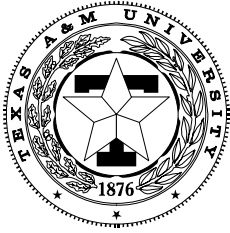


Texas A&M University

**Department of Entomology
Academic Program Review**

October 15 – 18, 2006





TEXAS A&M UNIVERSITY

College of Agriculture and Life Sciences
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**Texas A&M University
Department of Entomology
Academic Program Review Team**

October 15 – 18, 2006

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July 20, 2006

Charge to the Peer Review Team

I write to provide you with background on the Entomology Program at Texas A&M University, and to explain the expectations for the external review. Entomology education and research has been recognized as a distinct entity at Texas A&M University since 1899. The Department of Entomology awarded its first B.S. in 1901, its first M.S. in 1920, and its first Ph.D. in 1943.

Although this review is part of a periodic review of all Texas A&M University academic programs, this type of review offers an excellent opportunity to identify ways to maintain the current high standards of the programs and to learn from review team members' experiences with similar programs.

I request that the review team examine the academic programs within the Department of Entomology using the materials that will be provided, along with any additional information you might request. While evaluating the existing program, please consider the allocation of resources, (i.e., human and fiscal) within the department, the absolute level of support the Department receives from the University, and comment as appropriate on current and potential "leveraging" of these resources. Enclosed in our "guidelines" is a suggested academic program review report format.

I look forward to meeting with you and the entire committee in October. If you have any questions or require additional information, please do not hesitate to let me know.

Academic Program Review 2006

Department of Entomology Texas A&M University

Academic Program Overview

Historical Perspective: The Department of Entomology celebrated its Centennial Year in 1999 and published a summary of its milestones in Teaching, Research, and Extension in *A Century of Success: 100 years of Entomology at Texas A&M University* (Appendix I). The department hired its first entomologist and offered undergraduate courses in 1899, added the Master of Science degree program in the 1920's, the Doctoral degree program in 1935, and the Master of Agriculture degree in the late 1970s. National, state and local changes in Higher Education during the 1990s brought significant attention to academic programs, especially the undergraduate program. Increased demands for accountability of financial resources and metrics of teaching became the order of the day.

The transition into the 21st Century found the Department of Entomology in the midst of change and opportunity. The student body at Texas A&M University now exceeds 45,000 with growth expected to continue. Out of the recognition of the relevance of entomology to the 21st century and a deeply expressed desire to see the discipline of entomology grow, our department took a series of steps that have positioned us for continued academic program improvement and success.

21st Century Relevance: The relevance of entomology is recognized in the very diversity of the science and in the state, national, and global significance of its application for all. The educational experience from classroom to experiential learning environments, rooted in critical thinking and problem solving, is as applicable as ever. Entomology is attractive to a diverse community of students who find it relevant to take courses and major, double-major, or minor in our discipline. These students are finding a strong employment market at graduation and opportunities for graduate and professional schools. Furthermore, a diverse community of faculty scholars is willing to collaborate in teaching. "Discover Entomology" became our theme.

Undergraduate Student Recruiting: Student recruiting efforts were improved and expanded with three targets in mind; incoming freshmen, internal transfers (i.e., change of majors, or change of curriculum), and external transfers from other institutions (Appendix II, Figure 1). Recruiting is largely coordinated through the departmental outreach program and the student advising office. We developed 4 "products" for current students to consider; our major, a double-major, a minor, and recommended introductory or supplementary ENTO courses. We concentrated recruiting efforts for pre-registration periods near the end of each semester. Faculty and student presentations to introductory and career exploration courses were directed at current students who were still seeking a major, or were looking for ways to enhance their education by bridging disciplines with a double-major or minor (e.g., biomedical science, horticulture, agronomy, wildlife & fisheries, animal science).

Transfer students are recruited through a variety of ways, including presentations and communications at nearby community colleges. This interaction has led to development of an articulation agreement with Blinn College in 2006 and there is expressed interest for additional articulation agreements from a number of additional institutions. The department of entomology is one of the university departments on the initial phase of a university wide articulation agreement program to include a number of community colleges in areas the university has designated as recruiting targets. In addition, the university hosts “Transfer Information Day” for students and parents who are considering the transfer process. We participate with informational booths, tours and presentations about our programs.

Our undergraduate demographic analysis of entomology majors shows that the largest sub-populations are juniors and seniors and reflects the efforts to recruit students both inside and outside TAMU (Appendix II, Figure 2). It also reflects the reality of the latent discovery of entomology for most students.

Freshmen students are recruited through outreach programs at public and private schools, through youth programs such as 4-H, FFA, Scouting, the high school science Olympiad and through science fair projects coordinated with students and teachers. The 4-H and FFA programs have state and national contests in entomology. We annually host the district and state 4-H entomology contests and two invitational FFA entomology contests and workshops in our department. We recruit at each of these opportunities. Our extension entomology faculty statewide also assist in recruiting students from their respective local areas. The university sponsors numerous recruiting activities, such as Aggieland Saturday, the university open-house, and our current students and faculty participate with informational booths and presentations, as well as discovery exhibits, and games. Future ideas for additional exposure and recruiting include development of a sanctioned high school forensics science contest.

The demographics of our undergraduate program reflect steady growth in the numbers of majors, double-majors, and minors (Appendix II, Figure 3). The gender (Appendix II, Figure 4) and ethnic diversity (Appendix II, Figures 5-17) of this student population has also grown. In 2005, our college recognized the Department of Entomology as having the most diverse student body in our college. Appendix II, Figure 18 indicates the growth in the sub-population referred to as “First Generation in College” a population of particular interest with respect to the university’s Vision 2020 and the College of Agriculture and Life Sciences Teaching Roadmap.

Graduate Student Recruiting: Graduate student recruiting has traditionally been an activity expected of all faculty and governed by resources for assistantships. In recent years, the department has more heavily focused recruiting at the Entomological Society of America annual meetings with a recruiting booth, special invitations to the TAMU mixer and a focus on meeting students at paper and poster sessions. Demographic data 2000-2006 (Appendix III, Figure 20) show an increase to 65 students through 2004, followed by decline to 52 in the fall 2006. Gender and ethnic diversity are summarized

in Appendix III, Figures 21-34. Appendix III, Table 2 summarizes graduate applicant, admissions and matriculation data by year for academic years 2000-2005. The department has developed a proposal to the National Science Foundation's Research Experience for Undergraduates to help identify and recruit top undergraduates, including those from underrepresented populations. In 2005 the department was accepted as a participant in the Sloan Scholars Program to recruit PhD students from under represented populations. Our first student joined us through this program in 2006. New faculty hires in key areas and new ideas for enhancing doctoral student recruitment is expected to reverse this trend. Our plan for a new program in this area is described below.

Curricula and Courses in Entomology: Curricula and courses offered at the undergraduate and graduate levels are found in Appendix IV, Tables 4-7. The undergraduate curriculum was recently reduced from 128 hours to 120 hours as part of a college-wide approach to improve on-time graduation. This change was achieved through reduction in both technical and free-elective credits. A history of course offerings and enrollment by semester is compiled in Appendix IV, Table 8. Course syllabi will be made available on the departmental website.

Expanding Entomology Teaching on Campus: The department has developed several courses that have expanded opportunities for students to learn about our discipline and gain knowledge to help them in their respective areas of interest. *Insects and Human Society* (ENTO 322) was the first of these ventures initiated by Dr. Roger Gold and it has become a tremendous success. This course was accepted into the University Core Curriculum in the Natural Sciences and attracts students across many of the university colleges. *Biotechnology and Society* (ENTO 315) was initiated by Dr. Craig Coates to serve students understanding of the technologies of biotechnology and societal issues about its applications. *Honey Bee Biology* (ENTO 320) was initiated by Dr. Tanya Pankiw for science and non-science majors and is now offered as a very successful on-line course. This course is a recommended elective for students majoring in Agricultural Leadership. *Aquatic Entomology for Anglers* (ENTO 330) was initiated by Dr. John Jackman to integrate insect behavior and anatomy with that of fish behavior through the design and artistic creativity and expression of insect lures for anglers. *Insects In The Classroom* (ENTO 440) was initiated by Drs. Pete Teel and John Jackman in collaboration with faculty in the College of Education. The course is designed for pre-service and in-service science teachers and is now offered on-line.

In 1999, Dr. Jimmy Olson began teaching *The Science of Forensic Entomology* (ENTO 431) and *Applied Forensic Entomology* (ENTO 432); lecture and laboratory courses, respectively. The courses have been an overwhelming success, not only in student interest, but also in drawing interest from other faculty across campus and forensic, criminal justice, and legal practitioners. These courses led to our development of the Forensic Science Track under the B.S. degree in Entomology approved in November 2004 (Appendix II, Figure 19). There are approximately 30 students presently in this track and additional student interest on- and off-campus has generated additional interest in a forensics program. We have subsequently developed a proposal for a separate Bachelor of Science Degree in *Forensic and Investigative Science*. The proposal is under

university-level review at this time and, if approved, we anticipate bringing students into the program as early as the fall semester 2007. We are currently recruiting for an Assistant Professor, Forensic Entomologist, as part of this program.

Each of these new venues attracted students and academic attention from colleges across the campus. The impact translates into increased student contact hours and weighted student contact hours (described below), metrics currently emphasized by our college, and into potential new majors, double-majors, and minors.

Expanding the Undergraduate Educational Experience: From 2000-2006 changes were made to the curriculum in entomology and designed into the forensic science track to update content areas, develop a “capstone” course, focus on experiential learning, and provide better linkages to an international experience for entomology students. Dr. Linda Guarino and Dr. Keyan Salzman developed lecture and laboratory courses, respectively, in *Insect Biotechnology & Insect Biotechnology Laboratory* (ENTO 428 & 429). The purpose of these courses was to examine genetic engineering and biotechnology applications in entomology and provide hands-on experience in basic laboratory procedures. The challenge for equipping a teaching laboratory was met in-part by a partnership with Pioneer Hybrid International of DuPont Inc., and in-kind donations of approximately \$100,000 in equipment and supplies. Dr. Guarino is currently on a sabbatical project to write a new textbook for the lecture portion of this course. The examples and context of exercises in this course connect to learning objectives and exercises in other courses, such as medical entomology and insect physiology. A capstone course, *Problem Solving in Entomology* (ENTO 435) was developed by Dr. Pete Teel. The course examines the scientific method and reasoning strategies through a series of case studies in entomology, and contrasts short- and long-term problem solving approaches of local scientists and community leaders. The course calls upon the students to use their knowledge and skills from other courses in reviewing and solving case studies and considering how these elements are applied to the problem-solving process.

The department of entomology has held high value in experiential learning and student mentoring, and recognized benefits gained by former students who participated in internship and research projects as technical elective credit. Consequently, a two-credit hour minimum requirement of either undergraduate research (ENTO 491) or internship (ENTO 484) was included in the curriculum. During the 2005-2006 academic year, 32 undergraduate students completed research projects with nine faculty members. That number includes students with a double major who have elected to pursue a research project with an Entomology Department faculty mentor. Undergraduate students are encouraged to develop their leadership and professional development through service activities to the department, the university, professional societies and the local community. Appendix IX summarizes a small sample of the variety of activities completed by students in the department.

A new university program to improve student communication skills requires that each department have two courses required in the major approved as “writing intensive” (designated “W” courses). These courses are to be reviewed and approved by the

University Writing Committee every 3 years. Dr. Marvin Harris received approval to offer our first W course as ENTO 481 *Seminar*. Students in this course research invited speakers and topics prior to presentations in the Departmental Seminar Series, then write summative papers based upon the seminar presentation. *Problem Solving in Entomology* (ENTO 435) is being submitted for the second W-course designation. The course features six major writing and speaking requirements.

Drs. Jim Woolley and Bob Wharton have been involved in teaching summer courses associated with the Department of Wildlife and Fisheries Sciences at TAMU and the Archibald Research Station in Dominica, Caribbean. This International Program provides a unique experience for students to learn about tropical ecology, biodiversity, and conservation and conduct research in this environment. Their diligent work provided the opportunity to cross-list two of the Wildlife and Fisheries Sciences courses with Entomology, specifically ENTO/WFSC 300 *Field Studies*, ENTO/WFSC 450 *Caribbean Conservation* and ENTO/WFSC 451 *Caribbean Research Seminar*.

We believe these additions and changes to the curriculum modernize, compliment and enhance the educational experiences of our students and are relevant to the needs of 21st Century entomology graduates.

Expanding the Graduate Educational Experience: Graduate students participate in developing the Departmental Seminar Series (Appendix V) of invited speakers through the Entomology Graduate Student Organization. In a recent curriculum change, Master's students take one-credit per year and Doctoral students take two-credits per year of ENTO 690 *Theory of Research* for attending and participating in the seminar series.

Dr. Patricia Pietrantonio initiated an annual Graduate Student Forum as a local showcase of Entomology graduate student research. The forum provides students the opportunity to present their research in a formal setting and in a contest format (Appendix VI). The day-long program integrates thought-provoking opening presentations by a noted faculty member from another department or administrator, and a panel of judges comprised of faculty from a variety of departments. Dr. Raul Medina has accepted responsibility for this program in 2007.

An Entomology New Graduate Student Orientation was initiated for incoming graduate students and new faculty. The orientation is held just prior to the fall semester and is designed to set high expectations of our students and provide detailed information and guidance as to program requirements and timelines as well as the many aspects of graduate student life on our campus. The orientation helps new faculty understand departmental expectations of students, as well as the responsibilities of the major advisor.

Entomology students who wish to seek teaching positions upon graduation are encouraged to gain experience by participating in the Departmental Teaching Assistants program (http://insects.tamu.edu/students/grad/pdf/ta_program.pdf) and to consider participation in the Graduate Teaching Fellows Program provided by the Center for Teaching Excellence (<http://cte.tamu.edu/gta/>). Former students in entomology helped

develop the program, our students were among the first class of Graduate Teaching Fellows, and have gone on to teaching positions in higher education. Several students are currently completing program requirements toward GTA designation.

Graduate students are also encouraged to develop their leadership and professional development through service activities to the department, the university, professional societies and the local community. Appendix IX summarizes a small sample of the variety of activities completed by students in the department.

Academic Metrics: The College of Agriculture & Life Sciences and the University place considerable importance on student contact hours and on weighted student credit hours (WSCH). The WSCH parameter is particularly important as it determines the level of state support. The WSCH generated by a course is calculated as follows:

$$\text{WSCH} = (\text{No. Students enrolled}) \times (\text{No. Credits for the course}) \times (\text{Course Multiplier})$$

The course multiplier is based upon the CIP code assigned to the course. This includes all courses whether classroom courses or variable credit courses. The CIP code reflects whether the course content is based in science, agriculture, engineering, liberal arts, etc., and whether the course is a lower division number, upper division number, or graduate division number. The multiplier value increases through the lower, upper, and graduate course designations, respectively. The maximum WSCH values are generated by matching the right students with the corresponding course numbers (i.e., lower division students in lower division courses). The value to the university in 2006 can be determined by multiplying the WSCH generated by \$55.72.

The five-year profile of WSCH generated by the Department of Entomology is summarized in Appendix VII, Figure 35 for the academic year (fall, spring, summer), and by semester per year in Appendix VII, Figure 36. There is an approximate increase of 40% across this period.

The impact of these factors on departmental participation in teaching, faculty hires, and resource allocation is significant.

Teaching Resources: Financial support for classroom teaching primarily comes to the department through the Institutional Equipment & Enhancement Fee (IEEF) levied on each student for each course. The fees are set by the department and are based on guidelines and review by the college. These funds are used to purchase equipment, supplies, and to pay for teaching assistantships. Examples of equipment and supplies include microscopes, computers, video imaging and projection systems, nets and other collecting equipment. Some of these funds have been used to leverage additional teaching support through university internal grants programs. In 2006 we initiated a departmental teaching equipment grants program with a designated portion of these funds. Faculty submitted proposals that were evaluated based upon justified needs and guidelines for fee usage. Six proposals received full or partial funding. This program will be continued as long as adequate funds are available.

As noted above, equipping and supplying the biotechnology laboratory course (ENTO 429) was a challenge met through the generosity of in-kind donations from Pioneer Hybrid International. Consideration will be given to meeting future classroom needs through external grants, partnerships, or other arrangements. The five classrooms under our control are vintage 1978 and in need of modernization to serve the future needs of our programs.

Undergraduate Retention Program: Interactions with undergraduate students begin at various points in their academic career. For students entering the Department of Entomology as freshman or transfer students, the initial formal interaction with the academic advisors in the department often occurs during the required New Student Conferences, held prior to the students' initial semester at Texas A&M University. During these conferences, the departmental advisor conducts a general orientation session discussing their academic and career goals, planning the course work accordingly, and assisting the student in registering for their first semester. For students entering the department by way of the internal change of curriculum process, much of this information is covered during the appointment with the departmental advisor when they make the decision to change their major.

Despite the many topics covered during the freshman New Student Conference, the departmental advisors were receiving many of the same questions from the freshman cohorts. So, beginning in the fall of 2005, the decision was made to develop a semester-long freshman orientation in addition to the required New Student Conference in an effort to specifically address many of the similar issues that these students were facing during their initial semester at TAMU. The advisors felt that this would be an effective way of disseminating information and answering questions with the students, as well as providing the students with an additional opportunity to interact with other freshman entomology majors, thus enabling them to develop camaraderie within their class.

The semester-long freshman orientation was structured such that there was a meeting once a month and topics were chosen to coincide with current needs and issues of the students during that time frame. For example, during the first meeting, the students were introduced to the department head and the entire advising team to give them points of contact for problems or issues. In addition, a review of all TAMU sponsored academic learning services were addressed, so that students would once again be provided the tools needed to begin and sustain their transitional semester in a successful nature. The second month a guest speaker from the Career Center was brought in to discuss the services that this office provides for students of all academic levels, in an effort to encourage the students to begin looking for potential internship opportunities early in their academic career. The focus of the third month's meeting was the registration process. In addition to the scheduled topics at each of these sessions, there was adequate time for students to share their successes and express any concerns or frustrations they were having.

Unfortunately, not all students will adequately utilize the academic learning services and tools available to them during their academic career. As a result of this and perhaps other extenuating circumstances, some students find themselves encountering academic

difficulties at some point in time in their academic career. To work with those students, the department has an academic probation process. Prior to the fall of 2004, all students whose cumulative GPR and/or semester GPR fell below the university minimum of a 2.0 were sent a letter indicating that they were being placed on academic probation. A registration block was placed on their student account and they were required to show academic progress and meet with a departmental academic advisor prior to pre-registering for the subsequent semester. Beginning with the spring of 2004 report of grades, an additional requirement was implemented for students whose cumulative GPR and/or semester GPR were below a 2.0. Included in their probation letter were requirements that needed to be met, including meeting with an academic advisor once or twice per month during the subsequent semester (once a month if the students overall GPR was above a 2.0 but their semester GPR was not; or if their overall GPR was below a 2.0 but their semester GPR was above a 2.0; twice a month if their overall and semester GPR were below a 2.0). These students met with the Senior Academic Advisor at designated times for approximately 30 minutes per session. During their first meeting, the students were asked the following questions: “What were the three top reasons for the previous semester’s academic difficulties?” and “What are three steps that you will take to overcome these problems this semester?” Discussion followed these questions until the student had determined what changes in behavior they felt needed to occur for their academic performance to improve. This also provided an opportunity for the Senior Academic Advisor to make referrals to other academic services available to the students, based on their particular needs and situation.

Beginning with the spring of 2006, an additional step was implemented in this process in an effort to ensure student responsibility for their academic progress and success. Included in the academic probation letters sent to the students was an acknowledgement signature line, and they were required to indicate that they read and understood the requirements and stipulations of being placed on academic probation and return that signed form to the academic advising office.

An interesting and unexpected result of these required academic probation meetings has been that some students have expressed their desire to continue the regular meetings with the academic advisor even after they have improved their academic performance and have been removed from academic probation. They indicate that the structure and accountability of the regular meetings were a positive influence and contributed to their increased academic success.

Graduate Retention Program: Interactions with graduate students vary somewhat from those of undergraduate students. Typically, the interactions occur between the student and their chosen major professor, with the Senior Academic Advisor working closely with the students to complete their graduate application process. For graduate students, TAMU hosts a New Graduate Student Orientation that all students pay for their initial long semester at TAMU; however, unlike undergraduate students, attendance and participating at this event is not mandatory.

As such, the department hosts an annual Department of Entomology New Graduate Student Orientation in August of each year, prior to the beginning of fall classes. Students admitted for the preceding spring and summer sessions, as well as for the fall semester, are required to attend this program. This orientation serves to introduce the students to the department and provides an opportunity for the incoming students to mingle and develop camaraderie within their cohort. Prior to the fall of 2004, this program was a half-day program and included topics such as, but not limited to, human resources, travel requirements and necessary paperwork, departmental policies and procedures, and separate panel discussions with current faculty and graduate students. Beginning with the fall 2004 orientation, the program was revised and expanded to a full day, including lunch and snacks provided by the department, with topics including: welcome and introduction from the department head; employee related services, which include human resources, insurance, parking, travel; funding opportunities; shipping training; an overview of the Entomology Graduate Student Organization (EGSO); separate panel discussions with current faculty and graduate students; overview of relevant TAMU services; degree information and departmental policies and procedures; registration instructions; professional development; and an overview of library services. During the orientation, students are provided a binder with the various presentations and additional miscellaneous information as a resource tool for which to refer at times later in their academic program. To ensure that new faculty hires understand the graduate program within the department, any and new faculty are invited to participate in this program as well.

Self-Study and Recommendations

Academic Program Review Committee:

Dr. Pete D. Teel, chair
Dr. Jim Woolley
Dr. Tanya Pankiw
Dr. Craig Coates
Dr. Spence Behmer
Dr. Darrell Bay
Rebecca Hapes, Sr. Academic Advisor
Bradly Hopkins, Student Representative

The Academic Program Review Committee (APRC) received instruction for the review from Dr. John R. Giardino, Dean, and Dr. John D. Vitek, Assistant Dean, of the Office of Graduate Studies, Office of the Vice President for Research, TAMU. The APRC examined data, trends, and issues affecting our academic program over the last 5 years (2000-2005/6) as a self-study to examine our future direction and goals and make recommendations appropriate to those goals. The committee reviewed the institutional goals set forth in *Vision 2020* (<http://www.tamu.edu/vision2020/>), our College of Agriculture & Life Sciences goals defined in the *Teaching Roadmap* (Appendix VIII or <http://coals.tamu.edu/coalsRoadmap.pdf>), our departmental strategic plan of 2001 (Appendix VII) and academic retreats of 2005. The APRC concluded that two areas warranted attention: Development of an outcome-based assessment program for better

tracking of our progress and defining future improvements, and an enhanced graduate student recruiting program.

Considerable institutional emphasis is being placed on developing and using outcome-based assessments from the classroom, to program, to institutional applications with a focus on re-accreditation of the university in 2009. Members of the APRC attended a college-level presentation and discussion on the topic provided by faculty of the Center for Teaching Excellence. This presentation was followed by discussion of design, introduction and adoption within the department, and by a search for similar outcome assessment programs in entomology at other institutions. The APRC subsequently developed an outcome assessment outline for the undergraduate and graduate degrees, and for the overall academic program in the department. Upon faculty approval of this outline for adoption, implementation would commence through several workshops directed at 1.) Outcome-based assessment from syllabi to program-level, 2.) Teaching methods and techniques, and 3.) a review of undergraduate and graduate course offerings. The program could be implemented by fall 2007.

Program-Level Outcome Assessment

The success of our academic programs in recruiting, retaining, graduating and placing students in successful careers will be the focus of the Program-Level Outcome Assessment. The APRC reviewed current data and issues surrounding student recruitment, matriculation, and graduate outcomes at the departmental, college, and institutional levels and defined program level assessment needs for the future. The APRC recommends the following outline for monitoring Entomology Department program-level outcomes across the B.S., M.S., MAg., and Ph.D. degree programs:

- I. Assess preparation of incoming students as indicated by such measures as standardized test scores, grade-point ratios, and academic coursework to benchmark both student outcomes and recruiting programs. Six populations of students would be benchmarked.
 - a. First generation in College.
 - b. Freshmen (Appendix II, Table 1)
 - c. Undergraduate change of curriculum – within TAMU.
 - d. Undergraduate transfer – outside TAMU.
 - e. Master of Science and Master of Agriculture students.
 - f. Doctoral Students.
- II. Monitor student retention rates and time-to-graduation by sub-population (Appendix III, Table 3).
- III. Assess involvement and products from student mentoring activities.
 - a. Undergraduate student credit hours taken and completed in research, internship, and directed studies (ENTO 491, 484, 485). Completion includes filing final reports and summary of any presentations or publications.

- b. Number of faculty engaged in mentoring undergraduate students in Entomology, or other majors, and the range in number of students mentored.
 - c. Number of graduate students advised by faculty for each graduate program.
 - d. Number of on-time completions of degree plans, proposals, and annual meetings for each graduate student.
 - e. Publication and outside presentations of thesis or dissertation work by graduation.
- IV. Assessment of student service activities that develop a broader sense of awareness within the science, the department, college, university and community-at-large.
- a. Develop an on-line professional development survey or on-line resume posting service that can be continuously updated by individual students.
- V. Assessment of overall educational experience.
- a. Summary of exit interviews from Department Head.
 - b. Develop an on-line exit interview survey to aid in identifying areas for program improvement.
- VI. Professional success.
- a. Number of students by program employed within 4 months of graduation and types of employers.
 - b. Number of students by program entering graduate schools or professional schools, and the institutions and programs they have entered.
 - c. Develop a retrospective 5-year assessment of employment and educational experience through an on-line survey.
 - d. Employer survey conducted through the TAMU Career Center or other on-campus survey group.

IMPLEMENTATION: The Academic Advising Team will use academic databases of the institution to compile and report progress to the department on a regular basis. We recommend that the Academic Advising Team, Education Committee, Web Committee and others selected by the department head, develop a secure mechanism and survey instruments to capture student and employer data not held by other databases. The goal would be to have all elements for the program-level outcome assessment in place by AY 08 (Fall 2007).

Outcomes Assessment – Major Learning Goals by Academic Program

Undergraduate Program - Bachelor of Science Degree

The aim of the entomology undergraduate program is to provide students with a broadly-based education in the science and practice of entomology that will prepare them for employment, or graduate or professional school. The undergraduate curriculum in entomology is designed for persons interested in studying various aspects of insect biology and based upon developing and applying critical thinking and problem solving skills. All graduates will:

- Demonstrate an understanding of insect relationships, structure, function, and diversity.

Undergraduate students are required to take a suite of courses (in general entomology ENTO 301, 305, 306, and 311; forensic science track ENTO 301 and 311) that emphasize insect structure and function within the broad scope of insect biodiversity and relationships. Students receive instruction and demonstrate, through homework assignments, quizzes, laboratory exercises, and examinations, their knowledge of basic external morphology, internal anatomy, and functional associations across a diverse range of insect groups. Each student also produces an insect collection in ENTO 311 that assesses the students' skills and techniques in collecting and processing specimens, and the use of diagnostic keys and reference material.

- Demonstrate an understanding of insect evolutionary relationships, plus the ecological interactions insects have with one another, other life forms, and the environment.

An in-depth understanding of the interactions of insects with components of other life systems is covered in ENTO 424. Students receive instruction in the principles of insect ecology with emphasis on the interactions of insect populations and communities on ecosystem processes that influence landscape structure, function and change. Students demonstrate their understanding of these principles in the laboratory by solving problems posed through computer-based simulations and by reporting their results, discussion and conclusions in writing scientific formats. The Department Academic Program Review (APRC) committee recommends that consideration be given to development of an upper-division course in "Fundamentals of Insect Evolution". This course would build on ENTO 301, and provide students with a more in depth treatment of current topics in insect evolution. Students would be introduced to recently developed comparative techniques, including modern techniques in phylogenetic analyses.

- Demonstrate an understanding of how insects impact human, animal and plant health and well being, and the principles and methods of managing pest insect populations.

All students are required to take *Insect Biotechnology* lecture (ENTO 428). The corresponding *Insect Biotechnology Laboratory* (ENTO 429) is required of students in the forensic science track and encouraged for the general entomology students. Students receive instruction in the basics of genetic engineering and biotechnology and explore how these technologies are being applied to solve problems ranging from pest management to the development of human vaccines. Students demonstrate their understanding of these technologies through examinations and research papers, and can demonstrate

basic technical skills (DNA isolation, PCR, cloning and sequencing) through laboratory experiments. *Urban Entomology* (ENTO 403) and the two forensic entomology courses (ENTO 431 & 432) are required of the forensic science track students; these courses as well as *Field-Crop Entomology* (ENTO 402), *Principles of IPM* (ENTO 401), *Horticultural and Floricultural Entomology* (ENTO 405), *Medical Entomology* (ENTO 423) are technical electives from which students can choose to develop their particular career interests. These courses concentrate on the interactions of specific insect groups with humans, animals, and plants and problem-solving using the science and technologies associated with each area. Students demonstrate their understanding of the concepts, principles, and arthropods within these areas through homework assignments, quizzes, research papers, laboratory exercises, and examinations.

- Be able to apply the scientific method in problem solving and the principles of experimental design and analysis.

Problem Solving in Entomology (ENTO 435) is required of all general entomology students, and is a technical elective for the forensic science track students. Students re-examine the scientific method, including hypothesis development and testing, and focus on synthesis of ideas, critical thinking, and problem solving skills. Students review, present, and discuss published manuscripts. With the aid of practicing entomologists and case studies, students apply their learned entomological knowledge and skills to solve real-world problems. Students also demonstrate their understanding and application of problem solving through oral presentation, debate, and written products. All students must complete either a 2-hour research (ENTO 491) or internship (ENTO 484) experience. These are opportunities for students to gain hands-on and problem-solving experience, which is measured by their faculty mentor or internship supervisor, written products, including published manuscripts, and oral presentations. The APRC recommends that consideration be given to development of an undergraduate course in “Principles of Experimental Design & Analysis”. This course will introduce the students to commonly used statistical techniques in the entomological sciences, and prepare them to address the common concerns associated with constructing and designing robust experiments.

- Be able to communicate research and educational materials properly and competently in oral, visual and written formats, and be able to work effectively with others.

Beyond *Composition & Rhetoric* (ENGL 104) and *Scientific & Technical Writing* (ENGL 210), entomology students are currently required to take one course designated as “Writing Courses” by the University Writing Committee. This requirement will increase to two “Writing Courses” beginning with the next academic year (AY07) and will include those students matriculating in catalog 130 and beyond. Currently, *Seminar* (ENTO 481) is approved and

devoted to undergraduate students attending the Departmental Seminar Series in order to learn about the speakers and their research. As part of their requirement, they also write analytical essays about what they have learned. An additional course is being submitted for “W” designation: *Problem Solving in Entomology* (ENTO 435). Requirements for students in individual and team settings to produce written, oral, and visual products for evaluation exist throughout the Entomology and Forensic Science curriculum tracks. For example, *Insect Ecology* (ENTO 424) requires team written laboratory papers, and *Applied Forensic Entomology* (ENTO 431) requires teams to present case results (specimens and data) to an attorney in a courtroom setting and to defend their scientific conclusions on cross-examination. The APRC recommends that consideration be given to developing an undergraduate student forum for presentation of internship and research experiences.

- Develop a global perspective by incorporating national and international aspects of entomological subject matter in courses through participation in study-abroad courses, state, national and international conferences and internships.

Graduate Program – Doctor of Philosophy, Master of Science, and Master of Agriculture Degrees.

The aim of the entomology graduate programs is to provide students with a progressive educational and professional experience in the science and practice of entomology that will prepare them for competitive employment opportunities and help them succeed in their career endeavors. All graduates will:

- Demonstrate a command of core knowledge of entomology.

Graduate students are expected to demonstrate their knowledge of entomology based upon their academic degree plans and experiences as specifically designed by their graduate committee. The degree plan will be tailored to best match their former academic education, career goals, and research projects. The design of individual degree plans should take into account five specific areas; insect physiology, ecology, morphology, systematics, and molecular genetics.

- Design original research (or internship experience), gain skills in modern methods and techniques, and be able to write in a concise and informative manner.

All graduate students will design and carry out original research or an internship experience in order to earn an advanced degree. Graduate students are expected to demonstrate comprehensive understanding of their respective research topics, including supporting research on the topic, clear explanation of the justification of the research, the hypotheses and objectives proposed, the approach (methods, materials, and analyses), and results and interpretations. This comprehensive understanding will be measured by

submission of defended and approved thesis and dissertation proposals, and by subsequent successful defense of completed research. Students in the Master of Science program must pass an oral defense of thesis examination. Students in the Doctoral program must present a proposal seminar to the department prior to submission of the dissertation proposal, pass written and oral preliminary examinations, and present a final oral defense of dissertation. Students in the Master of Agriculture program are to file an approved proposal for their professional internship outlining the background, learning objectives, and approach; and upon completion are to present an oral presentation to the committee. Students in all graduate programs are to meet with their respective advisory committees annually to present and discuss the status of their academic and research progress. Graduate students are encouraged to continue the institutional research proposal requirement by pursuing external research support. This experience is intended to extend and enhance the grant writing skills of students and the understanding of development of competitive grant proposals.

- Demonstrate effective communication with scientific colleagues and the general public in both formal and informal settings.

Graduate students are highly encouraged to participate and expand their professional contacts and experiences through a variety of venues. All graduate students are required to present seminars to the department on their research or internship at the time of their final defense. In addition, students must take graduate seminar classes (ENTO 681) that not only focus on topics of interest, but also require written and oral participation. At a minimum, MS students take one semester of ENTO 681, while PhD students take this seminar course twice (new topics covered each semester). Graduate students are required to attend the Departmental Seminar Series through *Theory of Research* (ENTO 690) credit. This is to encourage and facilitate meeting and networking with invited speakers and expanding students' knowledge of current topics in entomology. All graduate students are highly encouraged to participate in scientific meetings by giving oral or poster presentations outside TAMU, and when possible compete for awards in student presentation competitions. The Graduate Student Forum, held annually prior to the start of each fall semester, highlights graduate student research presentations in a judged event and all graduate students are encouraged to participate.

- Address complex problems taking into account related ethical, social, legal, economic, and environmental issues.

The ethical, social, legal, economic, and environmental issues surrounding research and the science profession are woven through a variety of graduate courses (e.g., *Biological Control* (ENTO 608), *Host Plant Resistance* (ENTO 610), *Medical & Veterinary Entomology* (ENTO 618), *Insect Toxicology* (ENTO 619), and *Landscape Ecology* (ENTO 625)) and are expected to be

among topics of discussion throughout the graduate experience. Graduate students are required to address these issues, when relevant, in their research or internship proposals. For example, graduate students needing to use animals or humans in their research must be in compliance with institutional practices, and are required to submit appropriate forms and documents both at the proposal submission stage and prior to the initiation of any research.

- Demonstrate the ability to work effectively with their colleagues.

Graduate students are expected to work and interact collegially with their colleagues through active participation in student organizations, including the Entomology Graduate Student Organization, as well as through departmental committee assignments. Graduate student representatives are assigned at all departmental committees, except those dealing with faculty evaluation, promotion and tenure.

Graduate Student Recruiting

Graduate student enrollment in the department of entomology steadily increased to the fall semester of 2004 with 65 students, then declined to 52 students in the fall of 2006. While faculty changes (retirements, rehires, etc) are known to impact these numbers, the faculty in retreats in 2005 and the current APRC express the need to do more in graduate student recruiting. The department has depended upon the continuous participation of faculty to recruit graduate students and in recent years focused efforts toward recruiting at the annual Entomological Society of America meetings with special attention to student papers and posters, a recruiting booth, and to special invitations to the TAMU mixer to meet our students and faculty.

Drs. Spence Behmer, Albert Mulenga, and Raul Medina, brought forward to the APRC a proposal to address the graduate student recruitment concern through a new graduate student recruiting weekend.

Quality PhD students are a reflection of a strong Graduate Program and over the past year the Department of Entomology at Texas A&M University has initiated a scheme that hopes to attract top PhD candidates to our Department. In the fall of each academic year we will be offering a number of travel grants (between 6-10) for prospective PhD students to come visit the Department. The aim is to give prospective students an opportunity to interview with various faculty who could serve as graduate advisors or committee members, tour the Department to survey the available facilities and resources, meet the current graduate students, plus explore the Texas A&M University campus and College Station. The travel grants will be awarded on a competitive basis, and successful travel grant applicants will receive round trip domestic airfare to and from College Station, hotel accommodations while in College Station, and a modest per diem for meals. Visits to the Department will take place early in the spring semester, and will occur as part of a recruiting weekend (Wednesday evening through Saturday morning) where the visiting prospective PhD students will also have the opportunity to interact and

visit with one another. One of our aims in bringing the prospective PhD students in as a group is that positive interactions between individuals might influence their decision when picking a graduate program. The majority of the cost for the program will be airfare and hotel accommodations. We are keeping mailing costs low by distributing the travel grant announcement via email. It will go to all Entomology Departments in the U.S., plus selected regional Biology Departments (in the first year of the program, Departments in Texas and the surrounding states). We will also be sending announcements to select individuals as identified by faculty members within the Department. An important part of implementing this scheme is that we will also be able to measure, in each year, the effectiveness of the travel grant program through the number of inquiries we receive, and more specifically the number of graduate applications we receive.