/02	Office of the Vice President for Research	PI: R Houtz	Bridge Funding for graduate research assistantship stipends	1 yr	$18,000	Funded
Hatch Projects						
7/02-7/07			Mechanism and Signifi-cance of Post-Trans-lational Modifications in the Large and Small Subunits of Ribulose Bisphosphate Carboxylase/Oxygenase			Approved
7/95-6/00			Mechanism and Signifi-cance of Post-Trans-lational Modifications in the Large and Small Subunits of Ribulose Bisphosphate Carboxylase/Oxygenase			Approved
7/90-6/95			Influence of Lys-14 methylation of stability of Rubisco LS			Approved
7/85-6/90			Relationships among light, photosynthetic CO_2 assimilation, and ribulose-1,5-bisphosphate carboxylase			Approved
Non-Competitive						
7/98-8/01	Monsanto Corp		Construction and Evaluation of Transgenic Wheat and Maize Plants Expressing Full-Length and Truncated Forms of Pea Rubisco LSMT	2 yrs	$26,600	Funded
9/90-9/92	AIRCO Carbon Dioxide		*In Situ* Field Fertilization with CO_2	2 yrs	$3,000	Funded

Date	Agency	Title	Duration	Amount	Status
9/85-9/87	Kentucky Vegetable Growers Association	Optimization of Factors Affecting Bell Pepper Production	3 yrs	$1,500	Funded

V. PUBLICATIONS

*student, #post-doc

A. Research Papers

Whitney, S. M., **R. L. Houtz**, and Alonso, H. (2011). Advancing our understanding and capacity to engineer nature's CO_2-sequestering enzyme, Rubisco. **Plant Physiol.** 155(1): 27-35.

Del Rizzo, Paul A., Couture, Jean-Francois, Dirk, Lynnette M. A., Strunk, Bethany S., Roiko, Marijo S., Brunzelle, Joseph S., **Houtz, Robert L**., and Trievel, Raymond C. (2010). SET7/9 catalytic mutants reveal the role of active site water molecules in lysine multiple methylation. **J. Biol. Chem.** 285(41): 31849-31858.

Magnani, R#., Dirk, L. M., Trievel, R. C., and **Houtz, R. L.** (2010). Calmodulin methyltransferase is an evolutionarily conserved enzyme that trimethylates Lys-115 in calmodulin. **Nat. Commun.** 1:43.

Whitney, S. M., Kane, H. J., **Houtz, R. L**., and Sharwood, R. E. (2009). Rubisco oligomers composed of linked small and large subunits assemble in tobacco plastids and have higher affinities for CO_2 and O_2. **Plant Physiol.** 149(4): 1887-1895.

Raunser, S., Magnani, R#., Huang, Z., **Houtz, R. L.**, Trievel, R. C., Penczek, P. A., and Walz, T. (2009). Rubisco in complex with Rubisco large subunit methyltransferase. **Proc. Natl. Acad. Sci. USA** 106(9): 3160-3165.

Couture, J. F., Dirk, L. M., Brunzelle, J. S., **Houtz, R. L.**, and Trievel, R. C. (2008). Structural origins for the product specificity of SET domain protein methyltransferases. **Proc. Natl. Acad. Sci. USA.** 105(52): 20659-20664.

Dinkins, R. D., Majee, S. M., Nayak, N. R., Martin, D., Xu, Q., Belcastro, M. P., **Houtz, R. L.**, Beach, C. M., and Downie, A. B. (2008). Changing transcriptional initiation sites and alternative 5'- and 3'-splice site selection of the first intron deploys Arabidopsis protein isoaspartyl methyltransferase2 variants to different subcellular compartments. **Plant J.** 55(1): 1-13.

Dirk, L. M., Schmidt, J. J., Cai, Y., Barnes, J. C., Hanger, K. M., Nayak, N. R., Williams, M. A., Grossman, R. B., **Houtz, R. L.**, and Rodgers, D. W. (2008). Insights into the substrate specificity of plant peptide deformylase, an essential enzyme with potential for the development of novel biotechnology applications in agriculture. **Biochem J.** 413(3): 417-427.

Houtz, Robert L., R. Magnani#, N. R. Nayak#, and L. M. A. Dirk. (2008). Co- and post-translational modifications in Rubisco: unanswered questions. **J. Exp. Bot**. 59(7): 1635-1645.

Magnani, R#., N. R. Nayak#, M. Mazarei, L. M. Dirk, and **R. L. Houtz**. (2007). Polypeptide substrate specificity of PsLSMT. A set domain protein methyltransferase. **J. Biol. Chem.** 282:27857-27864.

Dirk, L. M. A., E. M. Flynn*, K. Dietzel*, J.-F. Couture, R. C. Trievel, and **R. L. Houtz**. (2007). Kinetic manifestation of processivity during multiple methylations catalyzed by SET-domain protein methyltransferases. **Biochemistry** 46:3905-3915.

Hou, Cai-Xia, Dirk, Lynnette M.A., Pattanaik, Sitakanta, Das, Narayan C., Maiti, Indu B., **Houtz, Robert L.**, and Williams, Mark A. (2007). Plant Peptide Deformylase: A Novel Selectable Marker and

Herbicide Target Based on Essential Co-Translational Chloroplast Protein Processing. **Plant Biotechnology** 5:275-281 (cover article).

Shepherd, R.W., Bass, W. T., **Houtz, R.L**., and Wagner, G.J. (2005). Phylloplanins of tobacco are defensive proteins deployed on aerial surfaces by short glandular trichomes. **Plant Cell** 17: 1851-1861.

Houtz, Robert L. and Portis, Archie R. Jr. (2003) The life of ribulose-1,5-bisphosphate carboxylase/oxygenase – post-translational facts and mysteries. Minireview. **Archives Biochemistry and Biophysics**, 414:150-158, special issue on C-fixing enzymes.

Trievel, Raymond C., Flynn E.M[*]., **Houtz, Robert L.**, and Hurley, J.H. (2003). Mechanism of multiple lysine methylation by the SET domain enzyme Rubisco LSMT. **Nature Structural Biology**, 10:545-552.

Dinkins, Randy D., Conn, Heather M., Dirk, Lynnette M.A., Williams, Mark A., and **Houtz, Robert L.** (2003). The *Arabidopsis thaliana* peptide deformylase 1 protein is localized to both mitochondria and chloroplasts. **Plant Science**, 165:751-758.

Trievel, Raymond C., Beach, Bridgette M., Dirk, Lynnette, M.A., **Houtz, Robert L.** and Hurley, James H. (2002). Structure and catalytic mechanism of a SET domain protein methyltransferase. **Cell** 111:91-103 (cover article, with depiction of the active-site of pea Rubisco LSMT).

Dirk, Lynnette M.A., Mark A. Williams, and **Robert L. Houtz**. (2002). Specificity of chloroplast-localized peptide deformylases as determined with peptide analogs of chloroplast-translated proteins. **Archives of Biochemistry and Biophysics** 406:135-141.

Dirk, Lynnette, Mark A. Williams, and **Robert L. Houtz**. (2001). Eukaryotic peptide deformylases: Nuclear-encoded and chloroplast-targeted enzymes in *Arabidopsis thaliana*. **Plant Physiology** 127:97-107 (featured article).

Ying, Z.[#], Mulligan, R.M., Janney, J., Royer, M., and **Houtz, R.L.** (1999). Rubisco SSMT and LSMT: Related $^{\nabla}$N- and $^{\prime}$N-methyltransferases that methylate the large and small subunits of Rubisco. **Journal of Biological Chemistry** 274:36750-36756.

Kumar, G.N.M., **Houtz, R.L.** and Knowles, N.R. (1999). Age-induced protein modifications and increased proteolysis in potato seed-tubers. **Plant Physiol.** 119:89-99.

Keathley, C., Potter, D.A., **Houtz, R.L. (**1999). Freezing-altered palatability of Bradford pear to Japanese beetle: evidence for decompartmentalization and enzymatic degradation of feeding deterrents. **Entomologia Experimentalis et Applicata** 90:49-59.

Zheng, Q.[*], Simel, E.J.[*], Klein, P.E., Royer, M.T., and **Houtz, R.L.** (1998). Expression, purification, and characterization of recombinant ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit $^{\prime}$N-methyltransferase. **Protein Expression and Purification** 14:104-112.

Mazarei, M.[#], Ying, Z.[#], and **Houtz, R.L.** (1998). Functional analysis of the Rubisco large subunit $^{\prime}$N-methyltransferase promoter from tobacco and its regulation by light in soybean hairy roots. **Plant Cell Reports** 17:907-912.

Kester, S.T., Geneve, R.L. and **Houtz, R.L.** (1997). Priming and accelerated aging affect L-iso-aspartyl methyltransferase activity in tomato (*Lycopersicon esculentum* Mill.) seed. **J. Experimental Botany** 48:943-949.

Ying, Z.[#], Janney, N., and **Houtz, R.L.** (1996). Organization and characterization of the ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit $^{\prime}$N-methyltrans-ferase gene in tobacco. **Plant Mol. Biol.** 32(4):663-672.

Wang, P.[*], Royer, M., and **Houtz, R.L.** (1995). Affinity purification of Ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ^{0}N-methyltransferase **Protein Expression and Purification** 6:528-536.

Klein, R.R. and **Houtz, R.L.** (1995). Cloning and developmental expression of pea ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit N-methyltransferase **Plant Mol. Biol.** 27:249-261.

Houtz, R.L., L. Poneleit*, S.B. Jones*, M. Royer, J.T. Stults. (1992). Post-translational modifications in the amino-terminal region of the large subunit of ribulose-1,5-bisphosphate carboxylase/oxygenase from several plant species. **Plant Physiol.** 98:1170-1174.

Houtz, R.L., M. Royer, M.E. Salvucci. (1991). Partial purification and characterization of ribulosebisphosphate carboxylase/oxygenase large subunit N-methyltransferase. **Plant Physiol.** 97:913-920.

Houtz, R.L., R.M. Mulligan. (1991). Catalytic protection of tryptic sensitive sites in the large subunit of ribulosebisphosphate carboxylase/oxygenase. **Plant Physiol.** 96:335-339.

Knavel, D.E., **R.L. Houtz. (**1990). Characteristics of 'Main Dwarf' short-internode muskmelon genotype as compared with its normal-internode "parent" and F_1 hybrid ('Main Dwarf' x 'Mainstream'). **HortScience.** 25:1277-1279.

Houtz, R.L., J. Stults, R.M. Mulligan, N.E. Tolbert. (1989). Post-translational modifications in the large subunit of ribulose bisphosphate carboxylase/oxygenase. **Proc. Natl. Acad. Sci. USA** 86:1855-1859.

Biernbaum, J.A., **R.L. Houtz**, S.K. Ries. (1988). Field studies with crops treated with colloidally dispersed triacontanol. **J. Amer. Soc. Hort. Sci.** 113:679-684.

Mulligan, R.M., **R.L. Houtz**, N.E. Tolbert. (1988). Reaction-intermediate analogue binding by ribulose bisphosphate carboxylase/oxygenase causes specific changes in proteolytic sensitivity: The amino-terminal residue of the large subunit is acetylated proline. **Proc. Natl. Acad. Sci. USA** 85:1513-1517.

Houtz, R.L., R.O. Nable, G.M. Cheniae. (1988). Evidence for effects on the *in vivo* activity of ribulose-bisphosphate carboxylase/oxygenase during development of Mn toxicity in tobacco. **Plant Physiol.** 86:1143-1149.

Nable, R.O., **R.L. Houtz**, G.M. Cheniae. (1988). Early inhibition of photosynthesis during development of Mn toxicity in tobacco. **Plant Physiol.** 86:1136-1142.

Archbold, D.D., **R.L. Houtz**. (1988). Photosynthetic characteristics of strawberry plants treated with paclobutrazol or flurprimidol. **HortScience.** 23(1):200-202.

Sterling, T.M., **R.L. Houtz**, A.R. Putnam. (1987). Phytotoxic exudates from velvet leaf (*Abutilon theophrasti*) glandular trichomes. **Amer. J. Bot.** 74(4):543-550.

Cockfield, S.D., D.A. Potter, **R.L. Houtz**. (1987). Chlorosis and reduced photosynthetic CO_2 assimilation of *Euonymus fortunei* infested with Euonymus scale (Homoptera: Diaspididae). **Environ. Entomol.** 16:1314-1318.

Houtz, R.L., S.K. Ries, N.E. Tolbert. (1985). Effect of triacontanol on *Chlamydomonas*. Stimulation of growth and photosynthetic CO_2 assimilation. **Plant Physiol.** 79:357-364.

Houtz, R.L., S.K. Ries, N.E. Tolbert. (1985). Effect of triacontanol on *Chlamydomonas*. II. Specific activity of ribulose-bisphosphate carboxylase/oxygenase, ribulose-bisphosphate concentration, and characteristics of photorespiration. **Plant Physiol.** 79:365-370.

Houtz, R.L. and S.K. Ries. (1983). Triacontanol levels in ascending sugar maple sap. **HortScience.** 18(1):101-102.

Ries, S.K. and **R.L. Houtz**. (1983). Triacontanol as a plant growth regulator. **HortScience** 18(5):654-662.

B. Book Chapters

1. Dirk, L. M. A., R. C. Trievel, and **R. L. Houtz.** 2006. Non-Histone Protein Lysine Methyltransferases - structure and catalytic roles p. 179-229. In Fuyu Tamanoi and Steven Clarke (ed.), *The Enzymes*. Elsevier Academic Press.

C. Conference Proceedings

1. **Robert L. Houtz**, Lynnette M.A. Dirk, Mark A. Williams, and Brent W. Meier. 2000. Primary and secondary structural elements influence the susceptibility of the Rubisco small subunit to methylation by Rubisco small subunit methyltransferase. Proceedings of the 5th International Jubilee Conference on the Role of Formaldehyde in Biological Systems. Methylation and Demethylation Processes. October 9-13, 2000. Sopron, Hungary. pp. 31.
2. **Robert L. Houtz**, Brent Meier, Lynnette Dirk, and Malcolm Royer. 1999. Characterization and functional significance of $^{\forall}$N-methylmethionine formation in the small subunit of Rubisco. Proceedings of the 6th International Congress on Amino Acids. Bonn, Federal Republic of Germany. August 3-7, 1999. Amino Acids Vol. 17:84 #2.
3. Ying, Z.[#], Mulligan, R.M., Janney, N., Royer, M., and **Houtz, R.L.** 1998 Related $^{\forall}$N- and ,N-methyltransferases methylate the large and small subunits of Rubisco. Acta Biologica Hungarica 49:173-184.
4. Ying, Z.[#], Mulligan, R.M., Janney, J., Royer, M., and **Houtz, R.L.** 1998 "Chloroplast-localized protein N-methyltransferases." Proceedings of the 4th International Conference on the Role of Formaldehyde in Biological Systems. Methylation and Demethylation Processes. July 1-4, 1998, Budapest, Hungary. Acta Biologica Hungarica 49:173-184.
5. **Houtz, R.L.**, M. Royer. 1990. "N-terminal processing of the large subunit of ribulose-P_2 carboxylase/oxygenase." Proceedings of the XXIII International Horticultural Congress. Florence, Italy. Vol. 2, 4154.
6. **Houtz. R.L.**, Putnam, A.R. and T.M. Sterling. 1984. Phytotoxic exudates from trichomes on the stems and petioles of velvetleaf (*Abutilon theophrasti* Medic.) plants. Proceedings of the ACS Symposium Series, "The Chemistry of Allelopathy."
7. **Houtz, R.L.** and S.K. Ries. 1982. Effect of triacontanol on starch phosphorylase and PEP carboxylase activities. Proceedings of the XXIst International Horticulture Congress. Hamburg, Germany. Vol. II. #2087.

D. Invited Presentations and/or Participation

International

Invited Member, Editorial Board for *Journal of Biological Chemistry*, Term, July 2003-June 2008.
Invited Member, Scientific Advisory Board, 6th International Conference on the Role of Formaldehyde in Biological Systems – Methylation and Demethylation Processes, Hungary, Oct., 12-16 2003.
Invited Speaker, NIAR/COE/BRAIN-RITE International Symposium on Photosynthetic CO_2-Assimilating Enzymes: Rubisco and PEPC, Nov. 30-Dec. 2, 2000, Greenpier Miki, Hyogo, Japan
Invited Member, Scientific Advisory Board, 5th International Conference on the Role of Formaldehyde in Biological Systems – Methylation and Demethylation Processes, Sopron, Hungary, October 9-13, 2000.
Invited Speaker, 6th International Congress on Amino Acids, Bonn, Federal Republic of Germany, August 3-7, 1999.
Invited Speaker, 4th International Conference on the Role of Formaldehyde in Biological Systems: Methylation and Demethylation Processes, Hot Topics, Budapest, Hungary, July 1-4, 1998.
Invited Seminar Speaker, Department of Agricultural, Food, and Nutritional Science, University of Alberta, Edmonton, Alberta, Canada. "Functional Aspects of Lys-14 Methylation in the Large Subunit of Ribulose-1,5-Bisphosphate Carboxylase/ Oxygenase." June 19-20, 1996.
Invited Presentation, First Joint USA-Mexico Symposium on Agrobiology, Molecular Physiology and Biotechnology of Crops Important to Mexican Agriculture, Cocoyoc, Mexico; Myrna I. Lopez (presenter), Malcolm Royer, and Robert L. Houtz, "Post-Translational Methylation of Lys-14 in the Large Subunit of Ribulose-1,5-bisphosphate Carboxylase/Oxygenase." November 5-9, 1995.
Invited Seminar Speaker and External Ph.D. Examiner, Department of Plant Science, University of Alberta, Edmonton, Alberta, Canada. November, 1992.
Invited Symposium Speaker, 5th Annual Meeting for Plant Biochemistry, Saltillo, Coahuila, Mexico. Post-translational modifications in the large subunit of ribulose bisphosphate carboxylase/oxygenase. Site specific methylation of Lys-14. October 13-17, 1991.

External Reviewer, Natural Sciences and Engineering Research Council (NSERC) of Canada Competitive Grants Program. 1989-present.
Invited External Examiner, Department of Plant Science, University of Alberta, Loretta Mikitzel, Ph.D. candidate. Dissertation title: "Physiological and biochemical characteristics of aging in potato tubers." October, 1989.
Invited Seminar Speaker and Guest Lecturer, Department of Plant Science, University of Alberta. Post-Translational Modifications in the Large Subunit of Ribulosebisphosphate Carboxylase/Oxygenase. September 20, 1988.

National

Invited Member, Editorial Board for Journal of Biological Chemistry, Term, July 2003-June 2008.
Host and Organizer, Annual meeting of Regional Project, NC-1142 Regulation of Photosynthetic Processes, University of Kentucky, November 11, 2006.
Invited Seminar Speaker, South Dakota State University, Department of Plant Science, Chloroplast-Localized Co- and Post-Translational Protein Modifications, July 18,2006.
Invited Seminar Speaker, Department of Plant Biology, University of Illinois, November 3, 2005. Chloroplast-localized co- and post-translational protein modifications: Structure/Function/ Significance.
Invited Seminar Speaker, Virginia Tech, Department of Plant Pathology, Physiology and Weed Science, Mechanism and Significance of Post-Translational Modifications in the Large and Small Subunits of Ribulose Bisphosphate Carboxylase/Oxygenase. July 20, 2005.
Invited Seminar Speaker, Department of Biochemistry, Emory University, September 23, 2004. Chloroplast-localized co- and post-translational protein modifications: Structure/Function/ Significance.
Invited Speaker, FASEB Summer Research Conference, July 10-15, 2004. Biological Methylation. Saxtons River, Vermont.
Invited Panel Review Member, DOE, Div. of Energy Biosciences grant review panel, Nov. 5-7, 2003.
Invited Seminar Speaker, Institute of Biological Chemistry, Washington State Univ., Oct. 14, 2003. Chloroplast-localized co- and post-translational protein modifications: Structure/Function/ Significance.
Invited Panel Review Member, NIH reverse site visit, NIAID, Project Grant, Oldest-Old Mortality-Demographic Models and Analysis. July 29-30, 2003.
Routine Reviewer of competitive grants for USDANRI, NSF, DOE, NIH, and BARD.
Invited Seminar Speaker, Department of Horticulture, Texas A&M University, "Chloroplast-localized Co- and Post-Translational Protein Modifications: Essential Administrative Processing of Critical Information," January 2002.
Invited Seminar Speaker, Integration Photosynthesis Research Program, University of Illinois, "Post-translational Modifications of the Large and Small Subunits of Rubisco," March 2, 2000.
Invited Seminar Speaker, Department of Biochemistry, University of Nebraska, "Post-translational Modifications of the Large and Small Subunits of Rubisco," September 29, 1998.
Invited Seminar Speaker, Botany and Plant Pathology Department, Purdue University. "Post-Translational Methylation of Lys-14 in the Large Subunit of Ribulose-1,5-bisphosphate Carboxylase/Oxygenase." March 22, 1995.
Invited Seminar Speaker, Molecular and Cellular Biology Program, Ohio University, Athens, OH. "Post-Translational Modifications in the Large Subunit of Ribulose Bisphosphate Carboxylase/Oxygenase." February 21, 1994.
External Reviewer, Consortium for Plant Biotechnology Research Inc. 1994-Present.
External Reviewer, USDA/NRI, DOE, NSF Competitive Grants Programs. 1989-Present.
Invited Attendee, The N. Edward Tolbert Symposium, Michigan State University, "Photosynthetic Carbon Metabolism and Regulation of Atmospheric CO_2 and O_2." March 4-6, 1990.
Invited Attendee, Gordon Research Conference on CO_2 Fixation in Green Plants, Plymouth State College, Plymouth, NH. July 23-27, 1990.
External Reviewer, Preproposals, Program in Science & Technology Cooperation/U.S.- Cooperative Development Research Agency for International Development, National Research Council. 1990-present.
Reviewer of manuscripts submitted for publication in *HortScience, Journal of the American Society for Horticultural Science, Plant Physiology*, and *Journal of Biological Chemistry*.
Moderator, Photosynthesis Session, 1987 meetings of the American Society for Horticultural Science.
Member, Screening Committee for the 1986 American Society for Horticultural Science, Cross-Commodity Publication Award.

Invited Participant, International Conference on Crop Productivity - Research Imperatives Revisited. Boyne Highlands, Michigan. Oct. 14-18, 1985.

Regional/Local

Special Awards Judge, Intel International Science and Engineering Fair, Louisville, KY, 2002.
Invited Speaker, Fayette County Hoe'nHope Garden Club, "Biotechnology and You," February 2002.
Science Demonstration Project - 5th grade science classes (4 sessions), Strode Station Elementary School, Winchester, KY, "Electron Transport and Photosynthesis, Chemiluminescence," September 2001.
Invited Seminar Speaker, Fayette County Master Gardener Association, "Agricultural Biotechnology in the Future," January 23, 1999.
Invited Seminar Speaker, Plant Physiology/Biochemistry Molecular Biology Program, University of Kentucky. "Exploring Methylation of Lys-14 in the Large Subunit of Rubisco. April 16, 1997.
Invited Judge, Intel International Science and Engineering Fair, Botany Section, Louisville, KY. May 10-16, 1997.
Invited Judge, Central Kentucky Science Fair, Botany Section, University of Kentucky. March 30, 1996; March 22, 1997.
Invited Seminar Speaker, Monsanto, St. Louis, MO. "Functional Aspects of Lys-14 Methylation in the Large Subunit of Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase." September 23, 1996.
Invited Seminar Speaker, Monsanto, St. Louis, MO. "Post-Translational Methylation of Lys-14 in the Large Subunit of Ribulose-1,5-bisphosphate Carboxylase/Oxygenase." December 19, 1995.
Invited Seminar Speaker, 25th Educational Conference and Kentucky Association of Milk, Food and Environmental Sanitarians, Louisville, KY. "Biotechnology." February 21-23, 1995.
Reviewer, Undergraduate Research Proposals, Howard Hughes Medical Institute Undergraduate Initiative Program in Biological Sciences, University of Kentucky. 1993-1994; 1997.
Invited Member and Reviewer, Technical Advising Committee of the Tobacco and Health Research Institute, Lexington, KY. 1993-1995.
Reviewer, American Society of Testing and Materials (ASTM), Special Technical Publications. June, 1990.
Selected Participant, Technology Transfer Conference. "Structure/ Function Relationships and Post-Translational Modifications in the Large Subunit of Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase." University of Kentucky, 1988.
Seminar Speaker, College of Pharmacy, Medicinal Chemistry seminar series, University of Kentucky. "Light/Dark Regulation of Ribulose-bisphosphate Carboxylase/Oxygenase Activity in Muskmelon Leaves." January 29, 1987.
Seminar Speaker, Department of Horticulture, Michigan State University. "Light/Dark Regulation of Ribulosebisphosphate Carboxylase/Oxygenase Activity in Muskmelon Leaves." Oct. 7, 1986.

E. Presentations before Professional Societies (Abstracts)

N.R. Nayak, R. Magnani, L.M. Dirk and R.L. Houtz. 2006. Elucidation of consensus amino acid sequence and potential alternate substrates of rubisco large subunit methyltransferase. American Society for Biochemistry and Molecular Biology Meetings.
Dirk, Lynnette MA , Hanger, Katherine M., Cai, Yiying, Schmidt, Jack J., Barnes, Jonathan C. Williams, Mark A., Grossman, Robert B., Rodgers, David W., **Houtz, Robert L**., 2006. Preliminary crystal structure of plant peptide deformylase, a unique potential target for broad spectrum herbicides. American Society of Plant Biologists Meetings.
EM Flynn, LMA Dirk, RC Trievel, BM Beach, JH Hurley, RL Houtz. Analysis of a structurally unique C-terminal domain of a SET domain-containing protein methyltransferase Rubisco LSMT. American Society of Biochemistry and Molecular Biology Annual Meeting. Boston, MA. June 12-16, 2004.
EM Flynn, KL Dietzel, LMA Dirk, BM Beach, JH Hurley, RC Trievel, RL Houtz. Elucidation of the Mechanism for Successive Methyl Group Transfers by SET Domain Containing Protein Methyltransferases. 29th FEBS Congress. Warsaw, Poland. June 26-July 1, 2004.
Zhang C, Dirk LMA, Hanger KM, Miller A-F, Houtz RL. 2004. The pH dependence of the active site Co(II) and Co-supported catalytic activity of peptide deformylase-2 from *Arabidopsis*. 228th American Chemical Society (ACS) National Meeting. August 22-26, 2004 Philadelphia, PA, USA.
Hanger KM, Houtz RL, Dirk LMA. 2004. Limited tryptic proteolysis of peptide deformylase

generates a core protein that retains the majority of activity without a salt-requirement for solubility. American Society of Plant Biologists' (ASPB) Plant Biology 2004. July 24 - 28, 2004 Lake Buena Vista, FL, USA.

Cai-Xia Hou, Heather M. Conn, Lynnette M.A. Dirk, Robert L. Houtz, and Mark A. Williams. Genetically Engineered Tolerance to a Peptide Deformylase Inhibitor in Tobacco. American Society of Plant Biologists Meeting. Lake Buena Vista, Florida. July 2004.

Williams MA, Houtz RL, Dirk LMA. 2004. Peptide deformylase: Site-directed mutation directed towards engineering inhibitor resistance. American Society of Plant Biologists' (ASPB) Plant Biology 2004. July 24 - 28, 2004 Lake Buena Vista, FL, USA.

Meier, Brent W., Zamora, Brian G., and Houtz, Robert L. 2002. Alteration of the methylation status of Rubisco by RNAi-mediated gene silencing of Rubisco LSMT. American Society of Plant Biologists. Abstract #616.

Conn HM, Dinkins R, Dirk LMA, Williams MA, and Houtz RL. 2002. Subcellular localization of plant peptide deformylases. American Society of Plant Biologists' Plant Biology 2002. August 3-7, 2002. Denver, CO.

Xu Q, Dirk LMA, Lowenson J, Houtz RL, Clarke S, and Downie B. 2002. An Arabidopsis protein isoaspartyl-methyltransferase gene, which produces two proteins through differential splicing, may function in the nucleus. American Society of Plant Biologists' Plant Biology 2002. August 3-7, 2002. Denver, CO.

Houtz RL, Williams MA, and Dirk LMA. 2002. Specificity of chloroplast-localized peptide deformylases as determined with N-terminal peptide analogs of chloroplast-translated proteins. American Society of Plant Biologists' Plant Biology 2002. August 3-7, 2002. Denver, CO.

Dirk LMA, and Houtz RL. 2002. Knocking out Arabidopsis peptide deformylase 2 has drastic consequences to plant growth. American Society of Plant Biologists' Plant Biology 2002. August 3-7, 2002. Denver, CO.

Williams MA, Dirk LMA, and Houtz RL. 2002. Chloroplast-localized peptide deformylase: A new target for the development of novel broad-spectrum herbicides. 42nd Annual Meeting of the Weed Science Society of America, February 10-13, 2002. Reno, NV.

Williams MA, Dirk LMA, and Houtz RL. 2001. Characterization and inhibition of chloroplast-localized peptide deformylases from *Arabidopsis thaliana*. American Society of Horticultural Science 2001 Conference and Exhibition. July 22-25, 2001. Sacramento, CA.

Dirk LMA, Kennedy HM, Conn HM, Williams MA, and Houtz RL. 2001. Activity and inhibition of two chloroplast-localized peptide deformylases. American Society of Plant Biologists' Plant Biology 2001. July 21-25, 2001. Providence, RI.

Lynnette M.A. Dirk, Mark A. Williams, and Robert L. Houtz. 2000. Post-translational modification of Rubisco SS: Methionine oxidation determines the methylatability of the N-terminal a-amino group? Plant Physiology Supplement #619

Mark A. Williams, Lynnette M.A. Dirk, and Robert L. Houtz. 2000. Characterization of a chloroplast-localized peptide deformylase from *Arabidopsis thaliana.* Plant Physiology Supplement #621.

Brent W. Meier, Malcolm Royer, and Robert L. Houtz. 1999. Characterization of Rubisco small subunit $^{\nabla}$N-methyltransferase (Rubisco SSMT) activity in spinach chloroplast lysates. Plant Physiology Supplement #307.

Lynnette M.A. Dirk, Malcolm Royer, Brent Meier, and Robert L. Houtz. 1999. Alterations in the penultimate amino acid residue of the processed form of the Rubisco SS: Influencing methylation by Rubisco. SSMT and SS stability. Plant Physiology Supplement #304.

Durbin, L., Ray, M., Royer, M., Zheng, Q., and Houtz, R.L. 1997. Identification of the S-adenosyl-L-methionine binding site in pea Rubisco large subunit $^{'}$N-methyltransferase. Plant Physiol. 114:149(706).

Kumar, G.N.M., Knowles, N.R., and Houtz, R.L. 1997. Further studies on protein degradation in aging potato tubers. Plant Physiol. 114:152(725).

Zheng, Q., Royer, M., and Houtz, R.L. 1997. Characterization of the interaction between Rubisco and Rubisco large subunit $^{'}$N-methyltransferase. Plant Physiol. 114:211(1062).

Ying, Z., Janney, N., and Houtz, R.L. 1996. Molecular rationale for the absence of methylation at lysyl residue 14 in the large subunit of spinach rubisco. Plant Physiol. 111:93(343).

Zheng, Q. and Houtz, R.L. 1996. Investigations of the interaction between pea rubisco LSMT and spinach rubisco using bifunctional cross-linking reagents. Plant Physiol. 111:93(344).

Kumar, G.N.M., Knowles, N.R., and Houtz, R.L. 1996. Mechanisms of protein degradation in aging potato tubers. Plant Physiol. 111:103(402).

Kester, S.T., Geneve, R.L. and Houtz, R.L. 1996. Priming and accelerated aging affect L-isoaspartyl methyltransferase activity in tomato seed. HortScience 31:632(391).

Zheng, Q., Simel, E.J., Klein, P.E. and Houtz, R.L. 1995. Functional expression of pea rubisco in *Escherichia coli*. Plant Physiol. 108:72(321).
Ying, Z., Janney, N. and Houtz, R.L. 1995. Isolation and characterization of the rubisco LSMT gene in tobacco. Plant Physiol. 108:135(701).
Wang, J., Klein, R.R. and Houtz, R.L. 1995. Transformation of *Arabidopsis thaliana* with a pea rubisco LSMT cDNA. Plant Physiol. 108:151(798).
Klein, R.R. and R.L. Houtz. 1994. Cloning and expression of Rubisco large subunit methyltransferase gene from pea. Plant Physiol. 105:85(438).
Houtz, R.L. and Royer, M. 1994. Characterization of the effects of methylation of Lys-14 in the large subunit of spinach Rubisco. Plant Physiol. 105:88(456).
Houtz, R.L., Wang, P., and Royer, M. 1993. Protein amino acid sequence of ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ε-N-methyltransferase. Plant Physiol. 102:47(248).
Crafts-Brandner, S.J. and Houtz, R.L. 1993. Protein degradation in chloroplast lysates. Agron. Abstr. 110.
Houtz, R.L., P. Wang, and M. Royer. 1992. Affinity purification of ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ε-N-methyltransferase. Plant Physiol. 99:58(343).
Houtz, R.L., H. Fang, and M. Royer. 1992. Identification and specificity studies of ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ε-N-methyltransferase. Plant Physiol. 99:58(344).
Houtz, R.L., M. Royer, and M.E. Salvucci. 1991. Partial purification and characterization of ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit ε-N-methyltransferase. Plant Physiol. 96:9.
Houtz, R.L., D.D. Archbold, and M. Royer. 1990. Atmospheric CO_2 enrichment of tomato and strawberry plants under field production conditions. HortScience (in press).
Houtz, R.L., L. Poneleit, and M. Royer. 1990. N-terminal acetylation and methylation of lys-14 in the N-terminus of the large subunit of rubisco from several plant species. Plant Physiol. 93(1):64.
Knavel, D.E., R. Houtz. 1988. Yield and leaf area of short-internode muskmelon genotypes at different spacings. HortScience 23(3):136.
Houtz, R.L., R.M. Mulligan, J.T. Stults, and N.E. Tolbert. 1988. Structure/function studies of the large subunit of rubisco from spinach and muskmelon by limited tryptic proteolysis. HortScience 23(3):154.
Houtz, R.L., R.M. Mulligan, J.T. Stults, and N.E. Tolbert. 1988. Amino-terminus of the large subunit of rubisco from spinach, wheat, tobacco, and muskmelon leaves. Plant Physiol. 86(4):30.
Lakitan, B., Dean E. Knavel, Robert L. Houtz, Robert L. Geneve, Douglas D. Archbold. 1987. Water influx and calcium content as related to fruit cracking in pepper (*Capsicum annuum* L.). HortScience 22(5):1082.
Houtz, R.L., J.G. Strang. 1987. Yield of fresh-market bell peppers (*Capsicum annuum*) as influenced by cultivar and several cultural practices. HortScience 22(5):1100.
Houtz, R.L., R. Michael Mulligan. 1987. Transition-state analogue binding or catalytic conditions protect the tryptic sensitive sites on the large subunit of rubisco from proteolysis. Plant Physiol. 83(4):69.
Knavel, D.E., R.L. Houtz. 1986. Main dwarf muskmelon. HortScience 21(3):705.
Archbold, D.D., R.L. Houtz. 1986. Strawberry plant growth, photo- synthesis, and ribulose-1,5-bisphosphate carboxylase/oxygenase (rubisco) activity as affected by paclobutrazol and flurprimidol. HortScience 21(3):156.
Houtz, R.L., M. Royer. 1986. Light regulation of ribulose-1,5-bisphosphate carboxylase/oxygenase (rubisco) in muskmelon (*Cucumis melo*) leaves. HortScience 21(3):156.
Houtz, R.L., Ries, S.K. and N.E. Tolbert. 1984. Stimulation of photosynthetic CO_2 fixation by *Chlamydomonas reinhardtii* with triacontanol. HortScience 19(3):441.
Houtz, R.L., Putnam, A.R. and S.K. Ries. 1984. Allelopathic exudates from velvetleaf (*Abutilon theophrasti* Medic.) trichomes. Weed Science Society of America (Abstracts) p.58.
Houtz, R.L. and S.K. Ries. 1981. An *in vitro* system responsive to triacontanol. HortScience 16(3):441.
Ries, S., Wert, V., and R. Houtz. 1981. Rapid *in vivo* and *in vitro* effects of triacontanol. Proc. 8th Ann. Plant Growth Reg. Soc. of Amer. 137.
Ries, S., Wert, V., and R. Houtz. 1981. The rapid response of plants to triacontanol. Presented at the First Coordination Meeting of the Coordinated Research Program on Isotopic Tracer-Aided Studies of the Management, Sept. 28-Oct. 2, 1981, Vienna, Austria.
Houtz, R.L. 1981. Development and characterization of an *in vitro* system responsive to 1-triacontanol. Plant Growth Regulator Bulletin 9(3):5.

Ries, S., Wert, V., Dilley, D., Houtz, R. and R. Knowles. 1979. Rapid response of plants to triacontanol. Plant Physiol. (Supplement) 63:47.

F. Professional and Honor Societies

American Society of Horticultural Science
American Society of Plant Physiologists
American Association for the Advancement of Science
Gamma Sigma Delta
Sigma XI

G. Honors and Awards

Member of the Editorial Board for the *Journal of Biological Chemistry* 2003-2008

Thomas Poe Cooper Award for Excellence in Research, College of Agriculture, University of Kentucky, 2001.

Chairman (2006), NC1142, Regulation of Photosynthetic Processes, Multi-State Research Project

VI. RESEARCH ADVISING

A. Post-Doctoral Research Associates

Major Advisor:

Niahr Nayak, Ph.D. Development and Utilization of Rubisco LSMT as a Molecular Vehicle for Targeting Enzymes to Rubisco. From the Department of SAgronomy, University of Kentucky. June 1, 2005 – present.

Roberta Magnani, Ph.D. Mapping Polypeptide Substrate Specificity Determinants in Rubisco LSMT. From the Department of Agricultural Sciences, University of Bologna, Italy. April 21, 2005 – present

Mark A. Williams, Ph.D. Molecular Engineering of Rubisco LSMT for increased Rubisco Activity *In Vivo*. From the Department of Developmental and Cell Biology, University of California, Irvine. August, 1999-December 1, 2000.

Lynnette M. Dirk, Ph.D. Molecular and Biochemical Characteristics of the Methylation of the Small Subunit of Rubisco. From the Department of Botany, University of California, Davis. March 1, 1999- Present.

Anandita Das, Ph.D. Molecular and Biochemical Characteristics of the Methylation of the Small Subunit of Rubisco. From the Department of Botany, Bose Institute, Calcutta, India. April 1, 1998-present.

Mitra Mazarei, Ph.D., Functional Analysis of the Promoter Region for the Tobacco Rubisco LSMT Gene. From the Plant Biology Division, The Samuel Roberts Noble Foundation. January 2, 1997-January 2, 1998.

Zhentu Ying, Ph.D., Mechanism and Significance of Post-Translational Modifications in the Large Subunit (LS) of Ribulose Bisphosphate Carboxylase/Oxygenase (Rubisco). From the University of Miami Medical School, Miami, FL. 1994-1996. Currently employed by the University of Florida at the Homestead Experiment Station.

Co-Advisor:

Ross O. Nable, Ph.D., in the Department of Agronomy. Major Advisor: Dr. James E. Leggett, Adjunct Professor, Department of Agronomy. The Effects of Manganese Toxicity on Photosynthetic CO_2 Assimilation in Tobacco. May, 1985 - April, 1986.

B. Graduate

Major Advisor:

Amanda Fergusson, M.S. graduate, Plant and Soil Science Program; Project: Evaluation of high tunnels as a seasonal extending technology for vegetable production in Kentucky. Fall 2004.

Brent Meier, Ph.D. graduate, Department of Horticulture, Plant Physiology/Biochemistry/Molecular Biology Program; Project: "Molecular targeting of human carbonic anhydrase to the active-site vicinity of Rubisco LSMT." Spring 2004.

Qi Zheng, Ph.D. graduate, Department of Horticulture and Landscape Architecture, Plant Physiology/Biochemistry/Molecular Biology Program; Project: "The Mechanism of Specificity for the Interaction between Rubisco Large Subunit ε-N-Methyltransferase and Rubisco." Summer 1994; Graduated August, 1997. Currently employed by the University of Florida at the Homestead Experiment Station.

Myrna I. Lopez, M.S. graduate and recipient of Lyman T. Johnson doctoral fellowship, Department of Horticulture and Landscape Architecture, Plant & Soil Science Program; Project: "Kinetic Analysis of the Reaction Mechanism for Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase Large Subunit ε-N-Methyltransferase." Graduated July, 1997.

Jianmin Wang, Ph.D. candidate, Department of Horticulture and Landscape Architecture, Plant Physiology/Biochemistry/Molecular Biology Program; Project: "Effects of Antisense and Sense Expression of Rubisco LSMT in Transgenic Tobacco Plants on the Methylation of Lys-14 in the Large Subunit of Rubisco." Fall 1994 - Fall 1995. Elected to leave program.

Pinger Wang, M.S. graduate, Department of Horticulture and Landscape Architecture, Plant Physiology/Biochemistry/Molecular Biology Program; Project: "Characterization of an Affinity Purification Technique for Rubisco Large Subunit ε-N-methyltransferase." Graduated Spring 1993.

Hui Fang, M.S. graduate, Department of Horticulture and Landscape Architecture, Plant Physiology/Biochemistry/Molecular Biology Program; Project: "Effects of Lysine-14 methylation in the Large Subunit of Ribulose Bisphosphate Carboxylase/Oxygenase on Catalytic Activity and Stability." Graduated Spring 1993.

Committee Member:

Keith Allen, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. (in progress).

Nitima Suttipanta, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 2011.

Tom Niehaus, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 2011.

Darby Harris, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 2011.

Meshack Afitlhile, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 2000.

Timothy P. Devarenne, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1998.

Cunxi Wang, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. 1995-1998.

Shaohui Yin, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1996.

Qingshun Li, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1995.

Kyoungwhan Back, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1995.

Yan Huang, M.S. graduate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1995.

Xiangha Yan, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1995.

Rui Wang, Ph.D. candidate, Plant Physiology/Biochemistry/Molecular Biology Program. Graduated 1995.

Jeffrey W. Stringer, Ph.D. candidate, Department of Forestry. Graduated 1993.

Guoqiang Hou, Ph.D. candidate, Crop Science Program. 1992.

Robert C. MacDonald, Ph.D. candidate, Department of Forestry. Graduated 1991.

Lorianne Matthews, Ph.D. candidate, Department of Plant Pathology. Graduated 1991.

Herawati Thalib, M.S. candidate, Department of Horticulture and Landscape Architecture. Graduated 1988.

Benyamin H.T. Lakitan, M.S. candidate, Department of Horticulture and Landscape Architecture. Graduated 1987.

C. Undergraduate

Advisor: (research projects supplemented or fully funded by external competitive grant dollars)

Erin Mulligan, graduated Fall 2006, Agricultural Biotechnology major. Research project: Kinetic analyses of the reaction mechanism for SET-domain containing protein methyltransferases.

Janey Moore, Agricultural Biotechnology major. Research Project: Chloroplast-localized N-terminal protein processing by peptide deformylase.

Megan Flynn, Honors student and Agricultural Biotechnology major. Research project: Kinetic analyses of the reaction mechanism for SET-domain containing protein methyltransferases. Graduated Spring 2004.

Heather Conn, graduated Spring 2002, Agricultural Biotechnology major. Research project: Molecular and biochemical characterization of chloroplast-localized peptide deformylase. Recipient of a travel grant from the American Society of Plant Biology to attend the 2002 meetings. Current Position: Senior Research Analyst, Department of Horticulture, Supervisor – Dr. Mark Williams.

Brian Zamora, graduated *summa cum laude* Spring 2002, Honors student and Agricultural Biotechnology major. Research project: Molecular engineering of resistance to peptide deformylase inhibitors in *Arabidopsis thaliana*. University of Kentucky Undergraduate Research and Creativity Grant, $502., Spring 2002. Current Position: M.D./Ph.D. program at West Virginia University.

Augustine Torres, undergraduate in Agricultural Biotechnology. Senior Research Project. Summer 1998.

Laura Durbin, undergraduate in Agricultural Biotechnology. Senior Research Project. University of Kentucky Honors Program Student. Recipient: Howard Hughes Medical Institute Undergraduate Initiative Grant for Research, funded Jan 30, 1996, $850. Fall 1995-Spring 1997.

Myrna I. Lopez, recipient of United Stated Department of Education Summer Fellowship to Encourage Minority Participation in Graduate Education. Summer 1994.

Undergraduate French Interns (3), Undergraduate Fellowship Program through Agricultural International Programs, University of Kentucky:
-Maryse Cattaneo, Summer 1993
-Celine Hanot, Summer 1994
-Guilleume Portejoie, Summer 1996

Loelle Poneleit, undergraduate in the Department of Horticulture and Landscape Architecture. Independent Research Project. 1989-1990.

Samantha B. Jones, recipient of United States Department of Education Summer Fellowship to Encourage Minority Participation in Graduate Education. Summer 1989.

Co-Advisor:

Mark Williams, undergraduate in the Department of Biology, independent research project with Dr. William Cohen. 1989-1990.

Academic Advisor:

Advise all Agriculture Biotechnology students fulfilling ABT 395 requirement.
1999-present Advised avg. 20 Agriculture Biotechnology students each semester.
1993-1999 Advised 5-10 Agriculture Biotechnology students each semester

D. Other

External Examiner - Eun Jeong Lim, Department of Biochemistry, September 2006

Research Mentor - Ms. E. Megan Flynn, recipient of a Beckman Scholarship, 2003.

Research Mentor - Melanie A. Stamper, Chemistry Instructor, Jessamine County High School. Recipient: Howard Hughes Medical Institute Summer Internship for Selected High School Instructors in Chemistry and Biological Science. Summer 1997.

Research Mentor - Melanie A. Stamper, Chemistry Instructor, Jessamine County High School. Recipient: Howard Hughes Medical Institute Summer Internship for Selected High School Instructors in Chemistry and Biological Science. Summer 1996.

High School Student Advisor: John Hafner, recipient of the 1995 Golden Scholarship ($7,000) award from the Multiple Sclerosis Association of America. I provided the guidance and laboratory for scientific research experience for John since 1990. John's accomplishments were featured in both the *Lexington Herald-Leader* and *Paris Sun* newspapers, where his internship at the University of Kentucky was featured as notable scholastic achievement.

Contact and placement person for Lafayette High School Experience Based Career Education Program. Coordinator: Lynn Akers. 1995-present.

University coordinator and contact individual for the implementation of the site-licensed Research Information System (RIS) Reference Update (RU) reference retrieval system. Implementation of the site-licensed software resulted in a minimum savings of $6000 to those research personnel at the University of Kentucky with active subscriptions to the RIS-RU database.

VII. RESIDENT INSTRUCTION (Teaching Portfolio available on request)

BCH/PPA/PLS 609, 3 credit hours, Plant Biochemistry (formerly BCH/PPA/PLS 503 with additional information). An in-depth examination of the biochemical mechanisms and enzymology associated with photosynthesis. 12 hours lecture. Spring 2003.

ABT 395, 1-4 credit hours, Independent Study in Biotechnology. Independent study under the supervision of a faculty member. Coordinator, Fall/Spring/Summer 1999-present.

ABT 399, 1-6 credit hours, Experiential Learning in Biotechnology. An internship in biotechnology under the supervision of a faculty member. Fall/Spring/Summer 2001-present.

ABT 201, 1 credit hour, Scientific Method and Logic in Agricultural Biotechnology. A required course for Agriculture Biotechnology majors designed to acquaint students with common experimental methods used in biotechnology, the interpretation of scientific data, and its effective communication via written and oral reports. 8 hours lecture. Fall 1994-present.

BIO/PLS/HOR/AGR/FOR 623, 3 credit hours, Physiology of Plants II. Detailed examination of the biochemical pathways involved in chaperonin-mediated protein folding and targeted protein degradation. 7 hours lecture. 1997-present.

BCH/PPA/PLS 503, 3 credit hours, Plant Biochemistry. An in-depth examination of the biochemical mechanisms and enzymology associated with photosynthesis. 12 hours lecture. 1986-2002.

HOR 375/410, 3 credit hours, Growth and Development of Horticultural Crops. A biochemical and physiological examination of the relationships between photosynthetic carbon assimilation, electron transport, water relations, and temperature stress tolerance as determinants in horticultural crop productivity. 11 hours lecture. Fall 1987-Spring 1995.

AGR 630, 3 credit hours, Experimental Techniques in Plant Physiology/Biochemistry. Principles of radioactivity and application of radioactive isotopes in biological research. 16 hours lecture and laboratory. Summer 1986, 1988, 1990.

BIO 106, 3 credit hours, Plant Biology. Thermodynamics, respiration, and photosynthesis. 15 hours lecture. Fall 1992.

HOR 601, 2 credit hours, Physiological Mechanisms in Horticultural Plants. Survey course of research in horticulture. 3 hours lecture. Fall 1994.

BIO 773, 1 credit hour, Plant Physiology/Biochemistry Seminar Series. Fall 1986 - Spring 1987.

Teaching Assistant, Michigan State University, Department of Horticulture, Horticulture 801, Research Procedures in Plant Science, Winter 1978, 1979.

Teaching Assistant, Michigan State University, Department of Horticulture, Horticulture 457, Cool Season Vegetable Crops, Fall 1979.

VIII. COMMITTEE ASSIGNMENTS

A. Departmental

Chair, Safety Committee, 1999-present
Internal Review Committee, 1993-present
Graduate Studies Committee, 1990-present
Project Review Committee, 1989-present
Chair, Search and Screening Committee, Molecular Biology Position, 1995-1998
Advisory Committee to Chair, 1994-1995
Chair, Research Committee, 1991-1995
Search and Screening Committee for Department Chair, 1989-1990
Chair, Search and Screening Committee for Molecular Biology Position, 1991-1992
Search and Screening Committee for Stress Physiology Position, 1991-1992

Co-Director, Seminar Series, Dept of Horticulture & Landscape Architecture, 1992

B. Interdepartmental Organizations

Executive Committee, Plant Physiology/Biochemistry/Molecular Biology Program, 1992-present
Member, Plant Physiology/Biochemistry/Molecular Biology Program - 1985-present
Search & Screening Committee, Biochemistry Position, Department of Agronomy, 1997-1999
Co-Chair, Plant Physiology/Biochemistry/Molecular Biology Program Seminar Committee, Fall 1986, Spring 1987

C. College

Chair, Regional Project, NC-1142 Regulation of Photosynthetic Processes, 2006
Review Committee, KTRDC, 2006
Member, Advisory Committee for Beckman Undergraduate Research Scholars Program
Chair, Advisory Committee for Appointment, Promotion and Tenure, 2004-2005
Appointed by the Dean to the College Strategic Planning Committee, 2003.
Advisory Committee for Appointment, Promotion and Tenure, 2002-2005
Member, Search Committee, Molecular Genetics position in Agronomy, 2002
Academic Scholarship Review Committee, Fall 2002
Chair, Agricultural Biotechnology Coordinating Committee, 1999-present
Member, Agricultural Biotechnology Coordinating Committee, 1990-present
Agriculture Plant Sciences Committee, 1997-1998
Agriculture Faculty Council (elected position), 1995-1997
Faculty Appeals Committee, 1993, 1997
Agricultural Biotechnology Coordinating Committee, 1990-present
College of Agriculture Library System Committee, 1991-1994
Agricultural Experiment Station Project Committee, 1994-1997
Gamma Sigma Delta, Outstanding Graduate Student Award Committee, Chair, 1996-1997
Gamma Sigma Delta, Outstanding Graduate Student Award Committee, 1995-1996

D. University

Program Review Panel, UK Intellectual Property, 2006
Fellowship Review Panel, UK Woman's Club Fellowship, 2006
Fellowship Review Panel, Presidential Fellowships, 2006
Elected Member, University Senate
Review Panel, Council of Southern Graduate Schools' Thesis Competition, December, 2005
Major Research Equipment Review Committee, 2002
Presidential Task Force on Computer Security and Resource Allocation Committee, 2002
Beckman Undergraduate Scholars Program Advisory Committee, 2001-present
Chair, Plant Science Technical Advisory Committee, Tobacco and Health Research Institute, 1998, 1999
Member, Research Committee Grants Review Panel, 1999
Howard Hughes Medical Institute, Undergraduate Research Committee, 1992-1994; 1997
Chair, University Faculty Senate Research Committee, 1996-1997
Technical Advisory Committee, Tobacco and Health Research Institute, 1993-1995
Research Committee Grants Review Panel, 1992

IX. PUBLIC SERVICE

Invited Speaker, Fayette County Master Gardener Association, "Genetically Modified Crops and You." February 24, 2001.
Science Demonstration Project - 5th Grade science classes (4 sessions), Strode Station Elementary School, Winchester, KY. "Electron Transport and Photosynthesis, Chemiluminescence." September 2000.

Invited Speaker, Fayette County Master Gardener Association. “The Future of Biotechnology.” January 23, 2000.

Invited Speaker, Extension Agents Training, Horticultural Concepts. “Transgenic Plants.” March 23, 1999.

"Biotechnology in Horticulture," presented at the 1988 133rd annual meeting of the Kentucky State Horticultural Society.

"Global atmospheric CO_2, problem or benefit?," presented to the Daughters of the American Revolution, Lexington Chapter, October 14, 1988.

Effects of Trickle Irrigation on Bell Pepper Yields, 1987. Investigators: Robert L. Houtz and John G. Strang. "Trickle Irrigation Installation for Horticultural Crops," presented a short course at the University of Kentucky research farm (South Farm) on March 24, 1987.

Evaluation of Foliar Nitrogen and Cytokinin on Bell Peppers. Investigators: Robert L. Houtz and John G. Strang. Presented at the 132nd Annual Meeting of the Kentucky State Horticultural Society, 1987.

Two Year's Results on the Effects of Trickle Irrigation, Black Plastic Mulch, Raised Beds, and Plant Density on Two Varieties of Bell Peppers. Investigators: Robert L. Houtz and John G. Strang. Presented at the 131st Annual Meeting of the Kentucky State Horticultural Society, 1986.

Reduced Tillage Sweetcorn. Investigators: Dean E. Knavel and Robert Houtz. Horticulture Field Day, South Farm, Lexington, 1985

Strang, J. G., R. L. Houtz. Effects of trickle irrigation, black plastic mulch, raised beds, and plant density on two varieties of bell peppers. 130th annual winter meeting of the Kentucky Horticultural Society, December 9-10, 1985.

CURRICULUM VITAE

Bruce A. Webb

EDUCATION AND PROFESSIONAL APPOINTMENTS

1995, 1997, 2001	Assistant Associate and Full Professor, Dept. of Entomology University of Kentucky, Lexington, KY
2005 -	Director Agricultural Biotechnology Program University of Kentucky, Lexington KY
1991-1994	Assistant Professor, Department of Entomology Rutgers University, New Brunswick, NJ
1988-1990	Postdoctoral research with Dr. Max Summers Texas A&M University, College Station, TX
1983-1988	Ph.D. Zoology, University of Washington, Seattle WA
1981-1983	M.S. Entomology, University of Kentucky, Lexington, KY
1978-1981	B.A. Biology, University of Virginia, Charlottesville, VA

AWARDS AND APPOINTMENTS

University of Kentucky, College of Agriculture, Comm. Exec. 2010-.
University of Kentucky Intellectual Property Committee, 2009-
University of Kentucky Intellectual Property Committee, Chair 2011-
University of Kentucky, Provost's Dist. Professor, 2011.
University of Kentucky, Distinguished Research Professor, 2003
Co-Founder and President, ParaTechs Corp., Lexington, KY, 2004-.
Panel Manager, USDA:NRI, Insects suborganismal panel 2002
Thomas Poe Cooper Distinguished Research Award, University of Kentucky, College of Agriculture, 2000
Editorial Board, Journal of General Virology, 1997-2001
National Institutes of Health FIRST Award, 1992-1996
National Institutes of Health Postdoctoral Fellowship, 1988-1990
National Institutes of Health competitive training grant, 1985-1988
Research and teaching assistantship, University of Washington, 1983-1985
Jeffrey Fellowship, University of Kentucky 1983 (declined)
Research assistantship, University of Kentucky, 1981-1983

PROFESSIONAL SOCIETIES

Gamma Sigma Delta, 1983- , Sigma Xi, 1983-, American Association for the Advancement of Science, 1985- , Entomological Society of America, 1982- , American Society for Virology 1988-present, Society for Inv.Path.(2000-).

PUBLICATIONS : over 75 research publications

GRANT AND CONTRACT SUPPORT. ~6M in competitive research grant support from USDA, NSF and NIH.

PANEL MEMBER SERVICE; USDA:ARS NP-304 Programmatic Review and NRI, NSF:MCB Eukaryotic Genomics, EPA:STAR, NIH:NIAID SBIR

CURRICULUM VITAE

NAME Subba Reddy Palli
ADDRESS Department of Entomology
University of Kentucky
Lexington, KY 40546
rpalli@uky.edu

EDUCATION

Ph.D 1984-87, University of Western Ontario
London, Ontario, Canada with Dr. M. Locke

POSTDOCTORAL RESEARCH EXPERIENCE 1988-1992
University of Washington
Seattle, WA 98195 U.S.A with Dr. L.M. Riddiford

WORK EXPERIENCE

RESEARCH SCIENTIST 1992-1998: Great Lakes Forestry Centre
Canadian Forest Service
1219 Queens Street East
Sault Ste. Marie, Ontario, Canada

SENIOR RESEARCH SCIENTIST 1998-2002: RheoGene LLC
Rohm and Haas Company
727 Norris Town Road
Spring House, PA 19477

ASSISTANT PROFESSOR 2002-2005: Department of Entomology
University of Kentucky
Lexington, KY 40546

ASSOCIATE PROFESSOR: 2005-2008: Department of Entomology
and Graduate Center for Toxicology
University of Kentucky
Lexington, KY 40546

PROFESSOR: 2008: Department of Entomology
and Graduate Center for Toxicology
University of Kentucky
Lexington, KY 40546

Co-Director 2013- NSF I/UCRC on Center for Arthropod pest management

HONORS AND AWARDS

1997: Recipient of Research Award for Foreign Specialists administered by National Institute of

Sericulture and Entomological Science, Tsukuba, Japan.
2008: Thomas Cooper Research award, University of Kentucky.
2009: Bobby Pass Excellence in Grantsmanship Award, University of Kentucky.
2010: University Research Professor, University of Kentucky.
2011: High Impact Research/Extension Award, University of Kentucky.
2012: President, Physiology, Biochemistry and Toxicology section of Entomological Society of America.
2013: President, Bluegrass Indo-American Cultural Society.
2013: ESA recognition award in Insect Physiology, Biochemistry and Toxicology.
2013: Prestigious Research Paper Award, University of Kentucky.

JOURNAL PUBLICATIONS:

125. Shukla, J.N., Palli, S.R. (2013) *Tribolium castaneum* transformer-2 regulates sex determination and development in both males and females. Insect Biochem. Mol. Biol. 42, 1125-1132.
124. Xu J, Sheng Z, Palli S.R. (2013) Juvenile hormone and insulin regulate trehalose homeostasis in the red flour beetle, *Tribolium castaneum*. PLoS Genet. 9, e1003535.
123 Parthasarathy R., Farkas, R. and Palli, S.R. (2012) Recent Progress in Juvenile hormone analogs (JHA) research. Adv. Insect Physiol. 43, 353-436.
122. Zhu F, Moural TW, Shah K, Palli SR (2013) Integrated analysis of cytochrome P450 gene superfamily in the red flour beetle, *Tribolium castaneum.* BMC Genomics. 14,174-182.
121. Zhu F, Gujar H, Gordon JR, Haynes KF, Potter MF, Palli SR (2013) Bed bugs evolved unique adaptive strategy to resist pyrethroid insecticides. Sci Rep. 3,1456.
120 Jindra, M., Palli, S.R., and Riddiford, L.M. (2013). The Juvenile Hormone Signaling Pathway in Insect Development. Ann. Rev. Entomol 58,181-204.
119. Xu, J., Baulding, J. & Palli, S. R. (2013) Proteomics of *Tribolium castaneum* seminal fluid proteins: Identification of an angiotensin-converting enzyme as a key player in regulation of reproduction, *Journal of proteomics.* 78C, 83-93.
118. Shukla, J.N. and Palli, S.R. Shukla JN, Palli SR (2012) Doublesex target genes in the red flour beetle, *Tribolium castaneum*. Sci Rep 2, 948.
117. Shukla, J.N., and Palli, S.R. (2012). Sex determination in beetles: Production of all male progeny by Parental RNAi knockdown of transformer. Sci Rep *2*, 602.
116. Deng H, Zhang J, Li Y, Zheng S, Liu L, Huang L, Xu WH, Palli, S.R, Feng Q.

(2012) Homeodomain pou and ABD-a proteins regulate the transcription of pupal genes during metamorphosis of the silkworm, *Bombyx mori*. Proc Natl Acad Sci *U S A*. 109, 12598-603.

115. Palli S.R. (2012) RNAi methods for management of insects and their pathogens. CAB reviews. 7,1-10.
114. Xu J, Raman C, Zhu F, Tan A, Palli SR. (2012) Identification of nuclear receptors involved in regulation of male reproduction in the red flour beetle, *Tribolium castaneum*. J Insect Physiol. 58, 710-717.
113 . Zhu F, Sams S, Moural T, Haynes KF, Potter MF, Palli SR. (2012) RNA interference of NADPH-cytochrome P450 reductase results in reduced insecticide resistance in the bed bug, *Cimex lectularius*. *PLoS One* 7, e31037.
112. Dinkins R, Tavva V, Palli SR, Collins G (2012) Mutant and overexpression analysis of a C2H2 single zinc finger gene of Arabidopsis. Plant Molecular Biology Reporter 30,99-110.
111. Sheng, Z., Xu, J., Bai, H., Zhu, F., Palli, S.R. (2011) Juvenile Hormone Regulates Vitellogenin Gene Expression through Insulin-like Peptide Signaling Pathway in the Red Flour Beetle, Tribolium castaneum. J Biol Chem 286, 41924-41936.
110. Bai H, Zhu F, Shah K, Palli S.R. (2011) Large-scale RNAi screen of G protein-coupled receptors involved in larval growth, molting and metamorphosis in the red flour beetle. BMC Genomics.12,388.
109. Parthasarathy, R. & Palli, S. R. (2011) Molecular analysis of nutritional and hormonal regulation of female reproduction in the red flour beetle, *Tribolium castaneum*, Insect Biochem Mol Biol. 41, 294-305.
108. Zhang, Z., Xu, J., Sheng, Z., Sui, Y. & Palli, S. R. (2011) Steroid receptor co-activator is required for juvenile hormone signal transduction through a bHLH-PAS transcription factor, methoprene tolerant, J Biol Chem. 286, 8437-47.
107. Zhu, F., Xu, J., Palli, R., Ferguson, J. & Palli, S. R. (2011) Ingested RNA interference for managing the populations of the Colorado potato beetle, *Leptinotarsa decemlineata*, Pest Manag Sci. 67, 175-82.107.
106. Singh AK, Tavva VS, Collins GB, and Palli SR. (2010) Improvement of ecdysone receptor gene switch for applications in plants: *Locusta migratoria* retinoid X receptor (LmRXR) mutagenesis and optimization of translation start site. FEBS J 277,4640-4650.
105. Xu J, Tan A, Palli S.R. (2010) The function of nuclear receptors in regulation of female reproduction and embryogenesis in the red flour beetle, *Tribolium castaneum*. J Insect Physiol. 56,1471-80.
104. Bai H, Palli S.R. (2010) Functional characterization of bursicon receptor and genome-wide analysis for identification of genes affected by bursicon receptor RNAi. Dev Biol. 344,248-258.
103. Parthasarathy R, Sheng Z, Sun Z, Palli S.R (2010) Ecdysteroid regulation of ovarian growth and oocyte maturation in the red flour beetle, *Tribolium castaneum* Insect Biochem. Mol. Biol. 40,429-439.
102. Bai, H., Gelman, D.B. and Palli, S.R. (2010) Mode of action of methoprene in affecting female reproduction in the African malaria mosquito, *Anopheles gambiae*. Pest management science 66,936-943.
101. Zhu, F., Parthasarathy,R., Bai, H., Woithe, K., Kaussmann,M., Nauen,R.,

Harrison,D.A. and Palli, S.R. (2010) A brain-specific cytochrome P450 responsible for the majority of deltamethrin resistance in the QTC279 strain of *Tribolium castaneum*. Proc Natl Acad Sci U S A 107,8557-62.

100. Parthasarathy, R., Sun, Z., Bai, H., Palli, S.R., (2010). Juvenile hormone regulation of vitellogenin synthesis in the red flour beetle, *Tribolium castaneum*. Insect Biochem. Mol. Biol. 40,405-14.
99. Zhu F, Wigginton J, Romero A, Moore A, Ferguson K, Palli R, Potter MF, Haynes KF, Palli SR (2010) Widespread distribution of knockdown resistance mutations in the bed bug, Cimex lectularius (Hemiptera: Cimicidae), populations in the United States. Arch Insect Biochem Physiol. 73, 245-257.
98. Tzertzinis G, Egaña AL, Palli SR, Robinson-Rechavi M, Gissendanner CR, Liu C, Unnasch TR, Maina CV (2010) Molecular evidence for a functional ecdysone signaling system in *Brugia malayi*. PLoS Negl Trop Dis. e625.
97. Bitra K, Palli S.R (2010) The members of bHLH transcription factor superfamily are required for female reproduction in the red flour beetle, *Tribolium castaneum*.J Insect Physiol. 56,1481-1489.
96. Zhang, Z and Palli, S.R. (2009) Identification of a cis-regulatory element required for 20-hydroxyecdysone enhancement of antimicrobial peptide gene expression in *Drosophila melanogaster*. J. Molec. Entomol. 18, 595-605
95. Bitra K, Tan A, Dowling A, Palli SR. (2009)Functional characterization of PAS and HES family bHLH transcription factors during the metamorphosis of the red flour beetle, *Tribolium castaneum*. Gene. 448,74-87
94. Parthasarathy, R., Tan A., Sun, Z., Chen, J., Rainkin, M. and Palli, S.R. (2009) Juvenile hormone regulation of male accessory gland activity in the red flour beetle, *Tribolium castaneum* Mech. Dev. 126, 563-579
93. Parthasarathy, R. and Palli, S.R. (2009) Molecular analysis of juvenile hormone analog action in controlling the metamorphosis of the red flour beetle, *Tribolium castaneum*. Arch Insect Biochem Physiol 70, 57-70.
92. Bitra K. and Palli S.R. (2009) Interaction of Proteins Involved in Ecdysone and Juvenile Hormone Signal Transduction. Arch Insect Biochem Physiol 69,1–13.
91. Lapenna S., Friz J., Barlow A., Palli S.R., Dinan L. and Hormann R.E. (2008) Ecdysteroid ligand–receptor selectivity – exploring trends to design orthogonal gene switches. . FEBS J 275,5785-5809
90. Flatt T., Heyland A., Rus F., Porpiglia E., Sherlock C., Yamamoto R., Garbuzov A., Palli S.R., Tatar M. and Silverman N (2008) Hormonal Regulation of the humoral innate immune response in *Drosophila melanogaster*. J. Exp. Boil. 211, 2712-2724.
89. Tan A. and Palli S.R. (2008) Edysone receptor isoforms play distinct roles in controlling molting and metamorphosis in the red flour beetle, *Tribolium castaneum* Mol Cell Endocrinol 291, 42-49.
88. Tavva V.S, Palli S.R, Dinkins R.D, Collins G.B. (2008) Improvement of a monopartite ecdysone receptor gene switch and demonstration of its utility in regulation of transgene expression in plants. FEBS J. 275, 2161-76.
87. Parthasarathy R, Tan A, Palli SR. (2008) bHLH-PAS family transcription factor methoprene-tolerant plays a key role in JH action in preventing the premature development of adult structures during larval-pupal metamorphosis. Mech Dev.

125, 601-616.
86. Parthasarathy, R. and Palli, S. R. (2008) Proliferation and differentiation of intestinal stem cells during metamorphosis of the red flour beetle, *Tribolium castaneum* Dev.Dyn. 237, 893-908.
85. Parthasarathy, R., Tan, A., Bai, H. and Palli, S. R. (2008) Transcription factor broad suppresses precocious development of adult structures during larval-pupal metamorphosis in the red flour beetle, *Tribolium castaneum*. Mech. Dev. 125, 299-313.
84. Tan A. and Palli S.R. (2008) Identification and characterization of nuclear receptors from the red flour beetle, *Tribolium castaneum*. Insect Biochem. Mol. Biol. 38, 430-439.
83. Li Y., Z. Zhang, Robinson G.E. and Palli S.R. (2007) Identification and characterization of a juvenile hormone response element and its binding proteins. J. Biol. Chem. 282, 37605-37617.
82. Panguluri S.K., Li B., Hormann R.E. and Palli S.R. (2007) Effect of ecdysone receptor gene switch ligands on endogenous gene expression in 293 cells. The FEBS J.. 274, 5669-5689.
81. Dhadialla T.S., Dat L., Palli S.R., Raikhel, A and Carlson G.R. (2007) Characterization of a non-steroidal ecdysone agonist photoaffinity compound, RH-131039. Insect Biochem. Mol. Biol. 37:865-875.
80. Bai H., Parthasarathy R. and Palli S. R. (2007) Identification and characterization of juvenilehormone esterase gene from the yellow fever mosquito, *Aedes aegypti.* Insect Biochem. Mol. Biol. 37,829-837.
79. Tavva V.S., Dinkins R.D, Palli S.R. and Collins G.B. (2007) Development of a tightly regulated and highly inducible ecdysone receptor gene switch for plants through the use of retinoid X receptor chimeras. Transgenic Research 16, 599-612.
78. Doucet D., Frisco C. , Cusson M., Bauce E, Palli S.R., Tomkins W, Arif B., Retnakaran A. (2007) Diapause disruption with tebufenozide for early-instar control of the spruce budworm, *Choristoneura fumiferana*. Pest Manag. Sci. 63, 730-736.
77. Tavva V.S., Palli S.R., Dinkins R.D and Collins G.B. (2007) Applications of EcR gene switch technology in functional genomics. Archiv. Insect Physiol. Biochem. 65, 164-169.
76. Parthasarathy, R. and Palli, S.R. (2007) Stage- and cell-specific expression of ecdysone receptors and ecdysone-induced transcription factors during midgut remodeling in the yellow fever mosquito, *Aedes aegypti*. J. Insect Physiol.. 53, 216-229.
75. Parthasarathy, R. and Palli, S.R. (2007) Developmental and hormonal regulation of midgut remodeling in a lepidopteran insect, *Heliothis virescens.* MecH. Dev. 124, 23-34.
74. Ponguluri, S.K., Kumar, P and Palli, S.R. (2006) Functional characterization of ecdysone receptor gene switches in mammalian cells. FEBS J. 273, 5550-5563.
73. Wu, Y., Parthasarathy R., Bai, H. and Palli,S.R. (2006) Mechanisms of midgut remodeling: juvenile hormone analog methoprene blocks midgut metamorphosis by modulating ecdysone action. Mechanisms of Development 123, 530-547.

72. Margam, V. M., Gelman, D. B., Palli, S. R. (2006) Ecdysteroid titers and developmental expression of ecdysteroid-regulated genes during metamorphosis of the yellow fever mosquito, *Aedes aegypti* (Diptera: Culicidae). J Insect Physiol 52**,** 558-568.
71. Yang D.H., Makhmoudova A., Arif B.M., Feng Q., Retnakaran A., Palli, S.R., Kamalova D and Krell P.J. (2006) Protein versus DNA immunisation for production of monoclonal antibodies against *Choristoneura fumiferana* ecdysone receptor (CfEcR). Vaccine 24**,** 3115-26
70. Kethidi D.R., Li Y. and Palli S.R. (2006) Protein kinase C Mediated Phosphorylation Blocks Juvenile Hormone Action. Mol.Cell.Endocrinol*.* 247**,** 127-34.
69. Tavva V.S., Dinkins R.D, Palli S.R. and Collins G.B. (2006) Development of a highly sensitive ecdysone receptor gene switch for applications in plants. The plant J. 45:457-469.
68. Palli, S.R., Kapitskaya, M.Z and Potter D.W. (2005) The influence of heterodimer partner ultraspiracle/retinoid X receptor on the function of ecdysone receptor. FEBS J. 272:5979-5990.
67. Perera, S. C., Zheng, S., Feng, Q. L., Krell, P. J., Retnakaran, A. & Palli, S. R. (2005) Heterodimerization of ecdysone receptor and ultraspiracle on symmetric and asymmetric response elements, Arch Insect Biochem. Physiol. 60,55-70.
66. Dai, X., Willis, L. G., Palli, S. R. and Theilmann, D. A. (2005) Tight transcriptional regulation of foreign genes in insect cells using an ecdysone receptor-based inducible system, Protein Expr Purif. 42,236-245.
65. Palli, S.R., Hormann, R.E., Schlattner U. and Lezzi, M. (2005) Ecdysteroid receptors and their applications in agriculture and medicine. Vitamins and Hormones 73, 59-99
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Ishaaya, I, Palli, S.R and Horowitz, A.R. (2012) Advanced technologies for managing insect pests. Springer

PATENTS ISSUED

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2. Weinstein B., Keller L. H. and **Palli S. R**. Methods for identifying products employing gene expression. US Patent # 6,576,422 B1 issued in June 2003.
3. **Palli, S. R**; Kapitskaya, Marianna Zinovjevna; Cress, Dean Ervin Ecdysone receptor-based inducible gene expression system. US Patent # 7,091,038 issued August 2006.
4. **Palli, S**.R. and Sigh, A (2012) Expression Modulation System For Use In Plants And Method For Modulating Gene Expression In Plants. US. Patent No. 8,115,059, issued February 2012.

PATENT APPLICATIONS PUBLISHED

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GRANTS AWARDED:

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2. 20-hdryoxyecdysone suppression of juvenile hormone action: To study the cross-talk between 20E and JH. PI: S.R. Palli, Agency:NSF, Award:$482,296 for four years (08/01/2004 to 07/31/2008).
3. Characterization of EcR-based gene switches: To understand the functioning of ecdysone receptor-based gene switches. PI: S.R. Palli, Agency; RheoGene Inc., Award: $196,000 for two years (09/01/2004 to 08/30/2008).
4. Molecular analysis of juvenile hormone action in *Heliothis virescens*: To identify and characterize critical genes involved in JH action in Heliothis virescens. Agency: USDA-NRI, Award:$260,033 for three years (12/1/2004-11/30/2007).
5. HATCH: Molecular Analysis of Pest Development and Resistance to Insecticides.
6. Micro array analysis of JH-response: To conduct pilot studies on JH-response in Drosophila L57 cells. PI: S.R. Palli, Agency:UK micro array core facility, Award: $5,000.
7. Development of ligand inducible gene switches for simultaneous and independent regulation of expression of two genes in transgenic tobacco plants. PI: S.R.Palli, Co-PIs: Drs. Collins and Dinkins of Agronomy department. Agency: KTRDC, Award: $119,643 for two years (01/01/2003 to 06/30/2005).
8. Identification of juvenile hormone receptors: Research award from UK VP research, $15,000. (11/01/03-10/30/04).
9. Molecular analysis of juvenile hormone action. . To identify molecules involved in juvenile hormone action. PI: S.R.Palli, Agency: National Institute of Health Award: $1,020,000 for five years (2/1/2005-1/31/2010).
10. Development of tightly regulated gene switches for trait improvement, pest resistance and functional genomics applications in tobacco plants. To develop and test tight gene switches for use in agriculture. PI: S.R.Palli, Co-PI: Dr. Collins of Agronomy department. Agency: Kentucky Tobacco Research and Development Center. Award: $ 116,382 for two years (07/01/2005 to 06/30/2007).
11. Evaluation methoxyfenozide as geneswitch legend. To evaluate formulations for methoxyfenozide for use as gene switch ligands. PI: S.R.Palli, Co-PI: Dr. Collins of Agronomy department. Agency: Dow AgroSciences Award: $32,000 (01/01/2005 to 5/31/2005).
12. Novel active insecticidal compounds from Kentucky native plants. To screen natural products against insect pests. PI: S.R.Palli, Agency: Neprogenix Inc. Award: $ 51,000 (01/01/2006 to 12/31/2006).
13. Development of tightly regulated ecdysone receptor-based gene switches. To develop two-hybrid gene switch so that background activity in the absence of ligand and ligand sensitivity are improved. PI: S.R.Palli, Co-PI: Dr. Collins of Agronomy department. Agency: Consortium for Plant Biotechnology Research, Award: $162,000 for two years (01/01/2006 to 12/31/2007).
14. Development of tightly regulated ecdysone receptor-based gene switches. This Dow AgroSciences match for CPBR project. PI: S.R.Palli, Co-PI: Dr. Collins of Agronomy department. Agency: Dow AgroSciences Inc. Award: $50,000 for two years (01/01/2006 to 12/31/2007).
15. 20-hdryoxyecdysone suppression of juvenile hormone action: NSF supplement to attract high school students into science. . PI: S.R. Palli, Agency: NSF,

Award:$6,000 (07/01/2006-06/30/2008).

16. Functional genomics on nuclear receptors: Target sites for insecticide development and resistance management. To characterize nuclear receptors and develop screening assays for identifying new insecticides as well as for fighting insecticide resistance development. PI: S.R.Palli. Agency: USDA-NRI. Award: $ 567,944 for four years (01/01/08 to 12/31/11).
17. Molecular analysis of juvenile hormone action. . To identify molecules involved in juvenile hormone action. PI: S.R.Palli, Agency: National Institute of Health Award: $820,000 for four years (2/1/2010-1/31/2014).
    As of August 2013, $445,584 balance left in this grant. I anticipate getting no cost extensions to carry this project for 2-3 more years until 2016.
18. 20-hdryoxyecdysone suppression of juvenile hormone action: To study the function and JH regulation of accessory gland proteins. PI: S.R. Palli, Agency:NSF, Award:$450,000 for four years (08/01/2010 to 07/31/2014).
19. Molecular Insect Physiology: Basic science to applications: To organize a symposium at ESA meeting. P.I S.R. Palli, Agency: USDA, Award: $10,000 (01/01/2010-12/31/2010).
20. Molecular mechanisms of synthetic pyrethroid resistance: To identify genes responsible for synthetic pyrethroid resistance in the bed bugs. PIs: S.R. Palli, K.F. Haynes and M. F. Potter, Agency: Bayer, $100,000. (2010-2013)
21. Molecular Analysis of Xenobiotic Response: To study role of P450s in xenobiotic response of Colorado potato beetle. PI: S.R.Palli. Agency: USDA-AFRI. Award: $ 499,000 for four years (02/14/2011 to 02/14/2015).
    As of August 2013, $459,129 balance left in this grant. I anticipate getting no cost extensions to carry this project for 2-3 more years until 2017.
22. Planning grant to establish National Science Foundation Industry/University Collaborative Research Center on Arthropod Management Technologies. PI: S.R.Palli. Agency: NSF. Award: $ 11,582 (08/22/2012 to 07/31/2013).
23. P450 Inhibition Assays. PI: S.R.Palli. Agency: USDA-ARS. Award: $ 80,918 (02/1/2013 to 08/30/2014).
24 Ecdysteroid Signaling in Filarial Parasite PI: Thomas Unnasch Co-PI: S.R.Palli. Agency: NIH. Award: $ $275,000 for two years (08/15/2013 to 07/31/2015). $32,666 is amount sub-contracted to my laboratory.
24. Center for Arthropod Management Technologies. To administer UK part of CAMTech. PI: S.R.Palli. Agency: NSF. Award: $ 360,000 (08/01/2013 to 07/31/2018).
25: Research Experience for Undergraduates. To train two undergraduate students during summer. PI: S.R.Palli. Agency: NSF. Award: $ 8,000 (08/01/2013 to 07/31/2014).
26. Center for Arthropod Management Technologies. PI: B. Bonning Co-PI: S.R.Palli. Agency: 7 Industrial members including Monsanto, Dupont, Poineer Hybrid, Bayer, BASF, Dow AgroSciences, and Futuragene contribute $50,000/year. Award: $ 1,850,000 (08/01/2013 to 07/31/2018). These funds will be allotted to research projects at ISU and UK. I anticipate getting one project funded at $50,000/year to a total of $250,000 for five years.

MEMBER OF EDITORIAL BOARD

Journal of Insect Physiology (1998-)
The Canadian Entomologist, Associate Editor (2002-)
Biopesticides International (2004--)
Archives of Insect Biochemistry and Physiology, Associate Editor (2005-)
Psyche-A journal of Entomology (2007-)
The Open Anatomy Journal (2008-)
BMC Developmental Biology, Associate Editor (2009-)
Insect Biochemistry and Molecular Biology (2009-)
Insects (2010---)
PLoSOne (2011--)

MEMBER GRANT REVIEW PANELS

USDA-NRI (2005, 2006, 2008)
NIH-VECTOR BIOLOGY (2005, 2006, 2009, 2010, 2011, 2012, 2013)
NIH-MCE (2009)
NSF-BIO-IOS (2009)

MEMBERSHIP IN SCIENTIFIC SOCIETIES

1. American Society for Cell Biology (1989-93)
2. Entomological Society of America (1988-91, 1998-)
3. American Society for Microbiology (1998-2002)
4. American Society for Gene Therapy (1999- 2002)

ORGANIZATION AND CHAIRING SESSIONS AT SCIENTIFIC MEETINGS

1. Along with Dr. A. Retnakaran organized a symposium on Insect Metamorphosis at the XX International Congress of Entomology, Firenze, Italy, August 25-31, 1996.
2. Chaired Insect Metamorphosis symposium at the XX International Congress of Entomology, Firenze, Italy, August 25-31, 1996.
3. Chaired a round table on ecdysteroid action at the XII Ecdysone Workshop. Barcelona, Spain, July 22-26, 1996.
4. Along with Dr. A. Retnakaran organized a symposium on Biotechnology for forest pest management at the XXI International Congress of Entomology, Iguassu Falls, Brazil, August 2000.
5. Chaired Biotechnology for forest pest management symposium, at the XXI International Congress of Entomology, Iguassu Falls, Brazil, August 2000.
6. Chaired Student competition presentations at the 51st annual meeting of the Entomological Society of America, October 26-29, 2003.
7. Chaired brainstorming session on future metamorphosis research at Molting and Metamorphosis symposium, Kyoto, Japan, March 3-7, 2005.
8. Chaired session 1 at the NIAS/COE symposium on lepidopteran genomics, Tsukuba, Japan March 2005.
9. Organized and chaired genomics technologies workshop at the 53rd annual meeting of the Entomological Society of America, Ft. Lauderdale, December 2005.
10. Chaired plenary session at the 93rd Indian Science Congress, Hyderabad, January 2006.
11. Member Organizing Committee, 16th International Ecdysone Workshop, July 10-14, 2006 Ghent, Belgium.
12. Co-organized a symposium “Impact of hormone research on science and society: A

symposium to honor Lynn M. Riddiford" at 54th annual meeting of the Entomological Society of America, Indianapolis, November, 2006.

13. Co-guest editor for a special volume of Insect Biochemistry and Molecular Biology in honor of Lynn M. Riddiford.
14. Member Organizing Committee: International symposium on midgut biology, April 7-11, 2008, Guangzhou, China.
15. Member Advisory Board, 17th International Ecdysone Workshop, July 20-24, 2008 Ulm, Germany.
16. Co-organized a symposium "Insect Molecular Physiology: Basic science to applications to honor Judy Willis" at the 57th annual meeting of the Entomological Society of America, Indianapolis, November, 2009.
17. Guest editor for a special volume of Journal of Insect Physiology in honor of Judy Willis, 2010.
18. Co-organized a symposium "Hormones as targets for insect control: insights about juvenile hormone action" at the 58th annual meeting of the Entomological Society of America, San Diego, 2010.
19. Co-organized a symposium "Basic science to applications for management of bed bug populations" at the 59th annual meeting of the Entomological Society of America, Reno, 2011.
20. Member Organizing Committee: International symposium on midgut biology, September, 2012, Guangzhou, China
21. Member Program Committee, 59th annual meeting of the Entomological Society of America, Reno, 2011.
22. Member Program Committee, 60th annual meeting of the Entomological Society of America, Knoxville, 2012.
23. Member organizing committee, International Insect Hormone (19th Ecdysone) Workshop 2013, July 22-26.
24. Member organizing committee, International conference on Juvenile hormones, May 2014, Tsukuba, Japan.

TEACHING:

1996-2002: Canadian Forest Service and Rohm and Haas Company

Trained 11 students and nine postdoctoral fellows. Most of them are employed and are conducting research at universities, government laboratories and private companies. Seven students and eight postdoctoral fellows published refereed journal articles with me as a co-author.

Trained students and post-doctoral fellows

Name	Years supervised	Degree completed	Title of Research Project	Present Position
Ravi Kothapalli	2	PDF	Cloning and Characterization of CfEcR	Research Associate at The university of Southern Florida
Hong Cheng	1	PDF	Cloning CHR75	Research Associate Agriculture Canada
Andrea Ricci	2	Coop, B.Sc	Diapause Associated	Graduate Student at The University of

			Proteins	Western Ontario
John Barrett	2	PDF	Recombinant Viruses	Research scientist Univ. Western Ontario
Imran Mangrue	1	Research Assistant	Molecular Entomology	Graduate student Univ. Toronto
Qili Feng	3	PDF	JH receptors	Professor, South China Normal University
M. S. Sundaram	2	PDF	Ecdysteroid Mimics	Scientist, BiomedTechnologies
Anjali Perera	3	PDF	EcRs	Research Associate GLFC-CFS
Cathy Goiten	2	Research Assistant	Defensin	Gradute student Univ. Toronto
Mohan Kumar	2	PDF	EcR Mutagenesis	PDF, University of Toronto
Masha Kapitskaya	2	M.Sc scientist	RXR Modifications	Scientist, Merck&Co
Youlin Wang	1	Research Assistant	Yeast Assay	Scientist, Merck & Co.
Dominic Titone	1	Research Assistant	EcR gel shifts	Research Assistant LSB Inc.
Peter White	1	PDF	EcR co-activators	Scientist, University of Pennsylvania

2002- Current: University of Kentucky

Courses Taught

ENT 567 Applications of Molecular Genetics (taught once)
ENT 635 Internal morphology and Insect Physiology (taught twice)
ENT 690 Molecular Entomology (taught twice)
ENT 635 Insect Physiology (taught three times)
ENT 636 Molecular Entomology (taught twice)
ABT460 Advanced Molecular Genetics (taught four times)

GRADUATE STUDENT ADVISING

Major Advisor

1. Margam Venumadahan, completed M.Sc. joined Perdue University for Ph.D.
2. Zhang, Zhaolin, completed Ph.D. Research associate in Northwestern University
3. Kavita Bitra, completed Ph.D. PDF at University of Georgia
4. Hua Bai, completed Ph.D. , PDF at Brown University
5. Sun Zhiyuan, completed M.Sc Facility manager, University of Pittsburgh
6. Robert Miller (GCT rotation student)
7. Aline Mackert Santos (visiting Ph.D. student from Brazil, spent four months at UK).
8. John Wigginton, Ph.D. student

9. Megha Kalsi, Ph.D. student
10. Hemant Gujar, Ph. D. student
11. Sunny Yoon, Ph.D. student
12. Neuhaus, Kaylee, GCT rotation student

Served on the advisory committees of two M.Sc and 10 Ph.D. students.
Serving on the advisory committees of 12 Ph. D. students

POST-DOCTORAL SCHOLARS TRAINED

1. Sumistha Das
2. Yun Jin Cui
3. Jay Shukla
4. Jingjing Xu
5. Fang Zhu (left after five year stay, Research professor, WSU)
6. Zhantao Sheng (left after 2 year stay, Research associate, University of Chicago)
7. Raman Chnadrasekhar (left after two year stay, Research Associate, KSU)
8. Yipeng Sui (left after 2 years training, PDF at UKY)
9. Parthasarathy R (Left in 2009 after 5 year stay and joined Monsanto Company)
10. Sresty Tavva (left in 2008 after 4 year stay, works for Dupont)
11. Anjian Tan (left in 2008 after 4 year stay, professor at Chinese academy of sciences)
12. Ajay Singh (left in 2008 after 2 year stay, Principal scientist, ICAR)
13. Damu Kethidi (left in 2006 after 4 years stay)
14. Wu Yu (left in 2006 after one year stay, professor in Sun-Yat-Sun University)
15. Siva Kumar P (left 2007 after 2 years stay, Instructor University of Louisville)
16. Yiping Li (left in 2007 after 2 years stay, Research Assistant professor at WSU)

UNDERGRADUATE STUDENTS WHO DID RESEARCH IN PALLI LAB

1. Megan Dillery
2. Elizabeth Berlin
3. Clay Turner
4. Rachel Ward
5. Ali More
6. Perdan Erica
7. Zeltner Mathew
8. Zhang Zijing
9. Reiya Heyden
10. James Baldwing
11. Fariba Kanga
12. Mathew Testa
13. Anciro Ashlee

Advising an average of 3-6 Agricultural Biotechnology undergraduate students per year during the past 10 years.

HIGH SCHOOL STUDENTS

A number of high school students including Kim Ferguson, Ryan Will, Roshan Palli and Joseph Ferguson conducted research for Science Fair projects in Palli lab and won awards at district, regional, state and International science fair competitions.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Yuan, Ling	Associate Professor of Plant Biology
eRA COMMONS USER NAME (credential, e.g., agency login) lyuan3	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Jinan University, Guangzhou, China	B.S.	07/83	Biology
University of Texas	Ph.D.	07/89	Biochemistry and molecular biology
University of California, San Francisco	Postdoctoral	01/89	Pharmaceutical chemistry

A. Personal Statement

My expertise is in plant biochemistry and molecular biology. I have more than 20 years of experience working on analysis, characterization and engineering of plant compounds. At UK, I teach graduate-level plant biochemistry and conduct research in metabolic engineering of plants, including, but not limited to, tobacco. After my postdoc training at University of California at San Francisco in 1993, I joined the biotech company, Calgene (subsequently acquired by Monsanto), as a principal scientist. My research focus was plant oil biosynthesis. My work was highlighted by a paper, published in the journal *Nature Biotechnology*, and is considered to be the first example of utilizing a protein-engineered enzyme to alter a metabolic pathway in a crop plant. In 1997, I became a program manager at Maxygen, Inc., where I led a number of research projects on plant biochemistry and bioengineering. Since joining UK in 2003, my research interests are centered in several main areas: (i) modification of tobacco leaf chemistry by understanding regulation of biosynthesis of leaf surface compounds and using novel technology (e.g. TransActivator-Like Endo-Nuclease, or TALEN) for precision-mutagenesis of targeted genes, (ii) mechanistic study of transcription factors (TFs) for plant metabolic pathway regulation, and (iii) improvement of bioenergy production through engineering plants to produce high-density biofuels and engineering enzymes for novel functions in biomass conversion. The research addresses key issues in molecular biology and protein biochemistry, and contributes to the development of new-crop opportunities and bioenergy, two important areas in the agricultural economies of Kentucky and the nation. In summary, I have extensive experience in conducting research and managing projects related to plant chemistry and biochemistry.

B. Positions and Honors

Positions and Employment

03/1993- 07/1997 Principal Scientist, Calgene, Inc., Davis, CA
07/1997- 07/2003 Program Manager, Maxygen, Redwood City, CA
07/2003- Associate Professor, Department of Plant and Soil Sciences, University of Kentucky

Other Experience and Professional Memberships

2003- Member, American Society for Plant Biology

International Conference Organizer

- Session chair, Institute of Biological Engineering, Annual Meeting, March 2014
- Session chair (4 consecutive years), Plant and Animal Genome XVI Conference; workshop on plant metabolic pathway regulation and drug discovery. San Diego, 2008-11
- Session chair, Conference of International Drug Discovery Science and Technology. Shanghai, May 2007

Advisory Appointment

- Visiting professor, South China Normal University, Guangzhou, China, June 2011-present
- Visiting professor, Wuhan Botanical Garden, Chinese Academy of Sciences. June 2010-present
- Visiting professor, University of Chinese Medicine, Guangzhou, China, July 2008-present
- Advisory board member, Key Laboratory of Gene Engineering, Zhongshan University, Grangzhou, China. May 2001- April 2010.

C. Selected Peer-reviewed Publications (Selected from 42 peer-reviewed publications)

1. Sanjay K Singh; Chamroeun Heng; Jay D Braker; Victor Chan; Charles C Lee; Douglas B Jordan; **Ling Yuan** and Kurt Wagschal (2013) Directed evolution of GH43 β-xylosidase XylBH43 thermal stability and L186 saturation mutagenesis. Journal of Industrial Microbiology & Biotechnology. (in press)
2. Barunava Patra, Sitakanta Pattanaik and **Ling Yuan** (2013) Proteolytic degradation of the flavonoid regulators, TRANSPERENT TESTA8 and TRANSPERENT TESTA GLABRA1 in *Arabidopsis* is mediated by ubiquitin/26S proteasome system. *Plant Signal & Behavior*. 8(10): e25901.
3. Barunava Patra, Craig Schluttenhofer, Yongmei Wu, Sitakanta Pattanaik, and **Ling Yuan** (2013) Transcriptional regulation of secondary metabolism. *Biochim Biophys Acta.* 1829(11): 1236-1247.
4. Patra, B. Pattanaik, S. and **Ling Yuan** (2013) Ubiquitin protein ligase 3 mediates the proteasomal degradation of GLABROUS3 and ENHANCER OF GLABROUS 3, regulators of trichome development and flavonoid biosynthesis in Arabidopsis. *The Plant Journal* 74:435-437.
5. Que Kong, Sitakanta Pattanaik, Antje Feller, Joshua R. Werkman, Chenglin Chai, Yongqin Wang, Erich Grotewold, and **Ling Yuan** (2012). A regulatory switch enforced by bHLH and ACT domain-mediated dimerization of the maize transcription factor R*. Proceeding of National Academy of Sciences, U.S. A.* 109: E2091-2097
6. Suttipanta, N., Pattanaik, S., Kulshrestha, M., Patra, B., Singh, S.K. and **Yuan, L.** (2011) The transcription factor CrWRKY1 positively regulates terpenoid indole alkaloid biosynthesis in *Catharanthus roseus. Plant Physiology* 157: 2081-2093.
7. Jordan, D.B., Wagschal, K., Fan, ZM., **Yuan, L.**, Braker, J.D. and Heng, C. (2011) Engineering lower inhibitor affinities in beta-D-xylosidase of Selenomonas ruminantium by site-directed mutagenesis of Trp145. *Journal of Industrial Microbiology and Biotechnology*. 38: 1821-1835
8. Pattanaik, S., Kong, Q., Zaitlin, D., Werkman, JH, Xie, CH, Patra, B., and **Yuan, L**. (2010) Isolation and functional characterization of a floral tissue-specific R2R3 MYB regulator from Tobacco. *Planta*. 231:1061-1076.
9. Fan, ZM and **Yuan, L.** (2010) Production of multifunctional chimaeric enzymes in plants. *Plant Biotechnology Journal*. 8:308-315.

10. Pattanaik, S., Kong, Q., Zaitlin, D., Werkman, JH, Xie, CH, Patra, B., and **Yuan, L.** (2010) Isolation and functional characterization of a floral tissue-specific R2R3 MYB regulator from Tobacco. *Planta*. 231:1061-1076.
11. Fan, ZM, Werkman, JH and **Yuan, L** (**2009**) Engineering a multifunctional hemicellulase. *Biotechnology Letters* 31： 751-757
12. Bai, Y., Pattanaik, S., Patra, B., Werkman, J.R., Xie, CH., and **Yuan, L.** (2011) Flavonoid-related basic helix-loop-helix regulators, NtAn1a and NtAn1b, of tabacco have originated from two ancestors and are functionally active. *Planta*. 234: 363-375
13. Fan, ZM*, Wagschal, K., Chen, W., Montross, MD, Lee, CC., and **Yuan, L.** (2009) Multimeric hemicellulases facilitate biomass conversion. *Applied and Environmental Microbiology*. 75: 1754-1757
14. **Yuan, L**., B. A. Nelson,* and G. Caryl. (1996) The Catalytic Cysteine and Histidine in the Plant Acyl-ACP Thioesterases. *Journal of Biological Chemistry* 271: 3417-3419.
15. **Yuan, L.**, S. P. Craig, J. H. McKerrow, and C. C. Wang. (1992) Steady State Kinetics of the Hypoxanthine-guanine Phosphoribosyltransferase of *Schistosoma mansoni*. *Biochemistry* 31: 806-810.

D. Research Support

<u>Ongoing Research Support</u>

US Department of Energy Christer Jansen (PI) 02/01/1-1/31/14
FOLIUM: developing tobacco as a platform for foliar synthesis of high-density liquid fuels.
The goal of this project is to produce high-density hydrocarbons including alkanes and terpenes in plants. The hydrocarbon fuels thus synthesized have characteristics of petroleum.
Role: co-PI

US Department of Agriculture Yuan (PI) 5/1/12-4/30/16
Tall fescue biochemical characterization.
The goal is to provide analytical support of constituent composition of forage plants.
Role: PI

The Council for Burley Tobacco Yuan (PI) 09/113/09-08/31/14
Topping-triggered sucker control system.
The goal is to develop an inducible gene expression system for the control of axillary shoots.
Role: PI

Kentucky Tobacco Research and Development Center Yuan (PI) 7/1/13-6/31/14
Tobacco Surface Chemistry: engineering of glandular trichome secretion.
The project aims to modification and analysis of tobacco leave chemicals.
Role: PI

<u>Completed Research Support</u>

USDA Yuan (PI) 02/01/02-01/31/05
Directed evolution of hemicellulosic hydrolases for bioconversion of corn fiber for the production of biofuels and bioproducts.
The goal is to engineer a hemicullulase for improved catalytic properties using directed evolution technologies.
Role: PI

DOE Chatterjee (PI) 09/01/06-08/31/07

Novel approach to microbial hydrogen production
The goal of this project was to increase hydrogen production in E.coli by altering the metabolic pathway.
Role: co-PI

Kentucky Science and Technology Foundation Yuan (PI) 11/1/10-10/31/12
Directed evolution of transposons”
The goal is to engineer a transposon for increase efficiency in plant gene transformation.
Role: PI

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Craig W. Vander Kooi	Associate Professor of Biochemistry
eRA COMMONS USER NAME (credential, e.g., agency login) CRAIG.VANDERKOOI	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION		DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Wheaton College	Wheaton, IL	B.S.	1997	Chemistry and Biology
University of Michigan	Ann Arbor, MI	M.S.	1999	Chemistry
Vanderbilt University	Nashville, TN	Ph.D.	2004	Biochemistry
Johns Hopkins University	Baltimore, MD	Postdoctoral		Biophysics

A. Personal Statement

The overarching goal of the laboratory focuses on determining the mechanism of physical interactions underlying human disease-associated biological processes at an atomic level and translate these insights into the development of specific inhibitors. The major focus of the lab is the interaction and regulation of cell surface receptors by circulating cytokines, growth factors, and hormones. One major research focus of the laboratory is the essential endothelial cell surface receptor Neuropilin, which is essential for both physiological and pathological VEGF-dependent angiogenesis.

B. Positions

1998 Research Aid, Argonne National Laboratory
1998-2000 Graduate Student, University of Michigan
2000-2004 Graduate Student, Vanderbilt University
2005-2008 Postdoctoral Fellow, Johns Hopkins University
2008-2013 Assistant Professor, University of Kentucky
2013-present Associate Professor, University of Kentucky

Honors and Awards

1994 Anton Hofstead Memorial Science Scholarship
1994-1997 President's Scholarship, Wheaton College
1998 Outstanding Chemistry Student Award, American Institute of Chemists Foundation
1998-2000 Regents Fellowship, University of Michigan
2000-2002 NIH Molecular Biophysics Training Grant
2006-2009 Leukemia and Lymphoma Society Fellow
2008-2012 Charles Wethington Research Excellence Award, UK College of Medicine

C. Selected peer-reviewed publications (34 total)

1) Guo H-F., Li X., Parker M.W., Waltenberger J., Becker P.M., **Vander Kooi C.W.‡** (2013) Mechanistic Basis for the Potent Anti-angiogenic Activity of Semaphorin 3F. Biochemistry, 52, 7551-7558. PMCID: In progress

2) Parker M.W., Linkugel A.D., **Vander Kooi C.W.‡,** (2013) Effect of C-Terminal Sequence on Competitive Semaphorin Binding to Neuropilin-1, J. Mol. Biol, 425, 4405-4414 PMCID: In progress

3) Bohnert K.A., Grzegorzewska A.P., Willet A.H., **Vander Kooi C.W.**, Kovar D.R., Gould K.L. (2013) SIN-dependent phosphoinhibition of formin multimerization controls fission yeast cytokinesis. Genes Dev. 27, 2164-2177. PMCID: In progress

4) Meekins D.A., Guo H-F., Husodo S., Paasch B.C., Bridges T.M., Santelia D., Kötting O., **Vander Kooi C.W.‡**, Gentry M.S.‡ (2013) Structure of the Arabidopsis Glucan Phosphatase LIKE SEX FOUR2 Reveals a Unique Mechanism for Starch Dephosphorylation. Plant Cell, 25, 2302-14. PMCID: PMC3723627

5) Jeoung M., Abdelmoti L., Jang E.R., **Vander Kooi C.W.**, Galperin E. (2013) Functional Integration of the Conserved Domains of Shoc2 Scaffold. PLoS One 8, e66067. PMCID: PMC3689688

6) Goel, H., Pursell, B., Chang, C., Shaw, L.M., Mao, J., Simin, K., Kumar, P., **Vander Kooi, C.W.**, Shultz, L.D., Greiner, D.L., Norum, J.H., Toftgard, R., Kuperwasser, C., & Mercurio, A.M., (2013) Gli1 Mediates Autocrine Signaling Involving Neuropilin-2 and the α6β1 Integrin that Contributes to Breast Cancer Initiation. EMBO Mol Med, 5, 488-508. PMCID: PMC3628099

7) Zhang W., Sviripa V., Chen X., Shi J., Yu T., Hamza A., Ward N.D., Kril L.M., **Vander Kooi C.W.**, Zhan C.G., Evers B.M., Watt D.S., Liu C. (2013) Fluorinated N,N-Dialkylaminostilbenes Repress Colon Cancer by Targeting Methionine S-Adenosyltransferase 2A. ACS Chem Biol, 8, 796-803. PMCID: PMC3631441

8) Parker, M.W., Guo, H-F., Li, X., Linkugel, A.D., **Vander Kooi C.W.**‡ (2012) Function of the Neuropilin Family as Essential Pleiotropic Cell Surface Receptors. Biochemistry, 51, 9437-9446. PMCID: PMC3510667

9) Parker M.W., Xu P., Guo, H-F., **Vander Kooi C.W.**‡ (2012) Mechanism of Selective VEGF-A Binding by Neuropilin-1 Reveals a Basis for Specific Ligand Inhibition PLoS ONE, 7, e49188, doi:10.1371/ journal.pone.0049177. PMCID: PMC3493496

10) Parker M.W., Li X., Gou H-F., Xu P., **Vander Kooi C.W**.‡ (2012) Structural Basis for VEGF-A Isoform Specific binding to Neuropilin. JBC 287, 11082-11089. PMCID: PMC3322888

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19) Mori M., **Vander Kooi C.W**., Leahy D.J., & Yue, D.T. (2008) Structure of the CaV2 IQ domain in complex with Ca2+/calmodulin: High-resolution mechanistic implications for channel regulation by Ca2+ *Structure,* **16**, 607-620. PMCID: PMC2363160

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21) **Vander Kooi C.W.**, Ohi M.D., Oldham M.L., Newcomer M.A., Gould K.L., & Chazin W.J. (2006) The Prp19 U-box crystal structure suggests a common dimeric architecture for a class of oligomeric E3 ubiquitin ligases. *Biochemistry* **45**, 121-30. PMCID: PMC2570371

‡ Corresponding author

D. Research Support

Ongoing Research Support

R01 GM094155 (Vander Kooi, PI, 30% effort) 09/06/10-06/30/15
NIH/NIGMS
Mechanism of Neuropilin Dependent Angiogenesis
The major goals of this grant are to determine the mechanisms underlying neuropilin dependant angiogenesis. Coupled structural and functional studies will define the physical interactions required to activate the angiogenic signaling complex. Novel modes of inhibition will be developed in order to target neuropilin-dependent tumor angiogenesis and tumor metastasis.
Role: PI

R01 NS070899 (Gentry, PI, 10% effort) 07/01/10-06/30/15
NIH/NINDS
Regulation, signaling, and dynamics of glucan phosphatases
The major goals of this grant are to characterize the function, regulation, and structure of laforin and sex4 glucan phosphatases.
Role: Co-PI

Completed Research Support

Kentucky Lung Cancer Research Foundation (Vander Kooi, PI) 12/01/09-11/31/11
Physical mechanisms of VEGF receptor activation and novel modes of inhibition.
The major goal of this study is to develop novel inhibitors of angiogenesis.
Role: PI

P20 RR020171 (Hersh, PI) 03/17/08-06/30/11
NIH/NCRR
Project lead: Structural Studies of Neuropilin Signaling.
This study focuses on determining the interaction of neuorpilin with its ligands VEGF and semaphorin and determining the basis for neuropilin activation of axon guidance.
Role: Co-PI

Leukemia and Lymphoma Society (Vander Kooi, PI) 07/01/06-06/30/09

Structural studies of Flt3 activation and inhibition in AML.
This study focused on understanding the mechanisms of activation of Flt3 in AML and examining the binding of antibodies in clinical development.
Role: PI - Career Development Award

ABT Research Mentors

Plant & Soil Science
Joe Chappell
Randy Dinkins
David Hildebrand
Art Hunt
David McNear
Sharyn Perry
Todd Pfeiffer
Olga Tsyusko
Luke Moe

Anatomy & Neurobiology
Guoying Bing
Luke H. Bradley
Marilyn Duncan
Lothar Jennes

Animal Science
Laurie Lawrence
James Matthews

Molecular & Cellular Biochemistry
Trevor Creamer
Robert Dickson
Rebecca Dutch
Matthew Gentry
Michael Mendenhall
Carole Moncman
Kevin Sarge
Qingjun Wang
Craig VanderKooi
Haining Zhu

Biological Sciences
Phillip Bonner
Robin Cooper
D. Nicholas McLetchie
Edmund Rucker
S. Randal Voss

Entomology
Stephen Dobson
James Harwood
Charles Fox
Reddy Palli
Xugou Zhou
Bruce Webb

Horticulture
Seth DeBolt
Lynnette M.A. Dirk
Bruce Downie
Bob Houtz

Infectious Disease
Richard Greenberg

Internal Medicine
J. Scott Bryson
Nancy R. Webb

Kentucky Tobacco Research & Development Center
Ling Yuan
Indu B. Maiti

Microbiology & Immunology
Anthony Sinai
Robert Geraghty
Brett T. Spear
Brian Stevenson
Susan Straley

Molecular & Biomedical Pharmacology
John Littleton

College of Dentistry, Orthodontics
Sarandeep Huja

College of Dentistry, Restorative Dentistry
Michelle Steffen
Richard Mitchell

OHP Oral Diagnosis
Craig Miller

Center for Oral Health
Jeffrey Ebersole

Anesthesiology
Ivan Horvath

Obsterics & Gynecology
Misung Jo

Neurosurgery
David Yurek

Toxicology
Isabel Mellon

Pediatrics
John D'Orazio

Physiology
Karyn Esser
Ming C. Gong
Karin High
Mariana Nikolova-Jarakashian
Melinda Wilson

College of Pharmacy
Younsoo Bae
Esther Penni Black
Wooin Lee
Steve Van Lanen

Plant Pathology
Mark Farman
Michael Goodin
Aardra Kachroo
Peter Nagy
Christopher Schardl
Lisa Vaillancourt

Veterinary Science
Ernest Bailey
Udeni B. R. Balasuriya
Thomas M. Chambers
Kathyrn Graves
David W. Horohov
Daniel K. Howe
Charles Issel

Psychology
Susan Barron

(Updated 12/3/2013)

ABT Student Publications/Presentations

Professional Publications (2007-present):

Crum, M.R., Nadolski, J., Robinson, A.*, Burns, E., Robinson, M.M., DeCastro, L. and Cooper, R.L. (2013) Physiological effects of acute hypercalcemia in a crayfish model: behavior, cardiac, neurophysiology, gastrointestinal. (In preparation).

Tori B. Dunlap, Erik C. Cook, Julie Rumi-Masante, Hannah G. Arvin*, Terrence E. Lester and Trevor P. Creamer. 2013. The distal helix in the regulatory domain of calcineurin is important for domain stability and enzyme function. *Biochemistry*, in press.

Magnani, R., Chaffin, B., Dick, E.*, Bricken, M.L., Houtz, R.L., and Bradley, L.H. 2012. Utilization of a calmodulin lysine methyltransferase co-expression system for the generation of a combinatorial library of post-translationally modified proteins. *Protein Expression & Purification,* 86: 83-88. http://dx.doi.org/10.1016/j.pep.2012.09.012. PMID: 23036357

Fletcher, A. M.*, Kowalczyk, T. H., Padegimas, L., Cooper, M. J., and Yurek, D. M. 2011. Transgene Expression in the Striatum Following Intracerebral Injections of DNA Nanoparticles Encoding For Human Glial Cell Line-Derived Neurotrophic Factor *Neuroscience* 194, 220–226.

Shridas, P., Bailey, W.M., Talbott, K.R.*, Oslund, R.C., Gelb, M.H., and Webb, N.R. 2011. Group X secretory phospholipase A_2 enhances TLR4 signaling in macrophages. J Immunol. 187:482-9. PMCID: PMC3119755.

Bandyopadhyay, A., Kopperud, K.*, Anderson, G., Martin, K., and Goodin, M. 2010. An integrated protein localization and interaction map for potato yellow dwarf virus, type species of the genus *Nucleorhabdovirus.* Virology. Jun 20; 402(1):61-71.

Fox, C. W., Bush, M. L.*, and Messina, F.J. 2010. Biotypes of the seed beetle *Callosobruchus maculatus* have differing effects on the germination and growth of their legume hosts. Agricultural and Forest Entomology 12: 353-362. doi: 10.1111/j.1461-9563.2010.00484.x

Stork, J., Harris, D., Griffiths, J., Williams, B.*, Beisson, F., Li-Beisson, Y., Mendu, V., Haughn, G., and DeBolt, S. 2010. CELLULOSE SYNTHASE9 serves a non-redundant role in secondary cell wall synthesis in Arabidopsis epidermal testa cells. Plant Physiol. 10.1104/pp.110.154062.

Legan, S.J., Franklin, K.M., Donoghue, K.M.*, and Duncan, M.J. 2009. Phenobarbital blockade of the preovulatory LH surge: Association with phase-advanced circadian clock and altered suprachiasmatic nucleus *Period1* gene expression. Am. J. Physiol. Regul. Integr. Comp. Physiol. 296: R1620-1630. PMCID: PMC2689824

Martin, K., Kopperud, K.*, Chakrabarty, R., Banerjee, R., Brooks, R.*, and Goodin, M.M. 2009. Transient expression in Nicotiana benthamiana fluorescent marker line provides enhanced definition of protein localization, movement and interactions in planta. Plant J. 59, 150–162.

Crowdus, C.A.*, A.E. Marsh, W.J. Saville, D.S. Lindsay; J.P. Dubey, D.E. Granstrom, and D.K. Howe. 2008. SnSAG5 is an alternative surface antigen of Sarcocystis neurona strains that is mutually exclusive to SnSAG1. Veterinary Parasitology 158:36-43.

Firestine, Angela M.*, Chellgren, Veronique M., Rucker, Shelly J., Lester, Terrence E., and Creamer, Trevor P. 2008. Conformational properties of a peptide model for unfolded alpha- helices. *Biochemistry* 47, 3216-3224.

Dirk, L. M., Flynn, E.M.*, Dietzel, K., Couture, J.F., Trievel, R.C., and Houtz, R.L. 2007. Kinetic manifestation of processivity during multiple methylations catalyzed by SET domain protein methyltransferases. Biochemistry. 46:3905-3915.

Goodin, M.M., Chakrabarty, R., Yelton, S., Martin, K., Clark, A., and Brooks, R.* 2007. Membrane and protein dynamics in live plant nuclei infected with Sonchus yellow net virus, a plant-adapted rhabdovirus. J. Gen Virol. 88:1810-1820.

Morford, L.A., Davis, C.*, Jin, L., Dobierzewska, A., Peterson, M.L., and Spear, B.T. 2007. The oncofetal gene glypican 3 is regulated in the postnatal liver by zinc fingers and homeoboxes 2 in the regenerating liver by alpha-fetoprotein regulator 2. Hepatology. [Epub ahead of print] PMID: 17668883 [PubMed - as supplied by publisher].

Wilson, M.E., K.F. Allred, E.M. Kordik, D.K. Jasper*, A.N. Rosewell, and A.J. Bisotti. 2007. Gender-specific effects of HIV protease inhibitors on body mass in mice. AIDS Res. Ther. 4:8.

Student Journal Publications:

Houtz, Philip L.* Mentor: Professor David Atwood. "The Agricultural Footprints on the Environment." Kaleidoscope: University of Kentucky Journal of Undergraduate Research. 8.1 (2009) pp. 30-35.

Dick, D.E.* Mentor: Dr. Luke Bradley. "Screening Synthetic Combinatorial Protein Libraries for Changes in Calmodulin Binding Specificity." Kaleidoscope: Vol. 10, Article 8.

*****denotes Agricultural Biotechnology student

Oral Presentations:

Entomological Society of America Annual Meeting (2013) Rebecca Wente

National Conference on Undergraduate Research (2013) Emerson Dick

National Conference on Undergraduate Research (2013) Raquel Hegge

National Conference on Undergraduate Research (2013) Rebecca Wente

Showcase of Undergraduate Scholars (2013) Rebecca Wente

2nd International Symposium on the Molecular Detection of Trophic Interactions (2013) Rebecca Wente

National Conference on Undergraduate Research (2012) Alyssa Fountain

Undergraduate Representative for Bluegrass Chapter of Society of Neuroscience (2011-2012) Alyssa Fountain

University of Kentucky Showcase of Undergraduate Scholars (2012) Ashlee Anciro

The Kentucky Academy of Science Annual Meeting (2012) Emerson Dick

7th Annual Showcase of Undergraduate Scholars, University of Kentucky (2012) Ariel Robinson

Spring Neuroscience Day, University of Kentucky (2012) Ariel Robinson

Annual meeting of the society for Neuroscience (2012) Ariel Robinson

American Arachnological Society Annual Meeting (2012) Rebecca Wente

Entomological Society of America Annual Meeting (2012) Rebecca Wente

National Conference on Undergraduate Research (2011) Philip Houtz

6th Annual Showcase of Undergraduate Scholars, University of Kentucky (2011) Ariel Robinson

Annual meeting of the Society of Neuroscience Bluegrass Chapter (2011) Ariel Robinson

Annual meeting of the Society for Neuroscience (2011) Ariel Robinson

The Kentucky Academy of Science Annual Meeting (2011) Ariel Robinson

The Kentucky Academy of Science Annual Meeting (2011) Emerson Dick

National Conference on Undergraduate Research (2010) Philip L. Houtz

Discovery Seminars Program Showcase, University of Kentucky (2009) Philip Houtz

3rd place award 23rd Annual Forum Undergraduate Student Paper Competition Ohio Valley Entomological Association (2008) James Baulding

Poster Presentations

University of Kentucky Showcase of Undergraduate Scholars (2013) Ashlee Anciro

Third Place in the Animal Science Association Joint Annual Meeting (JAM) Undergraduate Poster Competition (2012) Raquel Hegge

Society of Invertebrate Pathology Annual Meeting's Outstanding Student Poster Presentation: Honorable Mention (2011) Philip Houtz

44th Annual Meeting of the Society of Invertebrate Pathology (2011) Philip Houtz

Undergraduate Student Competition Poster: Entomological Society of America (ESA) Annual Meeting (2010) Philip Houtz

Student Competition Poster: Entomological Society of America (ESA) Annual Meeting (2009) Philip Houtz

Posters at the Capital

2013

Emerson Dick – *High-throughput Platform for Monitoring Protein Binding Specificity*

Jessica Gambrel – *In vivo Screen to Measure the Role of Post-translational Modification on Protein Binding Specificity*

Rebecca Wente – *Effects of Intraguild Cues on Ground-dwelling and Foliage-dwelling Spiders on Lady Beetle Oviposition and Aphid Suppression*

2011

Philip Houtz – *The Characterization of a Novel Cypovirus in a Parasitoid-Host Relationship*

Taylor Lloyd – *Seed Maturation Protein (SMP): Regulating Seed Behavior Following Temperature Shock*

2010

Alyssa Fountain – *Enzymatic Investigation of the Anti-apoptotic Properties of DNSP – 11*

Philip Houtz – *Persistence of Campoletis sonorensis ichnovirus in vivo and TAIL PCR Method in Junction Site Determination.*

2009

Mark Adams – *Molecular Elucidation of Carabid Beetle Foraging Behavior in Alfalfa*

Lesley Mann – *In situ Protein Localization in Endophytic Fungi during Benign Plant Colonization and Stromata Development*

College of Agriculture
Interdepartmental Program in Agricultural Biotechnology (B.S. program)
Program Assessment

Mission Statement

The mission of the Agricultural Biotechnology degree program is to recruit and train students in modern methods and principles of biotechnology research including cellular and molecular biology, genetic engineering, and protein science, and to graduate students who will contribute to the economic development of Kentucky through enhancement of a knowledge-based research and technology-driven economy.

Statement of Learning Outcomes

1. Agricultural Biotechnology graduates will acquire knowledge about the range of approaches to manipulate and improve plants, animals and microorganisms.

2. Agricultural Biotechnology graduates will demonstrate the ability to interpret, evaluate and communicate their assessment of modern biotechnology approaches for the purposes cited in Learning Outcome 1.

3. Agricultural Biotechnology graduates will evaluate how their experience in the Agricultural Biotechnology program has influenced their outlook on the relationship between society and biotechnology, and how their personal philosophies and values have been influenced as a consequence of the program.

4. Agricultural Biotechnology students will participate in research projects including the requirements of the independent study course ABT 395, or experiential learning course ABT 399. Presentation (oral and written) is an integral part of their research program and they will demonstrate their ability to communicate about science through these presentations. ABT students will have the opportunity to become authors and co-authors on suitable outlets for communication of their research results including abstracts presented at professional meetings, and where possible peer-reviewed scientific research publications.

Curriculum Map for Agricultural Biotechnology

Courses		Outcomes			
		Outcome 1	**Outcome 2**	**Outcome 3**	**Outcome 4**
	Pre-major requirements	I /R	I/R		
	ABT101	I	I	I	I
	ABT201W	R	R	R	R
	ABT301W	A	A	A	E/A
	Other major requirements: BIO308/209, BIO304, BCH401G, STA291 or 570	R/E	R/E		
	ABT460	E	E		
	ABT461	E	E		
	ABT495		E		E
	ABT395/399	A	E	A	A
	Specialty Support courses	E/A	E/A		

I=Outcome is Introduced; R=Outcome is Reinforced; E=Outcome is Emphasized; A=Outcome is Applied

Program Assessment Methods and Procedures

The basic strategy for program level assessment is similar for all four learning outcomes. All students, both transfer students from other programs and students who initiate their college career at UK as ABT students, take ABT201. A small writing assignment is part of this course. This will serve as the initial assessment point. All ABT students perform independent research projects (ABT395 or 399) culminating in a public presentation. This will serve as an exit assessment point. The papers from ABT201 will be electronically archived and a sampling (at least three papers) assessed using the attached rubric by a subset of the ABT coordinating committee in April-May of each year. For the presentations, a similar rubric (please see below) will be provided to the members of the coordinating committee and other faculty of ABT in attendance to collect data. This will occur in May of each year. Following, the data will be assessed to compare performance in ABT201 to 395/399, summarized, circulated to the coordinating committee and entered into Blackboard by a UGS.

Assessment strategy for Outcome 1:

A great deal of basic and specialized knowledge is inherent in biotechnology. The papers/presentations from ABT201 and 395 will be evaluated for basic understanding of the science behind the questions and approaches addressed.

Assessment strategy for Outcome 2:

Not only is basic knowledge important but also the ability to explain the background knowledge as well as the ability to interpret and evaluate approaches to addressing problems and questions in biotechnology. The papers/presentations will be assessed for LO2 for the clarity of explanation of the background material and the pros and cons of the scientific approaches to address remaining questions.

Assessment strategy for Outcome 3:

Exercises throughout the ABT curriculum require students to consider the societal value of first others, and later their own research programs. For this learning outcome the papers/presentations from ABT201 and 395 will be assessed for the how well the value of the research (others research in 201 and the students' own projects in 395) to society is presented.

Assessment strategy for Outcome 4:

This outcome is evaluated in part in ABT395/399 that culminates in a final report. General quality of communication (written in 201 and oral in 395/399) will be assessed to document students increased (or not) ability to communicate about science. Participation beyond the 395/399 project is measured by manuscripts co-authored by ABT students and published in peer reviewed scientific journals. Because this most often occurs later (after the student graduates), this is an indirect measure.

Assessment Cycle: Outcomes 1 and 2 will be evaluated the first year of the assessment cycle, Outcome 3 the second year, and Outcome 4 the third year. Assessment will be performed by a subset of the coordinating committee in the Spring of each year (after the final presentations for the 395/399 projects – May). Results will be circulated to the coordinating committee and an improvement plan will be agreed upon at a meeting or by an email consensus. A/the UGS for the program will enter data into Blackboard.

Targets/Benchmarks: For the initial cycles we will collect baseline data. However the goal is for an average overall evaluation score to be above 3.5 for students graduating from the program.

Scoring systems for the learning outcomes for the ABT201 papers:

Criteria	**Deficient**	**Low**	**Medium**	**High**	**Excellent**
score:	**1**	**2**	**3**	**4**	**5**
Outcome 1: e.g., is it clear that the student understands the question/problem and approaches to address the question?					
Outcome 2: e.g., can the student address pros and cons of approaches and describe caveats to interpretation?					
Outcome 3: e.g., is the student able to clearly explain why the research is worth doing? Should taxpayer money fund such research and why?					
Outcome 4: e.g., what is the overall quality of communication?					

Additional comments:

ABT 395 Student Presentation Evaluations

Please provide comments and a numerical score (1 = deficient, 2 = low, 3 = medium, 4 = high, 5 = excellent) for the following:
A) Does the student understand the research question/problem and the experimental approaches to address the question?
B) Is it apparent that the student is aware of the pros/cons of different experimental approaches and limitations to their data interpretations?
C) Has the student explained the study rationale and justifications?
D) How well has the student communicated their research project?

In addition to the comments and numerical scores, please give a final ranking of the student's presentation relative to others during the session. This ranking will be used to select the recipient of the Glenn Collins Research Achievement Award in ABT.

Final Ranking	**Student Name**	**Comments and scoring**
		A) = B) = C) = D) =
		A) = B) = C) = D) =
		A) = B) = C) = D) =
		A) = B) = C) = D) =
		A) = B) = C) = D) =

		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =
		A) =	B) =	C) =	D) =

UNIVERSITY OF KENTUCKY®

Annual Student Learning Outcomes Report

College of Agriculture, Food and Environment
Agricultural Biotechnology - Bachelor
Spring 2010 Agricultural Biotechnology.b

Student Learning Outcome(s) Assessed

agbiotch.b: Interpret & Evaluate Agricultural Biotechnology graduates will demonstrate the ability to interpret and evaluate modern biotechnology approaches to the manipulation and improvement of plants, animals, microorganisms, and the control of agricultural pests and diseases.

agbiotch.b: Relationship Agricultural Biotechnology graduates will evaluate how their experience in the Agricultural Biotechnology program has influenced their outlook on the relationship between society and biotechnology, and how their personal philosophies and values have been influenced as a consequence of the program.

agbiotch.b: Acquire Knowledge Agricultural Biotechnology graduates will acquire knowledge about the range of approaches to manipulate and improve plants, animals and microorganisms.

agbiotch.b:Communicate about research: ABT students will demonstrate their ability to communicate about science via oral presentations and written papers. For example, all Agricultural Biotechnology students participate in research projects including the requirements of the independent study course ABT 395, or experiential learning course ABT 399. Presentation (oral and written) is an integral part of this research requirement. The administration of the ABT program is very proud that many of the ABT students will have the opportunity to become authors and co-authors on suitable outlets for communication of their research results including abstracts presented at professional meetings and peer-reviewed scientific research publications.

Assessment Methods and Tools

Final term papers from ABT201 and ABT395 were compared with respect to four learning outcomes for ABT. Three term papers from each of ABT201 and ABT395 were chosen at random and provided to an independent evaluation committee for assessment.

C1. papers from ABT201W and 395 were evaluated for basic understanding of the science behind the questions and approaches addressed

C2. the ability to explain the background knowledge as well as the ability to interpret and evaluate approaches to addressing problems and questions in biotechnology.

C3. clarity of explanation of the background material

C4. pros and cons of the scientific approaches

C5. how well the value of the research to society is presented.

C6. General quality of writing

Results

C1. ABT395 reports were uniformly more complex than those of ABT201, demonstrating that students developed a deeper comprehension of science
C2. ABT395 reports all had detailed formal introductions and the data presented was supported by statistical analyses not present in ABT201 papers
C3. All 395 papers randomly selected for the review committee were excellent with respect of clarity of explaining background material
C4. Varied and appropriate scientific approaches relevant to each research question were used and evaluated in all 395 papers
C5. Research on pharmaceuticals, obesity, anti-venom production and other socially relevant issues were presented in both 201 and 395 papers
C6. In all aspects of writing, there was marked improvement in 395 papers compared to 201 papers

Interpretation of Results

The ABT students demonstrated increased basic knowledge in areas relevant to biotechnology and use of this knowledge to think creatively about scientific problems of importance to society. They improved in ability to interpret and evaluate information and communicate effectively with others.

Improvement Action

Recommendations are to maintain the current, and exceptional, high quality of instruction in the ABT program, which consistently places many students in high caliber graduate programs, medical-, and related, schools, as well as providing many with refereed journal publications.

Instructors of ABT201 and ABT395 will be presented with the impartial results of this evaluation so that they may, as necessary, make any required improvements to their exceptionally high quality courses.

Reflection

No specific actions were recommended in this first IAP other than to maintain the current, high quality instruction in the ABT program. Given that the following two years attracted a record number of merit scholars (20 in 2011 and 18 in 2012), the program is clearly seen as excellent training by entering students to help them fulfill their career goals.

Attachments

No Attachments

UNIVERSITY OF KENTUCKY

Annual Student Learning Outcomes Report

College of Agriculture, Food and Environment
Agricultural Biotechnology - Bachelor
ABT Assessment LO3 2011

Student Learning Outcome(s) Assessed

agbiotch.b: Relationship Agricultural Biotechnology graduates will evaluate how their experience in the Agricultural Biotechnology program has influenced their outlook on the relationship between society and biotechnology, and how their personal philosophies and values have been influenced as a consequence of the program.

Assessment Methods and Tools

Final term papers from ABT201 and public presentations from ABT395/399 were evaluated with respect to four learning outcomes for ABT (presented above). For 395, a rubric was provided to each ABT committee members in attendance to evaulate each presenter. For 201, random papers (3) were selected and evaluated using a rubric by members of the committee. Data was compiled and average scores calculated.

For LO 3: Exercises throughout the ABT curriculum require students to consider the societal value of first others, and later their own research programs. For this learning outcome the papers/presentations from ABT201 and 395 will be assessed for the how well the value of the research (others' research in 201 and the students' own projects in 395) to society is presented.

Results

Papers/presentations were scored for each LO. 1=deficient; 2=low; 3=medium; 4=high; 5=excellent. For LO3 committee members were asked to rate how well the student explained the study rationale and justification for the 395/399 presentations of which there were 15 in Spring 2011. ABT201 papers were assessed for LO3 by asking the reviewers to indicate how well the student explained why the research is important.

The average score for LO3 was 2.8 (SD, 0.7) for the ABT201 papers indicating the students did poorly (low = 2) to mediocre (medium =3) at explaining why the research should be performed. The score for this LO was much improved in the 395/399 presentations with an average score of 3.9 (SD, 0.8). This indicates high quality explanation of the value of the research to society. There is a significant improvement between 201 and 395/399 for this LO.

Interpretation of Results

The average score for LO3 was 2.8 (SD, 0.7) for the ABT201 papers indicating the students did poorly (low = 2) to mediocre (medium =3) at explaining why the research should be performed. The score for this LO was much improved in the 395/399 presentations with an average score of 3.9 (SD, 0.8). This indicates high quality explanation of the value of the research to society. There is a significant improvement between 201 and 395/399 for this LO.

Scores for the other outcomes also indicated improvement in 395/399 compared to 201 and will be reported in the appropriate year.

Improvement Action

The ABT program attracts and retains excellent students. A measure of this is the high number of merit scholars entering the program in 2011 (twenty merit students will enter the program in Fall 2011). The students while in the program receive many prestigious awards and honors including two Goldwater scholarships and the Astronaut scholarship in 2011. Many of the students co-author peer-reviewed scientific manuscripts from their independent study projects. ABT consistently places graduates in high caliber graduate and professional programs.

An assignment will be added to ABT201 that will help students develop an outline early in the semester to address the topic and importance of the topic. In the past, students provided peer review of each others papers, revised as appropriate, and the final paper was submitted to the instructor. Addition of this assignment will allow the instructor to provide feedback earlier in the semester.

Reflection

The ABT program has continued to attract excellent students. In 2011, 20 merit students entered the program. In 2012, 18 entering ABT students were advised during the merit weekends. In the 2011 IAP, plans were stated to add an assignment to ABT201 in which students were asked to identify the topic of their research paper earlier in the semester and justify importance of the topic. This was done to improve their performance on Outcome 3: Evaluate how their ABTexperience has influenced their personal philosophies of society and biotechnology. Assessment of the papers will occur soon allowing determination of whether this assignment improved performance on this learning outcome or not.

Attachments

No Attachments

UNIVERSITY OF KENTUCKY®

Annual Student Learning Outcomes Report

College of Agriculture, Food and Environment
Agricultural Biotechnology - Bachelor
Spring 2012 ABT

Student Learning Outcome(s) Assessed

agbiotch.b:Communicate about research: ABT students will demonstrate their ability to communicate about science via oral presentations and written papers. For example, all Agricultural Biotechnology students participate in research projects including the requirements of the independent study course ABT 395, or experiential learning course ABT 399. Presentation (oral and written) is an integral part of this research requirement. The administration of the ABT program is very proud that many of the ABT students will have the opportunity to become authors and co-authors on suitable outlets for communication of their research results including abstracts presented at professional meetings and peer-reviewed scientific research publications.

Assessment Methods and Tools

Final term papers (n=3) from ABT201 and public presentations from ABT395/399 were evaluated with respect to four learning outcomes for ABT (data is collected for all 4 outcomes but only LO4 is addressed in this cycle). For 395, a rubric was provided to each ABT committee members in attendance to evaulate each presenter. For 201, random papers (n = 3) were selected and evaluated using a rubric by members of the committee. Data was compiled and average scores calculated. Papers/presentations were scored for each LO. 1=deficient; 2=low; 3=medium; 4=high; 5=excellent. For LO4, ABT committee members were asked to rate how well the student explained the study rationale and justification for the 395/399 presentations of which there were 11 in Fall 2011 and 8 in Spring 2012 for a combined sample size of n = 19. ABT201 papers were assessed for LO4 by asking the reviewers to indicate how well the student explained why the research is important.

Results

The average score for LO4 was 3.0 for the ABT201 papers indicating the students did poorly (low = 2) to mediocre (medium =3) at explaining why the research should be performed (one facet of being involved in research that can be scored between 201 and 395/399). The score for this LO was much improved in the 395/399 presentations with an average score of 4.5. This indicates high quality explanation of the value of the research to society. Based on this sampling, it is clear that the students made much improvement between 201 and 395/399 for LO4.

Interpretation of Results

Details on the process of collecting and assessing the data are described in Methods. Members of the coordinating committee in attendance at the Fall 2011 and Spring 2012 395/399 presentations used the rubric to score the presentations. The co-directors of undergraduate studies (M.Goodin and S.Perry) and Dr. D. Howe (chair of the coordinating committee) scored the 201 papers. Data analysis was performed by M. Goodin and recommendations agreed upon by M. Goodin, D. Howe and S. Perry.

The scores for LO4 increased from an average of 3 (medium) to 4.5 (high to excellent) from the 201 to the 395 experience.

The ABT students continue to excel in their research pursuits. Several were awarded prestigious external scholarships to support their research in the past year including the Astronaut, Goldwater and Beckman scholarships as well as an American Society of Plant Biologists Summer Undergraduate Research Fellowship (ASPB-SURF) award.

The ABT program continues to attract and retain excellent students. A measure of this is the high number of merit scholars entering the program in 2012 (18 merit students will enter the program in Fall 2012). The Vice- and President of the Student Body 2011 were both ABT students. Many of the students co-author peer-reviewed scientific manuscripts from their independent study projects. ABT consistently places graduates in high caliber graduate and professional programs.

Improvement Action

A guide to preparing quality written and oral presentations will be provided to students in all relevant ABT courses (ABT101, 201, 301 and 395) that will help students develop project outlines early in the semester and throughout their undergraduate tenure. Additional incentive to spur student attention to quality presentations will be to encourage participation in the Alltech Young Scientist Program, which requires a 3500 word essay, and which awards a $5000 scholarship to the winner (http://www.alltech.com/education/alltech-young-scientist/about). We will track the numbers of students enrolled in the "pipeline" of presentation-oriented courses in the ABT program (ABT101, 201, 301 and 395), as an indicator of how mentoring in presentation skills contributes to overall success in the program. We will continue to quantify the quality of written and oral presentations, particularly between ABT201 and ABT395 as this should reflect the most significant transition from inexperienced writers to polished presenters in the ABT program.

Summary IAP over the years and uses of results, Oct. 29, 2012:

Over the period of assessment, data has been collected to demonstrate that students progress in their ability to communicate about their and others' research and the value of particular areas of research to society with number of years of their program completed. Therefore we used these results to introduce assignments and resources to support development of these skills earlier in their degree program. Specifically, an assignment was added to ABT201, a course normally taken in the Fall of the Sophomore year, to have students identify the topic of their paper and justify the importance of the research question or problem to society (e.g. why should tax dollars be spent to support a particular research area?).To help students develop effective written and oral presentations, guidelines are provided in multiple core courses throughout their time at UK. At the initiative of a faculty member, a new course has been developed ABT120: Genetics and Society, in which second semester freshmen will enroll. This course will provide hands on lab experience earlier in their degree program than currently available. Because the course will enroll not only ABT students but also non-science majors (the course is an approved UK Core course for Inquiry in Natural, Physical and Mathematical Sciences), students will gain experience communicating about science with a broader population than only other science-oriented students. The course includes a number of written and oral debate exercises to help develop our students' skills in these areas as well. Finally a number of other initiatives have been taken to strengthen our program. Students are made aware of broadening opportunities available to them such as Education Abroad, or the ability to perform research or internships nationally as well as internationally. These, as well as other opportunities are presented in ABT101 and 201.

Reflection

Over the period of assessment, data has been collected to demonstrate that students progress in their ability to communicate about their and others' research and the value of particular areas of research to society with number of years of their program completed. Therefore we used these results to introduce assignments and resources to support development of these skills earlier in their degree program. Specifically, an assignment was added to ABT201, a course normally taken in the Fall of the Sophomore year, to have students identify the topic of their paper and justify the importance of the research question or problem to society (e.g. why should tax dollars be spent to support a particular research area?).To help students develop effective written and oral presentations, guidelines are provided in multiple core courses throughout their time at UK. At the initiative of a faculty member, a new course has been developed ABT120: Genetics and Society, in which second semester freshmen will enroll. This course will provide hands on lab experience earlier in their degree program than currently available. Because the course will enroll not only ABT students but also non-science majors (the course is an approved UK Core course for Inquiry in Natural, Physical and Mathematical Sciences), students will gain experience communicating about science with a broader population than only other science-oriented students. The course includes a number of written and oral debate exercises to help develop our students' skills in these areas as well. Finally a number of other initiatives have been taken to strengthen our program. Students are made aware of broadening opportunities available to them such as Education Abroad, or the ability to perform research or internships nationally as well as internationally. These, as well as other opportunities are presented in ABT101 and 201.

Attachments

No Attachments

UNIVERSITY OF KENTUCKY®

Annual Student Learning Outcomes Report

College of Agriculture, Food and Environment
Agricultural Biotechnology - Bachelor
2012-2013 ABT

Student Learning Outcome(s) Assessed

agbiotch.b : Interpret & Evaluate Agricultural Biotechnology graduates will demonstrate the ability to interpret and evaluate modern biotechnology approaches to the manipulation and improvement of plants, animals, microorganisms, and the control of agricultural pests and diseases.

agbiotch.b : Acquire Knowledge Agricultural Biotechnology graduates will acquire knowledge about the range of approaches to manipulate and improve plants, animals and microorganisms.

Assessment Methods and Tools

Papers from ABT201 and public presentations from ABT395/399 were evaulated with respect to the four learning outcomes. Data is collected on all four outcomes each year but LO1 and 2 are assessed this cycle. Because these outcomes (Interpret and evaulate modern biotechnology, LO2 and Aquire knowledge about approaches, LO1) are closely related, they will be assessed together in this analysis. For 395/399, a rubric was provided to each ABT committee member in attendance to evaulate each presentor (each Fall and Spring semester has approximately 10 presenters). For 201, random papers (n=3) are selected each year, students identifiers removed, and the papers evaluted using a rubric by the members of the committee. Data was compiled and average scores calculated. Papers/presentations were scored 1 = deficient; 2 = low; 3 = medium; 4 = high; and 5 = excellent. For LO1, evaluators were asked to assess if the student understands the question/problem and approaches to assess the question. For LO2 students were assessed for whether they understand the pros and and cons of approaches used and caveats of interpretation.

Results

For LO1, the average score compiled from ABT 201 papers from 2011 and 2012 was 2.9 (standard deviation of 0.7); and for LO2 was 2.5 (0.7) indicating a low to medium understanding of approaches to questions (LO1) and pro/cons of the approaches/caveats to interpretation (LO2). For the 395/399 presentations these scores were 4.3 (0.7) and 3.9 (0.7) respectively indicating improvement in these areas.

Interpretation of Results

The ABT program is successful at improving our students understanding of modern biotechnology and approaches to current health, agricultural, and enviromental challenges that can be met by biotechnology. Scores greatly improve between 201 and 395/399 which measure understanding early in the program and near completion. Scores are near (3.9) or above "high" (4) for all LO. The most recent scores (Spring 2013) for ABT395/399 for all LO's are 4.3 to 4.8. Thus we are meeting our target.

Data was collected by members of the ABT faculty/coordinating committee, compliled by co-directors for UGS M. Goodin and S. Perry. This report was generated by S. Perry with input from M. Goodin and D. Howe (Chair of the ABT Coordinating Committee).

Improvement Action

ABT is currently undergoing a Self Study process that will be followed by External Review that will provide an opportunity to reflect on our assessment process. As part of the self study, Admissions Committees and Associate Deans of Admissions of the UK Medical School and Pharmacy programs were contacted and asked for feedback on the ABT students who enter these programs after their B.S. Feedback on our graduates has been very positive with ABT students recognized as among the most prepared and once in the programs, among the most successful. ABT continues to attract excellent students with high numbers of Merit students entering the program, and while in the program, students receiving prestigious external scholarships to support research activities, and publishing their research in peer reviewed scientific journals.

ABT already has high expectations and our students excel in the program and once they graduate. Therefore the goal of the program is to maintain the current level of success.

Reflection

Attachments

No Attachments

ABT Student Awards

Undergraduate Research Awards

AMSTEMM Research Fellowship (Spring 2013) Jessica Gambrel

Undergraduate Research Fellowship (Summer 2013) Jessica Gambrel

AMSTEMM Research Fellowship (Fall 2012, Spring 2013, Fall 2013) Rebecca Wente

Office of Undergraduate Research Summer Creativity Grant (Summer 2012) Rebecca Wente

AMSTEMM Research Fellowship Research Fellowship (Fall 2011, Spring 2012) Ashlee Anciro

Summer Undergraduate Research Fellowship (summer 2011) Emerson Dick

Undergraduate Research Summer Creativity Grant (Summer 2012) Ashlee Anciro

AMSTEMM Undergraduate Research Fellowship (2011-2012) Alyssa Fountain

AMSTEMM Undergraduate Research Fellowship (Spring 2009, Summer 2009, Fall 2011) Philip Houtz

AMSTEMM Undergraduate Research Fellowship (Summer 2010) James Baulding

Undergraduate Summer Research Grant (Summer 2008, Summer 2009) Kristin Kopperud

AMSTEMM Research Fellowship (Fall 2008) Mark Adams

Travel Awards

American Society of Virology Travel Grant (Summer 2013) Joseph Wells

Office of Undergraduate Research Travel Grant to the 2013 National Conference for Undergraduate Research (NCUR) Raquel Hegge

Office of Undergraduate Research Travel Grants (Nov. 2012, April 2013, November 2013) Rebecca Wente

The American Arachnological Society Travel Grant (July 2012) Rebecca Wente

Barry M. Goldwater Scholarship

2011 Philip Houtz

2011 Taylor Lloyd

2009 Lesley Man

Astronaut Scholarship Foundation Award

2011 Taylor Lloyd

Summer Undergraduate Research Fellowship Award from the American Society of Plant Biologists

2011 Taylor Lloyd

Alltech Young Scientist Award Undergraduate Regional Winner

2013 Samuel Janes

Beckman Scholars

2010-2011 Philip Houtz

2009-2010 Jessica Houtz

2009-2010 Laura Crawford

2008-2009 Lesley Mann

Chellgren Scholars

2009 Philip Houtz

2009 Zachary Willard

2012 Jessica Gambrel

Gates Cambridge Scholar

2010 Lesley Mann

Wethington Fellowship

2010 Laura Crawford

Outstanding Senior in the UK College of Agriculture

2009 Jessica Houtz

Outstanding Junior in the UK College of Agriculture

2010 Philip Houtz

The Oswald Research & Creativity Award

2013 Raquel Hegge

The Glenn Collins Undergraduate Research Achievement Award in Agricultural Biotechnology

Spring 2013 Raquel Hegge

Fall 2012 Joseph Wells

Spring 2012 Abby Rowland

Fall 2011 Damon Revelette

Spring 2011 Philip Houtz

Fall 2010 Micah Fielden

Spring 2010 Anita Fletcher

Fall 2009 Emily Cottrell

Spring 2009 Cassie Modahl and Elyse Tinker

Fall 2008 Reega Purohit

Spring 2008 Erika Namay

Fall 2007 Taylor Ashley and Carolyn Crowdus

Spring 2007 Aaron McNulty and Jeremy Bonzo

Special Awards and Recognitions

Elizabeth S. Moore, the Veterinary Investigator Program at Cornell University for (Summer 2008)

Devin Henry, Cornell Summer Research Program (Summer 2013)

Claci Ayers, Football Homecoming Queen (Fall 2013)

Micah Fielden, President of the University of Kentucky Student Government Association (Fall 2011 - Spring 2012)

Nicole Hunt, Vice-President of the University of Kentucky Student Government Association (Fall 2011 - Spring 2012)

Micah Fielden, Outstanding Greek Man (2010) Nicole Hunt, Outstanding Greek Woman (2011)

Comments from Dr. Carol Elam, Associate Dean for Admissions and Institutional Advancement, University of Kentucky College of Medicine:

"I believe the ABT program is the one of the most rigorous degree programs that undergraduate students can pursue at the University of Kentucky. Students complete demanding coursework, and have opportunities to pursue research in leading edge laboratories. I consider the advising for this program as well as the available support services through the College of Agriculture to be outstanding. For students who are considering work in the science fields, this degree can lead to many different careers. (And the College of Agriculture does an outstanding job in helping students learn of the range of possible positions and meet recruiters.) For ABT graduates who choose to come to medical school, I have found them to be well prepared, excellent time managers, and frankly… just nice people.

Some information about the performance of students who entered the UKCOM from 2008-2013 follows:

From this six year period, we matriculated 11 students who completed Agricultural Biotechnology majors. Four of these individuals are currently M2 or M3 students. Seven students are currently M4 or have graduated. Three of the 7 have been named Alpha Omega Alpha, and three of the remaining 4 were AOA eligible... *meaning they were in the top quarter of the class*. (Alpha Omega Alpha is the national medical honorary that requires outstanding academic performance as well as leadership and service. It is the most prestigious honor society in medicine.)

I have also attached the unedited comments from our medical school admissions committee members regarding the two questions that we agreed to pose to them in our earlier emails."

1. **How would you characterize their academic preparation at the time of their application to medical school?**

   Can't recall interviewing any.

   No useful data. I do not recall interviewing or working with them.

   I can't recall any specific candidates. Students seem to be well prepared.

   I know two of your students from their MS3 clerkship and both are doing quite well so I feel the Ag Bio program is doing a fine job.

2. **Do you have suggestions what the ABT program could do to enhance the academic preparation of students who may choose to apply to medical school?**

   Take immunology course

   No suggestion for change

A great program-student we admit does very well. I work primarily with admissions and I see a number that have not had proper counseling about the admissions process early in their undergrad years.

ABT faculty should become aware of the AAMC core entry level competencies and changes in the MCAT and adjust curriculum accordingly.

Overall opinion of ABT program is favorable and would be a good choice by pre-meds.

I have no suggestions on how to improve since I think they compare well with other well- prepared students.

Comments from Dr. Penni Black, University of Kentucky College of Pharmacy:

“I think I can speak for most of my colleagues in Pharm Sci that the students from Ag Biotech are among our most prepared students. I cannot recall an instance of a struggling student who began their academic career with you all, because I usually ask. I am aware that a few of our better students were Ag Biotech majors. I'm sure there are cases in between too.

Sorry I can't be more data-driven.”

ABT alumni survey

SurveyMonkey

1. In what month and year did you graduate?

	Response Count
	35
answered question	**35**
skipped question	**0**

2. What is your current status (student in graduate or professional school, employment position, etc.)?

	Response Count
	35
answered question	**35**
skipped question	**0**

3. How effective was the teaching within the ABT major?

	Response Percent	Response Count
Extremely effective	**48.6%**	**17**
Very effective	**48.6%**	**17**
Moderately effective	2.9%	1
Slightly effective	0.0%	0
Not at all effective	0.0%	0
answered question		**35**
skipped question		**0**

4. How effective was the teaching outside your major at the University of Kentucky?

		Response Percent	Response Count
Extremely effective		8.8%	3
Very effective		41.2%	14
Moderately effective		**50.0%**	**17**
Slightly effective		0.0%	0
Not at all effective		0.0%	0
		answered question	**34**
		skipped question	**1**

5. How helpful was your academic advisor?

		Response Percent	Response Count
Extremely helpful		**54.3%**	**19**
Quite helpful		22.9%	8
Moderately helpful		8.6%	3
Slightly helpful		8.6%	3
Not at all helpful		5.7%	2
		answered question	**35**
		skipped question	**0**

6. Were you employed full-time upon graduation?

	Response Percent	Response Count
Yes	22.9%	8
No	**77.1%**	**27**
	answered question	**35**
	skipped question	**0**

7. Did you attend graduate or professional school in the academic year immediately following graduation?

	Response Percent	Response Count
Yes	**80.0%**	**28**
No	20.0%	7
	answered question	**35**
	skipped question	**0**

8. Overall, were you satisfied with your experience as an Ag Biotechnology major, neither satisfied nor dissatisfied with it, or dissatisfied with it?

	Response Percent	Response Count
Extremely satisfied	**71.4%**	**25**
Moderately satisfied	20.0%	7
Slightly satisfied	5.7%	2
Neither satisfied nor dissatisfied	0.0%	0
Slightly dissatisfied	0.0%	0
Moderately dissatisfied	2.9%	1
Extremely dissatisfied	0.0%	0
answered question		**35**
skipped question		**0**

9. What were your most favorite experiences as an Ag Biotechnology major?

	Response Count
	29
answered question	**29**
skipped question	**6**

10. What were your least favorite experiences as an Ag Biotechnology major?

	Response Count
	25
answered question	**25**
skipped question	**10**

11. How could the student experience in Ag Biotechnology be improved?

	Response Count
	26
answered question	26
skipped question	9

12. Do you have any general comments about the Ag Biotechnology degree program?

	Response Count
	27
answered question	27
skipped question	8

Q1. In what month and year did you graduate?		
1	May 2007	Nov 25, 2013 6:29 PM
2	May 2008	Nov 21, 2013 3:06 PM
3	May 2007	Nov 15, 2013 7:49 PM
4	5/2003	Nov 14, 2013 2:26 PM
5	May 2013	Nov 13, 2013 4:36 PM
6	May 2010	Nov 13, 2013 3:32 PM
7	May 2012	Nov 13, 2013 12:14 PM
8	May 2007	Nov 13, 2013 10:34 AM
9	December 2001	Nov 12, 2013 7:13 PM
10	December 2011	Nov 12, 2013 3:07 PM
11	May 2007	Nov 12, 2013 2:09 PM
12	March 2000	Nov 12, 2013 1:48 PM
13	May 2008	Nov 12, 2013 1:11 PM
14	May 2003	Nov 12, 2013 12:43 PM
15	5/11	Nov 12, 2013 11:59 AM
16	May 2012	Nov 12, 2013 10:29 AM
17	May 2007	Nov 12, 2013 9:53 AM
18	05/2007	Nov 12, 2013 9:10 AM
19	May 2001	Nov 12, 2013 9:00 AM
20	May 2010	Nov 12, 2013 8:55 AM
21	May 2007	Nov 12, 2013 8:54 AM
22	December 2004	Nov 12, 2013 8:51 AM
23	5/11	Nov 12, 2013 8:32 AM
24	May 2013	Nov 12, 2013 7:51 AM
25	May 2002	Nov 12, 2013 7:45 AM
26	12/2011	Nov 12, 2013 7:37 AM
27	May 2008	Nov 12, 2013 7:27 AM

Q1. In what month and year did you graduate?		
28	June 2005	Nov 12, 2013 7:03 AM
29	May 2006	Nov 12, 2013 6:53 AM
30	May 2001	Nov 12, 2013 6:46 AM
31	May 2003	Nov 12, 2013 6:26 AM
32	May 2013	Nov 12, 2013 6:21 AM
33	May 2010	Nov 12, 2013 6:18 AM
34	May 2008	Nov 12, 2013 6:15 AM
35	May 2010	Nov 12, 2013 6:09 AM

Q2. What is your current status (student in graduate or professional school, employment position, etc.)?		
1	Completed MS in Physician Assistant Studies, working as Physician Assistant in Orthopedic Surgery	Nov 25, 2013 6:29 PM
2	Pharmacist	Nov 21, 2013 3:06 PM
3	Pharmacy Manager	Nov 15, 2013 7:49 PM
4	Employed as a physician at Baptist Health lexington	Nov 14, 2013 2:26 PM
5	Graduate School	Nov 13, 2013 4:36 PM
6	Graduate student	Nov 13, 2013 3:32 PM
7	Professional School - Pharmacy	Nov 13, 2013 12:14 PM
8	Third year medical resident at Baylor College of Medicine Ob/gyn	Nov 13, 2013 10:34 AM
9	Technician Specialist, Battelle Biomedical Research Center	Nov 12, 2013 7:13 PM
10	Dental School Student	Nov 12, 2013 3:07 PM
11	Grad Student at UK Law	Nov 12, 2013 2:09 PM
12	Gastroenterologist	Nov 12, 2013 1:48 PM
13	Residency- Urologic Surgery	Nov 12, 2013 1:11 PM
14	Construction Manager	Nov 12, 2013 12:43 PM
15	Uk medical school 3rd yr	Nov 12, 2013 11:59 AM
16	Graduate Student- Public Health	Nov 12, 2013 10:29 AM
17	MD - Dermatology Resident at Kansas University	Nov 12, 2013 9:53 AM
18	dentist	Nov 12, 2013 9:10 AM
19	Teacher- AP Biology, Biology, Anatomy, Department Chair and Program Coordinator for a Title I program at Rome High School	Nov 12, 2013 9:00 AM
20	Fourth Year Medical Student	Nov 12, 2013 8:55 AM
21	Postdoctoral Fellow, Vanderbilt University School of Medicine	Nov 12, 2013 8:54 AM
22	Postdoctoral Fellow	Nov 12, 2013 8:51 AM
23	3rd year of medical school at UK	Nov 12, 2013 8:32 AM
24	student in graduate school	Nov 12, 2013 7:51 AM
25	Full time Infection preventionist at hospital	Nov 12, 2013 7:45 AM
26	Employment position	Nov 12, 2013 7:37 AM

Q2. What is your current status (student in graduate or professional school, employment position, etc.)?		
27	student in MD/PhD program	Nov 12, 2013 7:27 AM
28	Lab manager	Nov 12, 2013 7:03 AM
29	Pediatrician in private practice	Nov 12, 2013 6:53 AM
30	Assistant Professor of Biology	Nov 12, 2013 6:46 AM
31	Assistant Director for Research Markey Cancer Center University of Kentucky	Nov 12, 2013 6:26 AM
32	Student in optometry school	Nov 12, 2013 6:21 AM
33	Professional school	Nov 12, 2013 6:18 AM
34	Intellectual Property Attorney	Nov 12, 2013 6:15 AM
35	Student in professional school - dental school	Nov 12, 2013 6:09 AM

Q9. What were your most favorite experiences as an Ag Biotechnology major?		
1	I liked the small college feel at a big university	Nov 25, 2013 6:29 PM
2	The ABT genetic courses	Nov 21, 2013 3:06 PM
3	Genetics, Dr. Collins, working in the lab	Nov 15, 2013 7:49 PM
4	Collage of Ag was great. Class were great. I worked in a lab for Dr. Collins. That was probably my favorite experience that and my last biotech class? I can't remember what the number was now like 401 Dr. Chappell taught it. It was lab based. Lots of fun.	Nov 14, 2013 2:26 PM
5	The experience that you get when doing lab research, I found in my masters program that I had been exposed to a broader amount of material than most others.	Nov 13, 2013 4:36 PM
6	ABT 495	Nov 13, 2013 3:32 PM
7	One of my favorite experiences with the Ag biotech program are the close relationships that I formed with classmates. Especially when you reach your 3rd and 4th year you begin to have classes with the same people both ABT and some of the larger classes. I really liked when we had the cookout so you could see the professors and relax with friends. Having small classes such as ABT 495, genetics, and such allow you to get to know the professors well and form a better relationship with them.	Nov 13, 2013 12:14 PM
8	Knowing the people i had classes with, reaearch experience, rigorous work that was employable/applicable whether i wanted to work or go to grad school	Nov 13, 2013 10:34 AM
9	Meeting other people in the Ag school and learning about other disciplines. (I was not from an Ag background and had no idea there were majors like ag econ or Ag Journalism.)	Nov 12, 2013 7:13 PM
10	I really enjoyed my experience as a whole. The science classes taught in the Ag department prepared me very well for the graduate and professional school classes I have taken. One of my favorite classes in the program was agronomy.	Nov 12, 2013 3:07 PM
11	The ABT Lab w/ Dr. Chappell was fantastic, I also really enjoyed Biochem w/ Dr. Watt, that may have been my favorite class. He was brilliant. My research and subsequent presentation was also a lot of fun. I also really enjoyed the flexibility of the Major. I was able to get my Sustainability Minor and that was great.	Nov 12, 2013 2:09 PM
12	Broad education in a field that is useful in itself. It is also an excellent training program for further study.	Nov 12, 2013 1:48 PM
13	Round up day, biotech labs, the close friendships I made with others in the biotech program	Nov 12, 2013 1:11 PM
14	Working thru my internship. It was the only opportunity I had to see the real world application of Biotechnology.	Nov 12, 2013 12:43 PM
15	Small class sizes and the ability to get to know professors.	Nov 12, 2013 10:29 AM
16	Small classes, great instructors, demanding workload	Nov 12, 2013 9:53 AM

Q9. What were your most favorite experiences as an Ag Biotechnology major?		
17	Working in Dr. Houtz's lab and all of the upper level courses.	Nov 12, 2013 9:00 AM
18	I appreciated that I was only one of a handful of students assigned to my academic advisor. She had loads of personally tailored advice and suggestions for me -- often without my even asking.	Nov 12, 2013 8:55 AM
19	Having the opportunity to perform undergraduate research. I also felt that I was more/better prepared than the average student at UK to excel in graduate or professional school. I was accepted into top 10 PhD programs because of my undergraduate research experience and scientific literacy.	Nov 12, 2013 8:54 AM
20	I thought it was very important (and fulfilling) that the degree required research for graduation. This was invaluable in preparing me for my move to graduate school. If I had decided to go straight into the workforce, I think it would have been equally as valuable. I also thought the genetics courses were strong as well as the lab class taught by Dr. Chappelle, although I can't remember the name of the course.	Nov 12, 2013 8:51 AM
21	I enjoyed the broad approach to the sciences and the required curriculum	Nov 12, 2013 8:32 AM
22	I loved being in a smaller biology major where everyone got to know everyone and was participating in research. And as much as I hated preparing for the independent project presentation, it is probably the number one thing that has helped me both in applying to grad school, and in working in grad school. If anyone continues in the sciences, they will have to give presentations like that, and it provides an opportunity to practice before it REALLY matters. Oh, and being part of the Ag school (picnic and great advisers) was nice too.	Nov 12, 2013 7:51 AM
23	Research	Nov 12, 2013 7:37 AM
24	I really loved my undergraduate research experience. I was in the same lab for three years, and I continue to communicate with my mentor regularly, even 6 years after graduation. I also really loved the capstone course. I also had a really excellent biotech adviser, who I also keep in touch with.	Nov 12, 2013 7:27 AM
25	I had a wonderful working relationship with my academic advisor who was instrumental in helping me find on-campus employment during the school year and internship opportunities during the summer. These research experiences were invaluable in helping me decide what I wanted to do after college.	Nov 12, 2013 6:46 AM
26	My research project	Nov 12, 2013 6:21 AM
27	Small class sizes and one on one help	Nov 12, 2013 6:18 AM
28	I enjoyed the hands-on lab work	Nov 12, 2013 6:15 AM
29	I really enjoyed my time working on my research project. I had an excellent mentor and learned a lot.	Nov 12, 2013 6:09 AM

Q10. What were your least favorite experiences as an Ag Biotechnology major?		
1	That the major required 12 more hours than other science degrees	Nov 21, 2013 3:06 PM
2	Nothing sticks out	Nov 15, 2013 7:49 PM
3	Ag Biotech is a great major. I didn't have any bad experiences	Nov 14, 2013 2:26 PM
4	I began in August 2008 and the one thing that I disliked was the way that ABT 101 was run. It just seemed sporadic and not very supportive of the students (possibly because there were many students in the class compared to many of the other ABT classes) and I felt that this turned some students away from a great program. I think that over the past few years this class has formed into a better overview of the program.	Nov 13, 2013 12:14 PM
5	Population genetic equations	Nov 13, 2013 10:34 AM
6	None.	Nov 12, 2013 3:07 PM
7	My classes were super difficult!! But it really prepared me well for law school	Nov 12, 2013 2:09 PM
8	Extra hours	Nov 12, 2013 1:48 PM
9	None	Nov 12, 2013 1:11 PM
10	Joe Chappell's class. It was too specific to what he did, not what the Biotech industry offered. Much like the Program itself, it was only about research, and repeating his work.	Nov 12, 2013 12:43 PM
11	More guidance in the ABT 399 (independent research) would have been helpful.	Nov 12, 2013 10:29 AM
12	none	Nov 12, 2013 9:53 AM
13	NA- I may have thought some of the classes were hard back then, but as I look back now, I greatly appreciate my depth of understanding of cellular biology and genetics.	Nov 12, 2013 9:00 AM
14	I'm not sure I have any, to be honest!	Nov 12, 2013 8:55 AM
15	I loved everything about ABT	Nov 12, 2013 8:54 AM
16	When deciding on my courses each semester, sometimes I felt like I had a better idea of what I needed to take than my advisor. However, I think my advisor was fairly new to advising students at the time.	Nov 12, 2013 8:51 AM
17	I never really considered myself a lab rat, so I didn't enjoy the required research project as much as others, but I did learn a lot of practical skills through it.	Nov 12, 2013 8:32 AM
18	ABT 495 was really hard. Not because the material was hard, but because there were so many things being done that a) we always went over the class time (by 2 hours sometimes) b) it was difficult to keep up with what we were trying to learn from our experiments because they all overlapped c)because we were rushing, over half the experiments didn't work. I think the class could be much better if a few experiments were removed so more time could be taken to explain the results, in addition to the methodology.	Nov 12, 2013 7:51 AM

Q10. What were your least favorite experiences as an Ag Biotechnology major?		
19	Presentations	Nov 12, 2013 7:37 AM
20	I hated the way the general physics labs were run, but that's just a required course, and not one taught by biotech.	Nov 12, 2013 7:27 AM
21	The academic advising I was given was a complete joke. Not helpful at all.	Nov 12, 2013 7:03 AM
22	My advisor was terrible	Nov 12, 2013 6:21 AM
23	Research	Nov 12, 2013 6:18 AM
24	I did not enjoy the "independent research" project....I don't advocate doing away with it, but I felt there was very little guidance leading up to it, it was justkind of sprung on us and many of us found ourselves scrambling to find something that would satisfy the requirement, instead of trying to find something we truly were interested in, which I believe is part of the point.	Nov 12, 2013 6:15 AM
25	I was not particulary fond of the ABT lab taught by Dr. Chapell.	Nov 12, 2013 6:09 AM

Q11. How could the student experience in Ag Biotechnology be improved?		
1	see above	Nov 21, 2013 3:06 PM
2	Not sure	Nov 15, 2013 7:49 PM
3	I thought it was great.	Nov 14, 2013 2:26 PM
4	I think the Ag biotech program could be improved by possibly having a more guided approach to helping each student identify a lab to work in. This would really be helpful possibly in the second year or along with ABT 201. This could help people who do not know exactly what they are interested in possibly identify a lab and a mentor.	Nov 13, 2013 12:14 PM
5	I don't know what it is like now	Nov 13, 2013 10:34 AM
6	More emphasis on learning to read primary literature. After graduation, I always felt pretty lost when handed a journal article and was told to critique it, because I had nearly no experience with this as an undergrad. This would be a helpful skill for those heading into research (or even medicine).	Nov 12, 2013 7:13 PM
7	Having a student group would be beneficial for students looking for study partners.	Nov 12, 2013 3:07 PM
8	I would have liked more classes with the other ABT majors. The ABT lab w/ Dr. Chappell was so great b/c I finally got to see my other ABT students.	Nov 12, 2013 2:09 PM
9	More intensive career guidance may be helpful.	Nov 12, 2013 1:48 PM
10	None	Nov 12, 2013 1:11 PM
11	Be more proactive with job placement opportunities and discussion / introduction of various work in the Biotechnology Industry that was not lab specific. It was way too lab/research based. The Ag Biotech industry is very broad based as I have come to find out in recent years. In my opinion, the program was so focused on lab/research work. For a person like me that was not destined for a lab, I felt like I did not get the full array of instruction and help on what the Industry had to offer. I soon ended up in construction management, using little, if any of my education. I suppose I should have been an Ag business major?	Nov 12, 2013 12:43 PM
12	More exposure to different professional opportunities possible with the degree. ABT did a nice introduction of this, but it may be useful to have a "refresher" later in course.	Nov 12, 2013 10:29 AM
13	Maybe start a network with undergrads connecting to graduates in their respective fields. I'd be more than willing to mentor people.	Nov 12, 2013 9:53 AM
14	It was pretty small when I was there, I would have liked more social experiences for just Ag Biotech rather than the school of AG. I like AG people, but biotech majors tend to be a little different from the overall school, so it would have been nice.	Nov 12, 2013 9:00 AM
15	I would have liked to experience more events for Ag Biotech students outside the classroom. Even though it's a small community, I felt as if I only knew about half the students with whom I graduated.	Nov 12, 2013 8:55 AM

Q11. How could the student experience in Ag Biotechnology be improved?		
16	Increase awareness of external scholarships/internships.	Nov 12, 2013 8:54 AM
17	I think more molecular biology-based labs may be beneficial. The intro to biology labs (BIO 150 series) seemed a bit too broad for Ag Biotech.	Nov 12, 2013 8:51 AM
18	I think that it is a wonderful program. One suggestion I have is maybe having a group of research mentors for a group of students with set interests, for example, students with an interest in medicine could be matched with a preceptor who does research at the college of medicine.	Nov 12, 2013 8:32 AM
19	I think there should be more ABT specific classes that fulfill the major or specialty support requirements. My favorite part about these classes was that everyone in them was ABT, so by junior year there was an amazing sense of camaraderie (and occasionally commiseration). In the general bio classes, most of the students were pre-med and were not interested in actually learning the material (read very whiny and annoying). Also, ABT 460, 461, and 495 were the best taught classes I took at UK, and I think students would learn more/better if there were more classes like those.	Nov 12, 2013 7:51 AM
20	More variety in electives allowed to fulfill major. Like immunology or endocrinology or pharmacology courses	Nov 12, 2013 7:37 AM
21	I would have liked more biotech classes taught by the ABT faculty. I seem to remember there were only a couple in the beginning, and more towards the end.	Nov 12, 2013 7:27 AM
22	Get academic advisors that actually know what they are advising about and that actually care about what happens to the student.	Nov 12, 2013 7:03 AM
23	More opportunities to meet people within my major	Nov 12, 2013 6:21 AM
24	A lot of these students are wanting to go to professional school so maybe have a course where admissions from several of uk professional schools come in	Nov 12, 2013 6:18 AM
25	See above #11	Nov 12, 2013 6:15 AM
26	A large portion of the ABT students are pre-professional. It might be a good idea to try to organize "sub-groups" within ABT for each of the respective professional schools to which ABT students are applying.	Nov 12, 2013 6:09 AM

Q12. Do you have any general comments about the Ag Biotechnology degree program?		
1	Great option for pre-professional students, Ag Biotech degrees set them apart from biology degree students	Nov 25, 2013 6:29 PM
2	no	Nov 21, 2013 3:06 PM
3	It prepared me very well for my career. If I could do it all over again, I would definitely choose ABT again	Nov 15, 2013 7:49 PM
4	Great degree, I went on to medical school, so I haven't really used it but I would have been well if I had to find a position in the field. I would consider offering a Masters degree (If you guys haven't already) and really encourage people to work in the labs, That was the best experience.	Nov 14, 2013 2:26 PM
5	I thought the Ag. Biotech program was great and am so thankful this is what I majored in. After graduating and being in professional school here at UK, I have told people I graduated from the Ag. Biotech program and they have told me that they know students who graduate from the program are top students. I felt the program prepared me to think independently, solve problems, and be ready for professional school course work.	Nov 13, 2013 12:14 PM
6	That the program attracted and graduated some very hardworking and successful people who I am still friends with at this time.	Nov 13, 2013 10:34 AM
7	I felt the major was well designed and had a lot of helpful classes. A little more help in determining post-graduation options would have been nice. That was the job of the academic advisor I suppose, but they always seemed eager to push people toward grad school. There was never much discussion of employment opportunites without further education.	Nov 12, 2013 7:13 PM
8	I believe this is one of the best programs that UK offers. The classes and curriculum have me the tools necessary to succeed in a graduate masters program and professional school.	Nov 12, 2013 3:07 PM
9	It was a great foundation for my legal career, and any career for that fact. There is a lot of flexibility with the major, and I really enjoyed it. The major allows for a lot of flexibility with choosing classes which was very cool. It was also very hard and challenging, and is a great preparation for any future career or grad school.	Nov 12, 2013 2:09 PM
10	Excellent program.	Nov 12, 2013 1:48 PM
11	I was very well prepared for medical school and thought that the rigorous course load paid off.	Nov 12, 2013 1:11 PM
12	It has been a while since I graduated, but I can only hope that the program has or will begin to focus on the various aspects of Biotechnology instead of being so focused on just the research aspect. I am sure there are other students who like me are not destined to be lab rats and dedicate their careers to research. Not that there is anything wrong with that, but Ag Biotechnology to me is about way more than just research. I felt under-prepared for professional life upon the completion of my Collegiate career.	Nov 12, 2013 12:43 PM
13	Best program in the state and region	Nov 12, 2013 11:59 AM

Q12. Do you have any general comments about the Ag Biotechnology degree program?		
14	One of the best aspects of my time at UK!	Nov 12, 2013 10:29 AM
15	great!	Nov 12, 2013 9:53 AM
16	It was a wonderful experience and I would go back in a heartbeat!	Nov 12, 2013 9:00 AM
17	I would encourage all self-starting, motivated students interested in any of the sciences to consider Ag Biotech. The coursework and advising lay a strong foundation for any field you could choose to pursue after graduation.	Nov 12, 2013 8:55 AM
18	Becoming an ABT major was one of the best decisions I've made. I was extremely prepared to handle the workload and competitiveness of graduate school in a top 5 program. I will begin my faculty search within the next two years, and will definitely explore tenure track positions at the University of Kentucky.	Nov 12, 2013 8:54 AM
19	I thought the Ag biotech program prepared me well for my PhD program at a very prestigious institution. I was very happy with the program and was so happy I chose Ag Biotech over the traditional biology program in A&S.	Nov 12, 2013 8:51 AM
20	Great program, I'm so glad I switched freshman year. And I know I was well prepared by it because I got accepted to the grad schools I wanted to get into and was prepared to do the research I wanted to do.	Nov 12, 2013 7:51 AM
21	No	Nov 12, 2013 7:37 AM
22	Thank you, thank you. I had such a great experience, and I'm not sure I would have discovered (or been as prepared for) my current career path without it!	Nov 12, 2013 7:27 AM
23	The program really just gets you ready for another degree program. By itself it's pretty useless, I think the same of a degree for biology though for comparison. All of the advisors I had in the program were not helpful and did not care. I had to switch advisors myself when the person I was assigned knew nothing about the biotech curriculum. I never found anyone much better.	Nov 12, 2013 7:03 AM
24	I think the program prepared students very well for a variety of post-graduate opportunities -- graduate school, med school, vet school and the job market. It was a very challenging program but also very rewarding. In the midst of a very large university, the Biotech program provided a comfortable environment for learning and meeting a cohort of students on a similar academic journey.	Nov 12, 2013 6:46 AM
25	Great experience I wouldn't change my major!	Nov 12, 2013 6:18 AM
26	I think there should be a little more exposure/PR, as it is a great program. For example, the patent and trademark office (USPTO) does not recognize Ag Biotech as a technical degree on the same page as biology, chemistry, and engineering. Clearly that should change.	Nov 12, 2013 6:15 AM
27	I felt very prepared for my professional program. The ABT program does an excellent job ensuring that undergraduate students are exposed to the type of courses/experiences that are useful down the road. The faculty in the College of Ag are wonderful, and I greatly appreciated the smaller, more personal atmosphere of the ABT program.	Nov 12, 2013 6:09 AM

Summary of ABT Teaching and Course Evaluations

2008-2009

Course/Unit	Fall		Spring	
	Value of Course	Quality of Teaching	Value of Course	Quality of Teaching
ABT 101	3.2	3.3		
ABT 201	3.2	3.5		
ABT301	3.4 3.6	3.8 3.7	3.8	4.0
ABT460			3.0	3.0
ABT461			3.2	3.5
ABT495	3.5	3.4		
ABT overall	3.3	3.4	3.3	3.4
College	3.3	3.4	3.3	3.4
Provost area	3.3	3.4	3.3	3.4

2009-2010

Course/Unit	Fall		Spring	
	Value of Course	Quality of Teaching	Value of Course	Quality of Teaching
ABT 101	3.4	3.7		
ABT 201	3.6	3.6		
ABT301	3.2 3.3	3.2 3.7	3.8	4.0
ABT460			3.3	3.5
ABT461			3.0	3.3
ABT495	3.6	3.4		
ABT overall	n/a	n/a	3.5	3.6
College	3.3	3.4	3.4	3.4
Provost area	3.3	3.4	3.3	3.4

2010-2011

Course/Unit	Fall		Spring	
	Value of Course	Quality of Teaching	Value of Course	Quality of Teaching
ABT 101	3.7	3.6		
ABT 201	3.7	3.8		
ABT301	3.4 3.9	3.9 3.9	3.7	3.9
ABT360	3.4 3.2*	3.6 3.1*		
ABT460			2.9	3.1
ABT461			3.2	3.6
ABT495	3.5 3.5*	3.7 3.5*		
ABT overall	3.4	3.5	3.3	3.5
College	3.4	3.5	3.4	3.5
Provost area	3.3	3.4	3.3	3.4

2011-2012 (Spring, in class evaluations)

Course/Unit	Fall		Spring	
	Value of Course	Quality of Teaching	Value of Course	Quality of Teaching
ABT 101	3.8	3.8		
ABT 201	3.5	3.8		
ABT301	3.4	3.6	3.5	3.9
ABT460			3.2*	3.1*
ABT461			3.5	3.7
ABT495	3.5	3.7		
ABT overall	3.6	3.8	3.4	3.6
College	3.4	3.5	3.4	3.5
Provost area	3.3	3.4	3.3	3.4

2012-2013 (in class evaluations)

Course/Unit	Fall		Spring	
	Value of Course	Quality of Teaching	Value of Course	Quality of Teaching
ABT 101	n/a	n/a		
ABT120	2.5*	3.0*	3.7	3.8
ABT 201	3.6	3.7		
ABT301	3.2	3.6	3.8	4.0
ABT460			2.9	3.2
ABT461			3.0	3.6
ABT495	3.1	3.1		
ABT overall	3.3	3.5	3.2	3.6
College	3.4	3.4	3.5	3.5
Provost area	3.3	3.4	3.4	3.5

*first time the course was offered or first time a new faculty taught the course

External Review

Agricultural Biotechnology Program Review

University of Kentucky

March 2-4, 2014

Submitted By:

Julie Campbell – Alltech, Inc.
Amit Dhingra – Washington State University
Jessica Gambrel – Undergraduate, University of Kentucky
Craig Vander Koii – University of Kentucky
Rebecca Lamb – The Ohio State University
Sue Nokes, Committee Chair, University of Kentucky
Reddy Pali – University of Kentucky
Ling Yuan – University of Kentucky

Summary of Recommendations

1. It is highly recommended that CAFE prioritize promotion and sustainability of the ABT program in its strategic plan. ABT is a unique program and the success of the ABT program concept based on its students' success is bound to breed competitive models both at the college, University and at other peer institutions that might erode enrollment if this issue is not aggressively addressed.
2. The review committee recommends that additional resources be committed to the ABT program in the form of a full-time academic coordinator, and that two full-time TAs be assigned to the program (one for ABT 120 and one for ABT 495; the two lab-intensive courses in the program).
3. The program is strongly encouraged to consider changing its name by either dropping the word agriculture from its name or adding another modifier to better align the program title with the academic program's mission and to enhance the program's reach.
4. It is recommended that an alumni database be established. This could be developed by the academic coordinator for whom full time support has been requested. The Steering Committee is encouraged to develop a plan for more fully utilizing this great resource based on the recommendations contained below in the Alumni Relations section.
5. To accommodate and enhance continued growth of the program, engagement with other colleges and units is strongly encouraged. (more detail in the Cross-disciplinary Cooperation section).
6. Develop a formal process to regularly review the curriculum offerings, and determine if the curriculum is remaining current and relevant to the needs of today's students and employers.
7. Revise the ABT web page with the focus on making it more student-centered.
8. Establish a physical "home" for ABT, possibly in a suite with additional offices for the other interdisciplinary academic programs in CAFE.
9. Offer a one hour seminar in technical business writing and interviewing skills.
10. Students desire a more structured process, provided early in the program, that could jumpstart the matching of students with research mentors and labs.

Summary comments: The CAFE and its faculty leadership are to be applauded for establishing a functional, productive and unique interdisciplinary undergraduate ABT program. Most peer institutions focus primarily on interdisciplinary graduate programs which draw students who do not have any prior knowledge of the confluence of disciplines. ABT addresses a critical gap in US education; that is to adequately prepare undergraduate students in interdisciplinary STEM disciplines.

The ABT program is healthy and has successfully navigated transitions in key leadership positions due in large part to the dedication and passion of the faculty members involved in the program. The Review Committee makes the following observations and recommendations with the intent to ensure the continued health of the academic program, and to attempt to establish a framework that provides continuity regardless of the actual faculty members involved in the program.

1. **Financial model**

One of the key attributes of the ABT program is the access the students have to faculty members across several disciplines and the resulting one-on-one instruction and feedback. As the academic program grows, this access necessarily diminishes with larger class sizes. The ABT program has addressed this by limiting section sizes, depending on the course needs. Additional sections require more resources, and additional students require more administrative overhead. This section of the report addresses these needs in the context of the new budget model slated to be fully instituted in FY 16.

The basic premise of the new budget model is that each college should receive the tuition they generate. The currently proposed formula is to return 75% of the tuition to the college of the instructor of record, and 25% of the tuition to the college in which the student is enrolled. For the purposes of this analysis, the assumption was made that 80% of the assessed tuition is available to be returned to the colleges; the remainder is assumed to be retained at the University level for their use.

Currently the ABT program has access to resources of approximately $50,000 above the salaries of the faculty members involved, in the form of ½ salary for an academic coordinator, one ½ time TA, and $5000 for materials and supplies. **The review committee recommends that the academic coordinator be made full-time, and that two full-time TAs be assigned to the program (one for ABT 120 and one for ABT 495; the two lab-intensive courses in the program).** We will show that the program generates sufficient tuition to justify this increase in personnel.

If we look at the current state of the program in the context of the new budget model, considering both the approximate faculty salaries required based on rank, and approximate tuition generated, the dollars generated from the current student/course load equal approximately $233,000. The expenses would be approximately $225,000 (including $5000 for materials and supplies, 2 TAs and 1 Academic Coordinator). Therefore, the ABT program will generate sufficient tuition to cover the added personnel, and still have approximately $7,000 "profit"; already accounting for 20% of the tuition staying at the university level. Faculty salaries assumed 10% effort for a 3-hr course. This does not account for any overhead except for the 20% tuition "tax".

The committee also recommends that the Steering Committee look carefully at the cost versus tuition generated for the courses they offer to make sound decisions. For example, ABT 301 is an expensive course, but it is also central to the quality education the students receive. This course needs to be offset by some of the earlier, larger courses that generate sufficient tuition to cover the added expense of the low student to professor ratio in ABT 301.

2. **Alumni relations**

The ABT program has been functional for the last 15 years however a comprehensive database of ABT alumni does not exist. **It is recommended that an alumni database be**

established urgently. This could be developed by the academic coordinator for whom full time support has been requested.
The connections and interaction with ABT alumni are expected to serve the following roles:

a.. Provide an instant professional network for the current and future ABT students. Select alumni members should be invited as featured speakers, judges for annual ABT poster presentations and recognized by ABT for achievements in their respective careers to build a community around the ABT program.

b. Provide regional advocates for the ABT program which seems to be struggling due to the paucity of stable funding and resources.

c. Establish a group of potential supporters and donors who could institute fellowships and scholarships for the current and future ABT students. The ABT alumni could be connected with Development and Alumni relations staff at UK to specifically support the ABT program.

d. Provide an avenue for input to modernize the training provided by ABT to meet market needs and current scientific trends.

Our interview with current students was a clear indicator of how grateful they are for the breadth and depth of training received while enrolled in the ABT program. They also claim to have formed life-long friendships as this program promotes community building. The rudiments of establishing a productive alumni group already exist.

It is highly recommended that CAFE prioritize promotion and sustainability of the ABT program in its strategic plan. It is a unique program and the success of the ABT program concept based on its students' success is bound to breed competitive models both at the college, University and at other peer institutions that might erode enrollment if this issue is not aggressively addressed.

3. **Cross-disciplinary cooperation**

The program is encouraged to expand the scope of its interdisciplinary outreach. This includes both continued growth of the program as well as the development of strategic partnerships.

Multiple constituencies, including panel members, faculty, and students voiced a strong consensus (although not unanimous) that the current name of the ABT program does not appropriately express the interdisciplinary content of the program or the career paths taken by its graduates. Indeed, many students indicated that the name was detrimental to their initially locating and participating in the program. **The program is strongly encouraged to consider changing its name by either dropping the word agriculture from its name or adding another modifier to better align the program title with the academic program's mission and to enhance the program's reach.**

To accommodate and enhance continued growth of the program, engagement with other colleges and units is strongly encouraged. Interdisciplinary partnerships may be of significant benefit going forward. The specific benefit to the program and appropriate structure for such engagement should be carefully considered. When details of the new financial plan are finalized, soliciting additional faculty involvement in core ABT instruction will likely be mutually beneficial. Additionally, a potential MS track in partnership with one or more colleges, was well received by the review committee and strongly encouraged.

4. **Curriculum mapping/forward planning process**

To earn a Bachelor of Science degree in ABT, a student must complete 128 semester hours with at least 45 hours from courses at the 300 level and above. In addition to university and college requirements, the student must satisfy pre-major, major and specialty support requirements, including an independent research project or internship relevant to his/her interest in biotechnology.

The ABT curriculum is uniquely distinguished from those of other undergraduate programs. Students are encouraged to learn from the experience of successful professionals, practical training, as well as self- and peer-evaluations (so termed "experiential track"). Courses centered on genetics form core training for students to excite and prepare them for the ever-changing field of biotechnology. The program provides 21 credit hours of "Specialty Support" that allow students to customize the degree to their own interests. Because of the diverse career aims of ABT students (roughly one third go on to medically- related professional schools, another third go on to graduate schools and the remaining move into the job market), the program provides flexibility, enabling students to select courses based on their individual interests. During the review process, participating students were overwhelmingly positive about this aspect of the curriculum.

However, questions were raised by teaching faculty and students regarding the current curriculum. **Our committee recommends to the steering committee that a formal process be developed to regularly review the curriculum offerings, and determine if the curriculum is remaining current and relevant to the needs of today's students and employers.** We recommend this process include course mapping, including a formal discussion about which concepts are appropriate to teach at each level, to ensure continuity through changes in course instructors. The alumni may be a good resource to contribute to this curriculum review process.

5. Recruitment/Retention/Enrollment Management

Students interested in Agricultural Biotechnology need to be able to find a clear, consistent message when investigating the program. The message could be enhanced by **a) revising the web page with the focus on making it more student-centered and b) establishing a physical "home" for ABT.**

When viewed from the perspective of a student new to the program, the website is difficult to navigate. To enhance recruitment, the web page should be student centered and be amenable to being used as the source of information for students interested in joining ABT.

In addition, the Academic Coordinator needs an office that can serve as a physical home for ABT, so that regardless of who is serving in the academic coordinator's roll, the students know the physical location to go to in order to receive face-to-face assistance.

6. **Administrative effort**

Comments from several ABT faculty and students point to a key role for the ABT academic coordinator in ensuring the success of this program. Esther Fleming, who currently holds this position, is performing several important functions from introducing new students to the program to initial advising as well as assisting in administration of program.

There were comments from students on lack of timely information about ABT program as well as on the course selection and research mentor selection processes. In view of these comments, the **committee recommends that the ABT academic coordinator position be made full-time and housed in an office dedicated to ABT, preferably near the offices of academic coordinators of other inter-disciplinary programs in the CAFÉ.** It is envisioned that the full-time ABT academic coordinator will facilitate the teaching of ABT 101, 201 and 395 series courses, participate in recruitment and retention efforts and deliver timely information to current and future students. The ABT academic coordinator may also start building the ABT alumni database. Since the ABT program does not have personnel dedicated to activities such as Internship coordination, fund rising, recruitment and retention, the committee recommends that personnel such as the Internship coordinator from other inter-disciplinary programs in CAFÉ be assigned to assist ABT in their area of expertise. It will be excellent, if all the coordinators of all inter-disciplinary programs in CAFE are housed in a common office space and encouraged to coordinate their activities to advance all inter-disciplinary programs in CAFÉ.

7. **Professional development**

The committee recognizes that the Ag Biotech program needs additional resources dedicated to the professional development of the students in order for them to be well rounded and adaptive to the business environment. Students need more direction in

curriculum vitae (CV) writing, interviewing skills, and in other skills that make them stand out for internships and positions in corporate settings.

In order to address this need, **a one hour seminar could be offered in technical business writing and interview skills.** Another way to address this would be to have one of the speakers in the ABT201 course series be a business contact from within the industry address these skills specifically. A third option is to arrange via the academic coordinator, student information seminars using industry professionals to conduct review sessions where the students can perform mock interviews and have their CV's reviewed by professionals.

8. **Summary of students' vision for the program**

The comments received from students were generally positive and indicated satisfaction with the ABT program; however, some comments also suggested there were specific areas needing further attention. Students praised the quality of academic advising and complimented the immediate, easy access to faculty throughout the ABT program.

Several concerns voiced by the students were associated with the process of finding a laboratory in which they could complete their independent research project. **There was an evident desire for a more structured process provided early in the program that could jumpstart the matching of students with research mentors and labs.**

Furthermore, there was a request for earlier exposure to lab techniques to help prepare students for upper-level lab courses (ABT 495) and independent research projects. It should be noted, however, that ABT 120 (an introductory science course with a wet lab that was recently implemented) had not been available to most of the students present during this session. Additionally, there were several requests for more sections of ABT classes—specifically fall and spring sections for ABT 360 and ABT 495.

Regarding the subject of recruiting students to the ABT program, it was enthusiastically suggested that current students visit and speak at high schools about the program and its

many opportunities. The students also suggested that the name of the program be amended to exclude the word “agricultural” to reflect the fact that the program is not only applicable to the field of agriculture, but to a vast number of other disciplines. Students responded positively to the suggestion and thought it would also attract a larger and more diverse group of future students.

Agricultural Biotechnology (ABT)
Program Review
March 2-4, 2014

Sunday, March 2

Airport-to-hotel transportation is provided by Dr. Sue Nokes for Dr. Dhingra, who arrives at 4:59 p.m. at Bluegrass Airport. Dr. Lamb is driving.

6:15 Dr. Sue Nokes transports Drs. Lamb and Dhingra and Julie Campbell from Crowne Plaza Campbell House Malone's Restaurant at Palomar, at the corner of Harrodsburg Rd. and Man 'O War

6:30-8 Committee has dinner and working session. Dr. Dan Howe, director of ABT, joins the committee. A local committee member returns guests to Crowne Plaza Campbell House

Monday, March 3

8:00-9:00 Breakfast on own (Drs. Lamb and Dhingra and Julie Campbell dine at Crowne Plaza Campbell House)

9-9:15 Dr. Sue Nokes transports external guests to Ag North

9:15-9:45 Meet with Assistant Dean for Academic Administration Lisa Collins, S-125B AgN

9:45-10 Break

10-11 Meet with ABT Coordinating Committee, N24B AgN (inside the Ag Information Center on the lower level by the deli). All committee members and all guests are invited to get food and drinks at the Ag Deli in the lobby. Tell staff you are with the NRES review; your name should be on the deli's list for refreshments at no charge.

Craig Vander Kooi (also review committee member), James Harwood, Luke Moe, Michael Goodin#, Robert Houtz, Sharyn Perry*, Xuguo (Joe) Zhou*

11-12 Facility tour led by Esther Fleming and Luke Moe. Guides will meet group in N24B AgN

12-12:45 Lunch and working meeting, N24B, AgN

12:45-1 Break

1-2 Meet with ABT course instructors, N24B AgN (inside the Ag Information Center on the lower level by the deli). All committee members and guests are invited to get food and drinks at the Ag Deli in the lobby. Tell staff you are with the NRES review; your name should be on the deli's list for refreshments

at no charge.

Michael Goodin, Joe Chappell*, Sharyn Perry*, Dan Howe, Ling Yuan, James Harwood, David Wagner, Joe Zhou*, Bruce Webb*, Reddy Palli, Luke Moe*

2-3 Meet with ABT students, N24B AgN (inside the Ag Information Center on the lower level by the deli). All committee members and all guests are invited to get food and drinks at the Ag Deli in the lobby. Tell staff you are with the NRES review; your name should be on the deli's list for refreshments at no charge.

3-3:15 Break

3:15-5 Working session, S125B AgN

5-5:15 Lisa Collins transports Drs. Lamb and Dhingra and Julie Campbell to Crowne Plaza Campbell House

6:15 Sue Nokes transports Drs. Lamb and Dhingra and Julie Campbell to Sal's Restaurant in Landsdowne on Tates Creek Rd. or working dinner with entire committee at 6:30

Tuesday, March 4

7:30-8:20 Working breakfast with review committee at Crowne Plaza Campbell House

8:20-8:35 Sue Nokes transports external guests to N24B AgN

8:35-10:30 Meet with ABT research mentors, N24B AgN (inside the Ag Information Center on the lower level by the deli). All committee members and all guests are invited to get food and drinks at the Ag Deli in the lobby. Tell staff you are with the NRES review; your name should be on the deli's list for refreshments at no charge.

Daret St. Clair, Graduate Center for Toxicology
Robin Cooper, Department of Biology
Kendra Steele, ParaTechs Corp., Lexington, KY
Robert Houtz, Department of Horticulture
Craig Vander Kooi, Department of Molecular and Cellular Biochemistry*
Ronan Power, Nutrigenomics Department, Alltech, Nicholasville
Michael Goodin, Department of Plant Pathology
John D'Orazio, Department of Pediatric Hematology/Oncology
Ernie Bailey, Department of Veterinary Science
Xuguo (Joe) Zhou, Department of Entomology*
Ashley Seifert, Department of Biology
Cherry K. Croft, Department of Cardiothoracic Surgery
Karyn Esser, Department of Physiology
Luke Bradley, Department of Anatomy and Neurobiology
Bruce Webb, Department of Entomology*
Reddy Palli, Department of Entomology
Teri Lear, Department of Veterinary Science
Steven Van Lanen, Pharmaceutical Sciences

Brian Stevenson, Microbiology and Immunology
Trevor Creamer, Molecular and Cellular Biochemistry
Brett Spear, Microbiology and Immunology
James Matthews, Animal and Food Sciences

10:30-10:45 Break

10:45-11:45 Meet with invited ABT Academic Advisors, location N24B AgN (inside the Ag Information Center on the lower level by the deli). All committee members and all guests are invited to get food and drinks at the Ag Deli in the lobby. Tell staff you are with the NRES review; your name should be on the deli's list for refreshments at no charge.

Ernest Bailey, Joseph Chappell, Seth DeBolt, Steve Dobson Bruce Downie, Rebecca Dutch, Mark Farman, Charles Fox, Michael Goodin, James Harwood, Ling Yuan, Joe Zhou*, David Horohov, Bob Houtz, Dan Howe, Aardra Kachroo, James Matthews, Luke Moe, Reddy Palli, Sharyn Perry, Chris Schardl, Lisa Vaillancourt, Bruce Webb*, Mark Williams

11:45-11:50 Move to S125B, AgN

11:45-1 Working lunch, S125B AgN. Dr. Dan Howe joins the group.

1-2 Working session, S-125B AgN

2-3 Meet with Dean of the College of Agriculture, Food and Environment Dr. Nancy Cox, and Assistant Dean Lisa Collins, S-125B AgN, to present preliminary findings

3:00 Lisa Collins transports Dr. Dhingra to BG Airport and Dr. Lamb and Julie Campbell to Crowne Plaza. Dr. Dhingra needs to be at the airport by 3:45

Review Committee
Sue Nokes, chair, snokes@uky.edu, 859-420-0522(cell)
Rebecca Lamb, lamb.129@osu.edu, 614-688-4322, Ohio State
Amit Dhingra, adhingra@wsu.edu, 509-432-3683(cell), Washington State
Subba Reddy Palli, rpalli@email.uky.edu, 227-5993(cell)
Ling Yuan, lyuan3@uky.edu, 859-492-5688(cell)
Jessica Gambrel, Jessica.gambrel@uky.edu, 606-389-1257(cell)
Julie Campbell, jcampbell@alltech.com, 859-553-9215(cell), Alltech
Craig Vander Kooi, craig.vanderkooi@uky.redu, 323-5549(no cell)

*Will be attending per RSVP

Michael Goodin will participate via Skype

Note: Due to schedule changes, Dr. Larry Grabau, associate dean for instruction, met with Dr. Sue Nokes and others prior to the site visit.

Implementation Plan

UK Program Review Implementation Plan

*This **required** form is described as Appendix A in AR II-I.0.6.*

Template website:

College/Unit: CAFE/Agricultural Biotechnology **Date: 05/02/2014**

Recommendation/ Suggestion	Source I/E/H*	Accept/ Reject**	Unit Response (resulting goal or objective)	Actions (including needed resources & approximate cost)	Time Line
It is highly recommended that CAFE prioritize promotion and sustainability of the ABT program in its strategic plan. ABT is a unique program and the success of the ABT program concept based on its students' success is bound to breed competitive models both at the college, University and at other peer institutions that might erode enrollment if this issue is not aggressively addressed.	I/E	A	Development of competing undergraduate programs has been a growing concern for the ABT Steering Committee, particularly in the new budget model environment. Therefore, enhancing prospective student awareness and strengthening the profile of ABT across the UK campus is an important objective.	Coordinate with CAFE administrative office personnel (e.g., Jason Headrick, Student Relations Director) to better advertise ABT within the University of Kentucky and to outside constituents (e.g., high schools, Future Farmers of America, etc). Formalize partnerships with faculty in other UK Colleges (e.g., Medicine, Pharmacy, Dentistry).	
The review committee recommends that additional resources be committed to the ABT program in the form of a full-time academic coordinator, and that two full-time TAs be assigned to the program (one for ABT 120 and one for ABT 495; the two lab-intensive courses in the program).	I/E	A	We agree enthusiastically with this recommendation. The change from a half-time to a full-time academic coordinator will strengthen student support activities and will put the program on par with other undergraduate degree programs in the College. Additionally, ABT 495 and ABT 120 are lab-intensive courses that will benefit from teaching assistant support.	We recommend that the CAFE administration extend to Esther Fleming an offer to become the full-time academic coordinator for ABT. The salary provided should be commensurate with the pay scale of present CAFE Academic Coordinators and with consideration for Esther's extensive knowledge and experience in this position. In upcoming years, ABT 495 will be offered during the Fall and the Spring semesters, so recurring support (stipend and tuition) for a full-time TA is requested. ABT 120 will be offered in the Spring, so a 0.5 TA support is requested for this course. If additional offerings of these courses are needed to accommodate expanding enrollment, the TA support should be adjusted accordingly.	Summer, 2014

The program is strongly encouraged to consider changing its name by either dropping the word agriculture from its name or adding another modifier to better align the program title with the academic program's mission and to enhance the program's reach.	E	A	Although there are some concerns about changing the program name, this action seems appropriate if it will better reflect the scientific disciplines that ABT students engage in while in the program and the career opportunities they pursue after graduation. In considering new program names, it is desirable to preserve the word "Agricultural" and the moniker "ABT" to maintain the program's identity and its connection to CAFE.	With input from ABT-affiliated faculty, staff, and students, the ABT Steering Committee will consider new names that are consistent with the broadened scope of the current ABT program.	Summer, 2014
It is recommended that an alumni database be established. This could be developed by the academic coordinator for whom full time support has been requested. The Steering Committee is encouraged to develop a plan for more fully utilizing this great resource based on the recommendations contained below in the Alumni Relations section.	E	A	The ABT program has not been proactive about maintaining contact with alumni and tracking their success after graduation. We agree that an alumni database will be beneficial.	The ABT Academic Coordinator will be charged with establishing and maintaining the alumni database. Information about program graduates will be obtained from ABT faculty and the CAFE Development Office. An exit survey will be developed to help keep the database current.	By end of 2014-2015 academic year
To accommodate and enhance continued growth of the program, engagement with other colleges and units is strongly encouraged (more detail in the Cross-disciplinary Cooperation section).	I/E	A	We agree that it will be very important to establish more formal partnerships with other Colleges at the University of Kentucky. This is particularly relevant for faculty in the Colleges of Medicine, Dentistry, and Pharmacy, who routinely serve as research mentors for students in ABT. The increased emphasis on undergraduate education at the University of Kentucky has led faculty in these Colleges to pursue opportunities to participate in instructional activities, which the ABT program can and should provide. Although not explicitly stated in the Summary of Recommendations, the establishment of a Master's program in partnership with other Colleges/Units was mentioned and encouraged by the external review committee. In previous discussions, the ABT Steering Committee has decided that this would be advantageous for some students and should be pursued.	Discussions will be initiated with interested faculty members in other Colleges regarding opportunities to participate in ABT course instruction and to better recognize research mentoring of ABT students. Under the new financial model for UK, mechanisms need to be established to ensure appropriate allocation of funds for participation in course instruction and research mentoring (i.e., fund distribution for ABT 395 student contact hours). Additionally, a Master's degree with individualized tracks will be implemented via the University Scholars Program.	Begin discussions in Summer, 2014
Develop a formal process to regularly review the curriculum offerings, and determine if the curriculum is remaining current and relevant to the	E	R	We agree entirely that the ABT curriculum needs to remain current and relevant. However, a process for curriculum review is already in place.	No changes planned.	

needs of today's students and employers.			Program status, including the curriculum, is reviewed and discussed during the ABT Steering Committee meetings, which typically convene biannually. When it is deemed appropriate by the committee, changes to the ABT curriculum are made.		
Revise the ABT webpage to make it more student-centered.	E	A	The ABT webpage may be the first and primary interface between the program and prospective students. As well, it should be a helpful resource for current students. Therefore, it will be beneficial to upgrade the webpage to ensure that it contains useful information and is easy to navigate.	Re-design of the ABT webpage was discussed by the Steering Committee at the most recent meeting (October, 2013). Use of ABT program funds to hire a professional web design company was approved by the Committee.	By end of 2014-2015 academic year
Establish a physical "home" for ABT, possibly in a suite with additional offices for the other interdisciplinary academic programs in CAFE.	E	A	An office dedicated to the ABT program will enhance the efforts of the ABT Academic Coordinator and will give students greater access to this individual. A suite of offices housing all CAFE interdepartmental program Academic Coordinators is logical, but may not be feasible or necessary.	Identify suitable office space for the ABT Academic Coordinator.	Summer, 2014
Offer a one-hour seminar in technical business writing and interviewing skills (i.e., improve professional development)	E	R	There is no question that career development skills will help students as they transition from school into the work force. However, resources for improving these skills are available through the CAFE Director for Career Development and Academic Enrichment (Amanda Saha) and the University's Stuckert Career Center.	The ABT faculty and Academic Coordinator will ensure that students are informed of the existing resources for professional development.	
Students desire a more structured process, provided early in the program, that could jumpstart the matching of students with research mentors and labs.	E	A	It is recognized that some ABT students have difficulty identifying a research mentor for their ABT 395 research experience. A more structured process and better information about potential research mentors will be beneficial.	With assistance from ABT-affiliated faculty, the Academic Coordinator will update and maintain the Research Mentor list on the ABT website. A mechanism to help match students with Research Mentors will be developed by the ABT Steering Committee and implemented by the program.	By end of 2014-2015 academic year

*** Source of Recommendation (I = Internal recommendation; E = External Review Committee recommendation; H = Unit Head recommendation)**

**** Accept/Reject Recommendation (A=Accept; R=Reject)**

Unit Head Signature: _____ Unit Chief Administrative Officer (CAO) Signature: _____ Date: _____