

Department of Entomology Draft Strategic Plan 2008 - 2013

The draft 2008-2013 strategic plan builds on our previous plan and focuses on priorities as measured by gaps, critical issues and opportunities as we deliver on our mission responsibilities in learning (teaching), engagement (extension/outreach) and discovery (research). The original plan was developed in 2002 and revised in 2004 to align with new College and University strategic priorities. We revised our research statements to reflect recent changes in our core discovery mission. The fundamental focus of our engagement and learning missions remain substantially the same, however new challenges and opportunities are recognized and embedded in this draft. Our international interests and commitments are integrated into the three missions of the department in this plan.

Mission

To improve the quality of life for the state, nation and the world by advancing scientific knowledge through the development and application of arthropod/nematode science.

Vision

To be a leader recognized worldwide for the solutions and discoveries generated through the application of science focused on arthropod and nematode biology.

Core Values

- Strive to be pace setting in everything we do
- Encourage the highest standards of ethics and citizenship
- Operate in an open, objective, and inclusive environment
- Foster a community of scholars committed to excellence and teamwork
- Promote the synergism that comes from interdisciplinary interactions
- Value our human capital
- Embrace and promote increased diversity
- Adopt emerging information and other technologies as tools - not final solutions
- Resolve to actively disseminate our knowledge to people of all ages

The following document reflects our stated goals and objectives, as well an evaluation of strengths, weakness, opportunities and threats, plus an outline of gaps, critical issues and opportunities we propose to address in each mission area. The intent here is not to present a detailed work plan, which has been outlined in the signature area and individual program statements, but to provide an accounting of the most important issues we expect to face in the next five years.

Learning

Learning Goal - Recruit high quality students, provide an excellent educational experience, and increase the visibility of entomology in the life sciences and other university programs.

Expected Outcomes:

- Entomology student enrollment and diversity increased.
- Students receive a superior and well-rounded education.
- Teach courses and maintain curricula that give our students a competitive advantage and meet the evolving needs of our students and stakeholders.

SWOT Analysis

Strengths

- Superior student experience as measured by their interactions with faculty, staff and peers, course instruction and extracurricular activities including study abroad, student research, internships as acknowledged by our graduates during exit interviews and recognized by subsequent advisors and employers.
- High quality undergraduate teaching program as measured by the performance and placement of our graduates, and by the awards and honors received by our teaching faculty.
- Service courses and instruction provided to a large number of science and non-science majors from across the university.
- A graduate program with the flexibility to meet the specialized needs of our students.
- A robust undergraduate program that complements our graduate programs across all mission areas.
- Highly successful forensic science minor initiative now administered through Entomology.
- Department website that appeals to students.

Weaknesses

- Perception by some that teaching is not valued as much as other missions.
- Selling entomology as a major with viable career opportunities to perspective students and parents.
- Poor quality of our teaching facilities and equipment e.g. microscopes, lab chairs, specimen storage cabinets, teaching collections.
- Current funding model for forensic science teaching effort not sustainable.

Opportunities

- Hire faculty with a primary teaching responsibility to continue the tradition and commitment to teaching excellence.
- Develop a formal structure (e.g. credit, course(s), internships) for outreach and service learning activities. This applies equally to undergrad and grad education.
- Provide qualified graduate students opportunities to gain teaching, outreach, service learning experiences through appropriate credit classes and internships.
- Position entomology courses as part of interdisciplinary curricula.
- Recruit more undergraduate and graduate students into entomology.
- Support for PK-12 STEM education and outreach programs.
- Develop an interdisciplinary regulatory science minor or graduate degree.

Threats

- Loss of faculty with primary teaching responsibilities.
- Loss of key support staff i.e. grad secretary and curator.
- Need to retain support staff and preserve institutional memory as Purdue transitions to online enrollment and student management.

Gaps

- Measures and evidence of critical thinking components in our courses and curriculum.

Critical Issues

- Ability to recruit faculty with primary teaching responsibilities.
- Succession plan for our teaching program that anticipates future faculty retirements.
- Funding forensic science teaching initiative.

Future Faculty Position

- Insect-Science Teaching/Informal Education (see draft position description in the Strategic Planning section).

2008-2013 Entomology Learning Priorities

Goal	Issue	Strategies/Action Plan (short & long term)	Metrics	Responsible person(s)
<p>Recruit high quality students, provide an excellent educational experience, and increase the visibility of entomology in the life sciences and other university programs.</p>	<p>Entomology student enrollment and diversity significantly increased</p>	<p>Grow undergrad enrollment by promoting careers in entomology; additional emphasis on recruiting under-represented minorities, urban majors, and students interested in forensic science</p>	<p>No. undergrads increased 50% by end of five-year period</p>	<p>Recruitment committee tbd</p>
		<p>Expand grad recruitment efforts beyond traditional Land Grant universities</p>	<p>Generate a steady number of urban majors</p>	<p>Urban program faculty and staff</p>
		<p>Implement, measure and track student recruitment efforts</p>	<p>Graduate student numbers will be increased to an average of 2.5 per faculty member by the end of the five-year period</p>	<p>Grad faculty</p>
			<p>No. minority students increased to represent the overall minority populations within greater Purdue student population</p>	<p>Recruitment comte. tbd</p>

	Students receive a superior and well-rounded education	Elevate value of teaching mission and enhance status of teaching responsibilities	Hire teaching faculty; increase recognition, awards, honors & support for teaching efforts	Faculty
		Increase scholarship in teaching	No. pubs, grants, grad students	Faculty with major teaching appointments
		Opportunities for experiential & service learning, community outreach	No. courses & extramural activities offering experiential, service learning experiences	Teaching & Curriculum (T&C) comte.
		Ensure retention rates exceed University population	90% placement within 12 mo of graduation	T&C comte.
		Promote/provide undergrad research experiences	At least 25% students in undergrad research	T&C and Grad comtes.
		Faculty support and promote international experiences for students	At least one international experience, e.g., study abroad class, offered by the faculty every other yr	Faculty
		Post-grad placement inventory	Data collected and dbase maintained	Grad/undergrad prof assist
		Promote development of teaching skills and opportunities to TA for grad students	No. teaching skills courses/seminars offered, grad student TAs, CIE teaching certificates	Grad comte.

		<p>Counsel grad students to obtain a broad competency of entomological knowledge and test for such competency</p> <p>Upgrade teaching facilities and equipment</p>	<p>As measured by courses, GPA, qualifying exam, thesis defense</p> <p>Teaching facilities and equipment upgraded</p>	<p>Grad comte.</p> <p>Faculty with major teaching appointments; T&C comte</p>
	<p>Teach courses and maintain curricula that give students a competitive advantage and meet the evolving needs of our students and stakeholders</p>	<p>Continually review and update course offerings, course availability</p> <p>Incorporate critical thinking skills in curriculum as appropriate</p> <p>Study abroad, experiential and service learning opportunities offered in courses & student clubs</p> <p>Position entomology courses as part of interdisciplinary curricula</p>	<p>Annual retreat to review teaching issues; peer review of all courses every 5 yrs</p> <p>Critical thinking activities included in 10% of current courses</p> <p>No. study abroad, experiential and service learning opportunities and student participants</p> <p>No. entomology courses added to interdiscip. Curricula</p>	<p>T&C and Grad comtes.</p> <p>T&C and Grad comtes.</p> <p>T&C and Grad comtes.</p> <p>T&C and Grad comtes.</p>

		Expand grad curriculum to reflect student needs and expertise in faculty Pursue sustainable funding for Forensic Science teaching effort	Grad curriculum upgraded to include new course offerings Sustainable funding secured	Grad comte. AG Admin/Yaninek, R. Williams
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Engagement

Engagement Goal – Effectively address the extension/outreach needs of society both here and abroad through education, partnerships, and leadership in knowledge and technology transfer.

Expected Outcomes:

1. Development of environmentally and economically sustainable best management practices (BMP) that meet current, emerging and future pest related challenges (see appendix for program specifics).
2. Implementation and adoption of the best management practices (see appendix for program specifics).
3. Engagement with stakeholders, end-users, policy makers, and the general public.

SWOT Analysis

Strengths

- Diversity of areas of expertise
- Meeting industry and stakeholder needs
- Interdisciplinary emphasis
- Financial support from industry
- Engagement with stakeholders
- Reputation with clientele
- Applied research
- Responsiveness
- Internal communication
- Providing Extension services in other states
- Regional collaboration
- External recognition of quality programs
- Adjunct programs, e.g., USDA APHIS
- International expertise
- Comprehensive urban program
- Outreach program

Weaknesses

- Ability to measure/communicate impact
- Limited financial support from commodity groups (esp. long term funding)
- Lack of continuity in field crops program
- Low visibility of web presence

- Facilities
 - Greenhouse/nursery production
 - Containment facility
 - Smith Hall
- Capitalizing on outreach activities (scholarship, grants, recruitment)

Opportunities

- Train students in applied (as well as basic) areas
- Globalization
- Monopolization (e.g. Box Stores)
- Changing clientele groups
 - Urbanization
 - Increasing corporate farms
 - Increasing small farms
 - Multicultural clientele
- Relationship with Indiana State Department of Agriculture
- Engaging with University K-12 outreach program
- Local foods/markets
- Energy
- Sustainability

Threats

Internal:

- Limited funding
- Potential loss of EFOB (field lab near campus)
- Pending retirements
- Reduction in Extension FTEs due to other departmental responsibilities e.g., teaching
- Outreach affected by pending retirements

External:

- Limited funding
- Economy
- Providing Extension services in other states drains our resources
- Loss of identity in regional efforts (e.g., extension and NPDN)
- Consolidation of Industry
- Possible loss of IPM 3d funding

Gaps

- No obvious gaps

Critical Issues

- Potential loss of federal 3d funding

Future Faculty Position

- Insect Science Teaching/Informal Education (see draft position description in the Strategic Planning section).

2008-2013 Entomology Engagement Priorities

Goal	Issue	Strategies/Action Plan (short & long term)	Metrics	Responsible person(s)
Engage with and meet the needs of stakeholders given our diverse areas of expertise	Comprehensive urban program: <ul style="list-style-type: none"> • Strengthen research base • Opportunities to grow correspondence courses • Emerging pest problems • Broaden impact of program 	Fill endowed positions Grow self-directed learning programs, including foreign clientele Develop programs for emerging pest problems Increase multi-institution collaboration	Positions filled Research dollars Student numbers Number and impact of publications Self-directed learning program students	Urban Ext staff (Bennett, Mason, Sadof, Buczkowski, Saltzmann, Gibb, Richmond)
	Outreach programs: <ul style="list-style-type: none"> • PK-12 science literacy • Scholarly output • External funding • Assessing impact 	Grants to support outreach efforts More scholarly evaluation of programs Assess outreach impact Measure effects of outreach on recruitment Hire insect science education specialist	Amount of external funding No. pubs Impact statements Student numbers Specialist hired	Outreach staff (Turpin, Shepson, Gibb, Oseto, Yaninek)

	Enhance programs through international research and Extension activities	More international opportunities that match interests and expertise e.g. USAID CRSP projects, Kabul U plant protection prog. rehabilitation, Moi U specialty crops pest management	International students Funded activities Scientific exchange, visiting scientists, workshop, publications	Ext staff, Foster, Sadof
	Develop appropriate Extension programs for emerging issues	Initiate new Ext progs to address important emerging issues e.g. local foods/markets, bioenergy, sustainability, the “green” movement	No. new initiatives and programs associated with emerging Ext issues	Ext staff
	Enhance ability to train students in applied as well as basic areas of entomology	Increased university/industry partnerships Targeted student recruitment effort	Amount of Industry support No. students	Ext staff Ext faculty
	Improve ability to measure/communicate impact of programs	Develop new IPM logic models Bring in consultants and implement training to measure impact measurement Work with AgComm to better communicate successes Lobby for college-level impact measurement specialist	More surveys, more contacts Increased stakeholder awareness Publications Response of CES administration	Ext coord., Ext staff, CES

	Improve the visibility of Extension web presence	Hire new webmaster and recruit student assistants with latest web skills	Move up list on web searches Increase hits, etc.	Ext coord., webmaster
	Enhance applied research/Extension progs by improving facilities	Field lab at TPAC Greenhouse/nursery production facility Biological containment facility	Facilities enhanced, improved, constructed	Ag admin, department, Ext staff

Discovery

Goal – Develop and maintain nationally and internationally acclaimed research and development programs in arthropod/nematode pest management, molecular genetics and genomics, and environmental and evolutionary entomology.

Expected Outcomes:

1. A pest management program focused on fundamental mechanisms underlying insect/host interactions, and application of practical and useful knowledge in programs here and abroad.
2. Become acknowledged as a national leader in the application of arthropod and nematode functional genomics and proteomics for the solution of problems and the discovery of new scientific knowledge.
3. Expanded program in environmental biology focused on biodiversity, spatial biology, environmental indicators, and ecosystem services.

SWOT Analysis

Strengths

- Recognized programs in molecular genetics and genomics, pest management, and environmental and evolutionary entomology
- Synergistic interactions between programs
- USDA ARS adjunct faculty, APHIS identifier cooperative agreement
- International presence
- Research collection
- Core facilities e.g. genomics, proteomics, microscopy, etc., research farms
- Capacity in urban pest management

Weaknesses

- Lack of quarantine facilities and limited BSL3 capacity on campus
- Inadequate internal support to seed innovative, interdisciplinary and high risk activities
- No dedicated infrastructure for green industry research
- Internal support for grad students and research technicians

Opportunities

- Green technologies, biotechnology, bioinformatics, risk assessment and resistance management, international efforts in food and fiber production, human health and environment
- New faculty hires
- Split appointments

- Increasing graduate student support through training grants, student fellowships, e.g. NSF
- Expanding nontraditional research support e.g. industry, foundations, foreign countries
- Filling committed endowed chair and professorship

Threats

- Loss of faculty positions in molecular genetics and biological control
- Declining quality of research labs
- Faculty retention
- Redistributing teaching load

Gaps

- Summer salary for academic year faculty

Critical Issues

- Filling vacant faculty positions
- Grad student/postdoc funding
- Facilities and other resources needed to compete for faculty hires/retention and grad students
- Maintaining/enhancing interdisciplinary interactions given our strengths in pest management, genetics/genomics, and environmental science
- Create an institutional climate that allows us to respond to emerging issues

Future Faculty Positions

- Biological Control (see draft position description in the Strategic Planning section).
- Molecular Entomology (see draft position description in the Strategic Planning section).

2008-2013 Entomology Discovery Priorities

Goal	Issue	Strategies/Action Plan (short and long term)	Metrics	Responsible person(s)
A pest management program focused on fundamental mechanisms, and the application of practical and useful knowledge in programs here and abroad	Enhance research component of pest management portfolio	Increase basic research in urban entomology portfolio and synergize interactions between members	Students, pubs, resources	Urban faculty
		Hire specialty crops faculty	Position filled	Faculty
		Hire biological control faculty	Position filled	AGAD/Faculty
		Fill endowed urban chair	Chair filled	AGAD/Donor/Fac
	Globalization	<i>New Initiatives:</i>		
		Purdue/CATIE clean nursery stock project	Interdiscip. programming; proposals	Sadof
		INIFAP, Mexico - Africanized honey bee research; formalize MOU	Formalize MOU with INIFAP	Hunt
		Kabul University Rehab	Faculty & student training implemented; curriculum reviewed & updated	Foster, Oseto, Yaninek
		Moi University	Collaboration initiated; proposals submitted	Yaninek

	Improve research facilities	New purpose-built labs for field crops, specialty crops, green industries, quarantine facilities, grain storage head house	Facilities in place	AGAD/Faculty
Build on strengths in use of arthropod & nematode genomics; discovery of new knowledge	Interdisciplinary genomics	Use techniques from multiple fields to make the connection between genotype and phenotype	No. genes tied to phenotype No. pubs describing gene functions	Ferris, Ginzel, Hill, Hunt, Murdoch, Schemerhorn, Shukle, Stuart, Williams C. and new hire
	Translational genomics	Identify markers or genes linked to agriculturally important traits Augment basic research capacity by filling molecular entomology Fill endowed chair	No. genes/markers identified Position filled Position filled	As above AGAD/Faculty AGAD/Donor/Fac
	Exploit core facilities	Increase projects/research proposals that use core facilities	Submitted proposals	Faculty
Expanded program in environmental and evolutionary entomology	Enhance stature of research collection	Recruit new curator Digitize type holdings and taxa with major representation	Position filled Type holdings and species in taxonomic areas of strength available online	Faculty Systematists, curator

	Need for environmental data resources	Digitize biodiversity data from collection and faunistic surveys Promote and distribute CERIS environmental data	Relevant data available online CERIS environmental data publicized and made available through a variety of appropriate information networks	Systematists, curator CERIS staff
	New linkages with other departs, institutions, public	Initiate new collaborations, where appropriate	No. linkages and funding involved	Ferris, Holland, McCafferty
Enhance opportunity for faculty to participate in inter-disciplinary efforts and compete successfully in large science initiatives	Lack of central support for new initiatives, innovations, high risk science	Change model for institutional research support	New admin paradigm established to support innovation and high risk science	Faculty/AGAD/University
	Group/center R&D initiatives increasingly important to be competitive	New group/center initiatives	Establishment of new functional inter-disciplinary groups or centers	Faculty/AGAD/University
	Critical scientific expertise transcends department/college boundaries	Consider joint faculty appointments where appropriate Support inter-departmental research and proposals	Joint appointment(s) established No. Inter-departmental proposals submitted	Faculty/AGAD Faculty
	Grad training initiatives	Develop interdisciplinary working group focused on graduate training	Submitted training grant proposals	Faculty

Future Faculty Positions

The Department of Entomology requests authorization to fill two vacant research positions with consideration for a third in extension/applied pest management in the future. These include:

- Insect Biological Control (ex Bob O'Neil who passed away in February 2008)
- Insect Molecular Physiology (ex Barry Pittendrigh who left this spring for Illinois)
- Insect-Science Teaching/Informal Education (new teaching position with research focused on informal outreach)

The most recent incumbents in the first two positions were faculty in or approaching the prime of their research careers as measured by resources, publications and graduate students, while the third position anticipates future retirements and embraces new opportunities.

Insect Biological Control - This position is central to our applied insect ecology and plant protection focus, and forms the foundation of our sustainable pest management interests.

Appropriate knowledge and skills could come from any number of related disciplines such as community and landscape ecology, insect pathology, population genetics, systematics and physiology. Further details are provided in the attached justification.

Insect Molecular Physiology - With our growing reputation and strengths in insect genetics and arthropod genomics, an insect molecular physiologist would substantially complement and expand our capabilities in a number of important areas e.g. insect/plant interactions, resistance management, genetic target site discovery, toxicology, translational genomics, proteomics, bioinformatics. The faculty are still deliberating how to pitch the position so that the best possible candidate pool gets created. Further details are provided in the attached justification.

Insect-Science Teaching/Informal Education - A traditional strength of the department has been in teaching popular introductory entomology courses that attract a large number of students. Faculty who moved from primary research appointments have taught these courses over the years. The benefit of successful teaching of such courses to the department is substantial. Two courses (ENTM105 and ENTM206) each semester account for nearly 70% of the students enrolled in entomology courses. In addition, today the need for formal expertise in methods of pedagogy and educational assessment are of value not only to outreach programs including traditional extension efforts but also to research projects that are often required to have a formal assessment component.

Insect Biological Control (Primary Research, Secondary Teaching)

Global trade, worth over \$10.2 trillion annually, has created unprecedented opportunities for the US and its trading partners. Unfortunately these opportunities have brought a steady

invasion of exotic pests that threaten US interests. Many of these invaders, such as soybean aphid and emerald ash borer, are not significant pests in their native range. The ability of these pests to thrive following their introduction is largely due to their populations being unfettered by the natural enemies that keep them in check at home. It has recently been estimated that over 7000 invasive pest species are in the US and that these species increase management costs by over \$140 billion annually.

Biological control is a fundamental component of insect ecology and plant protection, and the foundation of sustainable pest management. It should be no surprise that biological control is a critical pest management option in the battle to protect Indiana agricultural interests from the recently introduced soybean aphid. A native of Asia, this aphid has put nearly 60 million acres of soybean at risk in the Midwest and Canada. In 2003 an estimated 300 million bushels were lost to the aphid. With today's soybean prices hovering at \$15/bushel this translates into a loss valued at \$4.5 billion.

Successful biological control can reduce pest populations, decrease insecticide use, augment yields and increase profits in a sustainable manner with little risk to the environment. The exotic alfalfa weevil was a major pest in the US until a complex of natural enemies was introduced and distributed throughout the alfalfa growing regions of the US. The program spread the beneficial agents and increased parasitism rates as insecticide usage declined. Less than 3% of the fields reached economic injury levels once the natural enemies were established. The benefit:cost of this project has been estimated at < 91:1. Other examples of successful biological control include the introduction of the parasitic wasp *Pediobius foveolatus* to control the Mexican bean beetle on soybeans, and herbivores introduced as antagonists of exotic weeds e.g. the *Apthona* flea beetle to control leafy spurge and *Galerucella* chrysomelid beetles to control purple loosestrife.

Biological control, or the use of natural enemies already in the system to manage pests, requires much more than developing action thresholds to reduce non-target impacts from insecticides. It requires an intimate knowledge and understanding of a pest, its natural enemies, and their interactions that might be manipulated to reduce a pest problem. It also involves manipulating habitats including weed communities to build populations of nearby natural enemies so that they are present when pests become abundant. Knowing how best to manage these systems requires expertise in the biology and ecology of pest natural enemies in cropping and non-cropping systems. In addition, molecular diagnostic skills are increasingly important for evaluating these interactions at every level.

Meeting the growing challenge of invasive species must also include classical biological control options, whereby foreign exploration results in the discovery of natural enemies that keep an exotic pest under control in its country of origin. Successful efforts along these lines require a capacity to network with biological control specialists and taxonomists around the world who can aid in the search for these beneficial predators, parasitoids or diseases. Importing natural enemies is challenging in that it requires specialists to ensure that the beneficial organisms will

not have non-target effects on native species. For this reason, Purdue needs expertise familiar with natural enemy biology and insect ecology, and the capacity to determine if a candidate for importation is safe for release.

Not all biological control challenges involve newly invasive exotic pests. Many of our most important pests are indigenous or have been in the US for some time. Biological control of native and exotic pests will require a clear understanding of predator/prey or host/parasite interactions and the ecological processes involved in pest population and community dynamics. Such an understanding can be greatly enhanced by the knowledge and application of analytical tools from any number of related disciplines such as community and landscape ecology, insect pathology, population genetics, systematics and physiology.

Augmentation, or the release of additional natural enemies into crops is a potentially successful practice that is in its infancy. Though successful in systems that are well studied such as orchards, nurseries and glasshouses, it is ineffective when used inappropriately. Indeed, many natural enemies are labeled as “green” by agencies who are trying to draft a national standard from green practices. Many of the successes to date involve the release of insects, pathogens or nematodes in closed systems or natural enemies with limited mobility. Seeding crops with highly mobile natural enemies often fail because the beneficial insects leave the crops before they establish in the resident pest population. Much research is needed to understand the biology of natural enemies to allow more successful manipulations of their population through augmentation.

A successful program will build on department strengths in research and extension, and complement the biological control capabilities e.g. the Midwest Biological Control Institute, already present in the region. This position should serve as a bridge between applied and theoretical research, and be the catalyst for collaborations that are highly competitive for public and private funding. For example, when a critical pest has been identified like the soybean aphid, funding was made available from crop commodity groups such as the Indiana Soybean Alliance, USDA CSREES IPM and NRICGP programs. Other successful researchers have obtained funds from NSF and NIH to address basic science and public health questions that can also be part of a biological control portfolio.

The crosscutting nature of biological control will make this position a natural for supporting teaching efforts in our department. Historically this has involved teaching a course on the theory and practice of biological control, as well as coordinating an advanced course in insect ecology. Depending on the needs of the department and individual interest, the candidate may contribute to undergraduate teaching of our insect ecology requirement, or teach more advanced courses in disciplines of their choice such as insect pathology, or population or community ecology.

For Purdue to protect Indiana and US agriculture, non-production ecosystems, urban landscapes, and private property from exotic and native pests, we need more than a collection

of Extension specialists who sometimes use biological control as one of their many management tools. Rather we need an individual with dedicated expertise in biological control who can use sustainable biological means to shift a pest into a non-pest by lowering its ability to cause harm.

Insect Molecular Physiology (Primary Research, Secondary Teaching)

One of the great innovations in modern agriculture involves the deliberate breeding of crop plants for resistance to insect pests. Traditional plant-resistance approaches involving breeding and screening have resulted in many useful crop cultivars – for example, widely adopted Hessian fly-resistant wheat cultivars, in which success Purdue has played a major role. In addition to this classical approach, there has been a remarkable recent achievement in plant resistance for insect management – one barely a dozen years old – namely, genetic modification (GM). In a few short years GM varieties of several key American crops, namely corn, soybeans and cotton, have come to dominate the market. Among the special traits of GM crops is insect resistance. According to the USDA/ERS, by 2007 approximately 60 percent of cotton grown in the USA was a Bt variety, while nearly one-half of the corn in the Corn Belt carried some form of the Bt gene. Ninety percent of soybeans are now genetically modified.

Events at the molecular level are the foundation stones on which all forms of plant resistance to insects have been built and will, in the future, be built. Studies of plant resistance to insects and of the interactions of plants and insects at the molecular level are one of the supporting pillars of productive entomology departments. It is critically important that our Department of Entomology keep abreast of both traditional as well as the new opportunities for crop improvement for insect resistance, as well as contribute to new knowledge and understanding of plant insect interactions.

Needs and opportunities for both the science and applications of knowledge of plant insect interactions are substantial and relevant to societal needs. But in addition to this there are new forces at work that strengthen the need for a greater effort in understanding and exploiting plant-insect interactions at the molecular level: Thanks to extraordinary rises in the price of oil over the last several years there has been a major push to develop biofuels based on energy-rich plant feedstocks such as sugarcane and corn. In the Corn Belt, insects are among the important production-limiting constraints. Thanks to genetic engineering we now have European corn borer-resistant and corn rootworm-resistant cultivars expressing specific insect resistance genes. Additional genotypes with stacked insect resistance genes are on the way to market as early as next year. It is clear that as demand for and capacity to utilize biomass for biofuels grows, so will the pressure to increase acreage of crops like corn in the upper Midwest with improved traits, and these traits will require more effective insect resistance against a broader range of pests. In addition to the Midwest, the use of insect-resistant crops (conventional and GM) promises to grow substantially in the coming years as the rises in food prices and increasing scarcity of oil increases the pressure to find ways to increase crop plant productivity. This trend is not restricted to the USA, but is increasingly seen worldwide.

Additional new crops carrying insect resistance genes – such as borer-resistant cowpea and weevil-resistant sweet potatoes, are under active development for Africa, while Bt rice is at an advanced stage of testing in Southeast Asia. The prospect of novel insect-resistant forest tree species is likewise on the horizon.

Despite the wide deployment, rapid acceptance and promising future of this GM technology, as of the summer of 2008, the Department of Entomology has no faculty member with main interest in and experience related to the use of transgenic crops for insect management. In parallel, except for a very strong wheat/Hessian fly program, our capability to deal with traditional plant resistance for other insects has declined over the last decade. It is important that our Department be strengthened in the area of plant insect interactions, both as applied to GM-crop-related issues as well as in more fundamental areas of knowledge, for the benefit of our students and stakeholder groups. Equally import is it that a new faculty member capable of using the latest tools of molecular biology be recruited.

Over the last decade the new tools of molecular biology have penetrated into and have begun to transform virtually every field of entomological research. Those new tools include micro-arrays, qualitative gene expression profiling, qRT-PCR, and genome sequencing and characterization. They also encompass genetic transformation of animals and plants, use of molecular markers, characterization of microRNAs and gene regulatory elements, proteomics, metabolomics and RNA interference. They represent a whole new toolbox for agricultural research and development– one might even say a whole workshop. The new tools have found applications in entomological and nematological phylogenetics, biogeography, evolution, genetics, pest population genetics, pesticide resistance management, and insect-plant interactions. They are shedding new light on physiological and biochemical processes in insects, insect behavior, predator-prey relationships, toxicology, insect migration, and plant resistance.

Leadership with and innovative use of the new molecular tools related to plant-insect interactions is critical for the national and international stature of our Department. There are needs and opportunities for (1) creating new and better insect-resistant plants (2) understanding how insect resistance may break down and how such breakdown might be prevented or managed (3) discovering or devising new insect resistance genes (4) working in a complementary way with field entomologists to monitor insect population structures, feeding habits and movement (5) discovering or describing new protein-related target sites in insects that could be exploited, and (6) studying the fundamental molecular components in plant-insect interactions. The molecular entomologist will necessarily have the ability to work collaboratively with other scientists across departments and institutions. The position would complement and strengthen the already considerable departmental expertise in insect molecular biology and genomics with its special strength in wheat-related research – wheat being a non-GM crop and not likely to become one in the near future. Such a molecular entomologist studying plant-insect interactions would be in an excellent position to collaborate

with scientists in other departments as well as participate in interdisciplinary teams focused on issues such as biofuels.

The new hire should have (i) expertise with a set of molecular tools and (ii) a well-grounded commitment to address important entomological problems in the area of plant/insect interactions. Success in exploiting the unfolding opportunities will not merely require knowledge and skills with one or more of the cutting-edge molecular techniques, but also require an individual who incorporates a commitment to solving outstanding real-world problems as well as more basic research.

The individual's research output should contribute to new knowledge and understanding as well as to the solution of practical problems relevant to our stakeholders and the education of our students.

Funding opportunities exist in a wide range of special areas including traditional agricultural sources, private-sector sources – especially biotechnology-related businesses, private philanthropic foundations, urban-industrial entomology, as well as international agricultural research and development.

Depending on the needs of the department and individual interest, the successful candidate would likely teach a course in his/her area of expertise (toxicology, etc.) but address broader needs in the discipline or college by teaching a course in insect biotechnology or insect molecular biology.

Insect-Science Teaching/Informal Education (Primary Teaching/Outreach, Secondary Research)

Traditionally, there have been two courses (ENTM105 and ENTM206) responsible for attracting a very high percentage of all students who enroll in an entomology course. Individuals who have taught these courses have done so after moving from positions with other than primary teaching appointments. Teaching these high-demand courses necessitates that a large percentage of the individual's time be devoted to the demands of the course. Consequently most of the individuals teaching such courses eventually move to full time teaching appointments.

The department has also developed and maintained a number of informal education activities that provide visibility for the department on both a local, state, national, and international basis. As is the case for the popular courses, individuals who have stepped into leadership roles on a volunteer basis shoulder the burden of maintaining these activities. At the present time, most of the people who teach the popular courses and shoulder most of the burden of outreach are approaching retirement. It will be necessary for the department to address the issue of both teaching the popular courses and maintaining the outreach effort in one of three ways. First,

individuals in the department can be asked to shoulder a larger burden of teaching and outreach; this seems unlikely. Second, such courses and all or part of the outreach activities can be scaled back or dropped. Third, the department can establish a faculty position that would be dedicated to teaching and outreach.

A teaching/outreach position would allow the department to enter into the rapidly emerging area of research in science education and literacy. It would facilitate the ability of the department to capitalize on the leadership in teaching and outreach that has developed over the last 5 decades. It would position our department to be a leader in the development of outreach programs in both the College of Agriculture and the University as a whole. In addition, an individual with the strengths as defined above would be an invaluable resource to ongoing research and extension programs within the department.

Position Description: The successful candidate will serve as a faculty member in the Department of Entomology. Responsibilities include: developing an externally- funded research program to support research in methodology for formal teaching of insect science and informal life science education using insects, and research in techniques for assessment and evaluation of such programs; undergraduate and graduate teaching; and participate in outreach and engagement efforts related to informal insect science education. The successful candidate is expected to participate in cross-discipline research, and collaborations within the university system and outside with related partners.

Qualifications: Candidates must have an earned Ph.D. in entomology. An MS or BS focused on teaching methodology, assessment, or pedagogy or equivalent experience is highly desirable. Familiarity with life science-related education of youth in informal settings is desirable. The successful candidate must be able to conduct and publish high quality research, be able to work effectively in a team environment, and have excellent oral and written communication skills.

Preparing for the Department Review

Goal:

Review progress of department during period of 2002-2008; identify critical issues and develop goals for period of 2008-2013.

- May 7, 2008: Assign groups and tasks
- May – August, 2008: Groups work on tasks assigned
- May – August, 2008: Dept. Head and staff work on materials for Dept. Review notebook
- August 15, 2008: Reports due from each group on Questions/Tasks 1-7, above
- August 18: Reports distributed to faculty and staff
- August 21, 2008: Faculty and staff retreat/meeting to discuss reports
- September – Oct., 2008: Advisory Committee and Dept. Head draft new strategic plan and critical issues document for department review
- November 2008: Faculty and staff discuss draft of new strategic plan and critical issues document for department review
- January 2009: Finalize Dept. Review document
- April 2009: Department Review

Review Objectives:

- Vision and Mission Statements:
 - Our vision is *to be a leader recognized worldwide for the solutions and discoveries generated through the application of science focused on arthropod and nematode biology.*
 - Our mission is *to improve the quality of life for the state, nation and the world by advancing scientific knowledge through the development and application of arthropod/nematode science.*
- Recommendations by review team from 2002 Dept. Review and our responses.
- Department actions proposed in response to the 2002 Department Review recommendations.
- Department Strategic Plan (review total plan, and especially section of assigned mission area). (*Note: This plan was developed in 2002 and revised in 2004 to be consistent with College and University strategic plans.*)
- Compile data/information on metrics for goals of strategic plan.
- University and College Strategic Plans are currently being revised, but should be considered to the extent possible.

Review Procedures:

1. Prepare Accomplishment Report
 - Summarize metrics in 2002 strategic plan
 - Inventory accomplishments and highlights since 2002

2. Review previous recommendations, subsequent responses and resulting accomplishments, and identify critical issues for the future
 - Address by answering following questions:
 - Significant responses since 2002?
 - Major accomplishments since 2002?
 - What is the net change due to our accomplishments (i.e. effectiveness of what was done)?
 - Goals not met (i.e., what wasn't accomplished; consider if this is important for the future)?
 - Changes in the internal and external environment since the goals were set in 2002?
 - Do a SWOT (strengths, weaknesses, opportunities, threats) analysis relevant to mission area, and summarize each aspect (strengths, weaknesses, opportunities, threats).

3. Considering results of SWOT analysis, information/data from goals in previous strategic plan, and current environment, what are the critical issues to address for the next strategic plan (2008-2012)?
 - For each issue:
 - briefly summarize the status/nature of issue
 - give specific goals for each issue
 - identify strategies/action plans to achieve each goal
 - identify metrics for each of the goals
 - identify who will be responsible for each goal

4. Draft new strategic plan
 - Draft new strategic plan for each mission area based on critical issues identified during evaluation process above

Groups Assigned by Mission Areas:

Discovery

Hill/Hunt*

Buczowski

Ferris

Ginzel

Holland

McCafferty

Murdock

Richmond

Schemerhorn

Shukle

Stuart

Wang

C. Williams

Learning

York/Neal*

Dunn

Jones

Oseto

Turpin

R. Williams

T&C committee

Grad committee

Engagement

Gibb/Foster*

Bennett

Bledsoe

Brown

Ellis

Faghihi

Loven

Mason

Provonsha

Sadof

Shepson

Outreach committee

**Discussion facilitators and member of the review steering committee*