

## VII. Appendix G. Entomology Department Strategic Plan

### Entomology Department: Helping you to Become your Best

**The ISU Entomology Department has a long history of responsiveness, excellence, training students for leadership roles and developing innovative and practical solutions to insect-based challenges in public health and agriculture.**

#### **VISION:**

The ISU Entomology Department is a nationally recognized department that leads society by increasing food and fuel security, prevention and elimination of disease, and creating a sustainable environment to improve the quality of life in Iowa and the world.

**MISSION:** The mission of the Department of Entomology is to educate Iowans about insects and the science of entomology in order to improve the quality of life in our State.

- Training outstanding students that are tomorrow's leaders that successfully reach career goals
- Discover new knowledge/relationships that provides novel solutions to emerging and future problems
- Deliver recognized outreach programs that improve the lives of Iowa's residents.

#### **VALUES AND GUIDING PRINCIPLES:**

- Collegial environment
- Dedication to undergraduate and graduate education
- Strong relations with collaborators, public agencies and private industry
- Commitment to outreach/extension
- Interdisciplinary applied and basic research
- Use of web-based delivery/outreach

## Iowa State University – Department of Entomology

### Strategic Plan 2012-2017

The Department of Entomology has had a long tradition of leadership in the state, nation and world for training well-prepared, competitive students, providing solutions through research activities, contributing to economic growth, and extending new knowledge through extension/outreach programs. While the decision to terminate the undergraduate entomology major (2011) was due to limited but loyal enrollment, undergraduate entomology courses are important components of biology, environmental science, agronomy and other academic programs. The graduate training program remains strong and viable.

Faculty foster and value a variety of collaborations through promoting a collegial academic environment, leading and joining team projects, forging new efforts, and developing partnerships with private industry and public agencies including Interdisciplinary centers and participating in multi-state workgroup activities. Faculty have a commitment to developing solutions and delivering value to Iowa's citizens through mission-oriented programs.

#### Activities:

- **Outreach programs** that engage the public and extend research based advice for agriculture and food production, youth activities and recruitment, web-based entomological resources and training Iowa's citizens in pesticide safety.
  - Extension programs in production agriculture, urban and horticulture, and livestock entomology provide a variety of educational programs delivered through public presentations, print materials, mass media, and internet-based venues that include social media, distance education, award-winning pod casts/video and applications.
  - BugGuide is a valuable web-based resource for insect identification and a location to share observations,
  - Iowa State Insect Collection is a resource for entomologists from Iowa and around the world.
  - Insect Zoo delivers programs to pre-collegiate students and the public year round.
  - Pest Management Group trains 35,000 private and commercial pesticide applicators each year
  
- **Specialized undergraduate** academic courses and training that supports pre-professional health, agronomy, biology, environmental sciences, and global resource systems academic programs.
  - Progress in developing an undergraduate forensic entomology course
  - Interest in developing a 1XX insect and society course
  - Interest in developing an 'Insect Ecosystem Services' course
  
- **Graduate programs** internationally recognized for training competitive professionals to think innovatively and creatively.
  - Continue to recruit and retain nationally competitive graduate students;
  - Support students to engage in professional society activities
  
- **Cutting edge trans-disciplinary research by** nationally recognized scientists who provide leadership and cultivate national and international collaborations. ISU Entomology is known for leadership in the areas

of vector biology, crop entomology, resistance management, biodiversity/ecosystem services and green chemistry. Emerging/Invasive pests are a constant threat and present challenges to a small but dedicated faculty.

### **Strategic Goals**

Through a retreat process (January 2012) the Department identified five themes that described current strengths and future disciplinary directions. Teaching and extension/outreach activities are essential to the success of each research area and are embedded in each theme. Overall actions were identified and include the following:

#### **Overall Actions:**

- A.** Professional engagement and leadership through publishing peer-reviewed articles, service on grant review committees, and leadership and participation in professional societies.
  - 1. Publish refereed journal articles
  - 2. Attend and participate in professional society meetings
  - 3. Serve in leadership positions, grant review panels, editorial boards, etc.
- B.** Extend research through teaching, and extension faculty/staff/programs.
  - 1. Extend research programs through service activities, collaboration with dedicated extension faculty/staff
  - 2. Participate formally through classroom teaching or informally through guest lectures in the educational process
- C.** Increase competitive grant funding to support research, extension and teaching efforts
  - 1. Grant funds from state, regional and national sources are encouraged to provide a sustainable source of funds for research and extension programs.
- D.** Patent on intellectual property with application for innovative solutions;
  - 1. Intellectual property is protected
- E.** Recruit and retain excellent graduate students for a nationally recognized graduate research program
- F.** Foster research collaborations with state and federal agencies and with private industry
- G.** Increase partnerships with stakeholders including commodity groups, industry, extension field agronomists, etc.;
- H.** Continue to provide teaching, extension and research leadership in strategic areas.

#### **Theme Areas:**

- I. Vector biology and public health issues of human and animal health:** Research in this area addresses pathogenesis, genetics of vector-host biology, insect-virus interactions, and host resistance mechanisms of human and animal disease organisms. Translational medical efforts targeting human and animal health contribute opportunities for spin-off biotechnology companies and/or large pharmaceutical companies through the design and development of antimicrobials, chemotherapeutics, and novel vaccines and vaccine delivery platforms. Disease systems of interest focus on mosquito and tick borne diseases including West Nile Virus, Lyme disease that affect health and well-being of Iowa residents.
  - o Outcomes/Indicators:

- Applied and basic research that provide fundamental knowledge in the support of human and animal health;
    - Competitive grant funding to support research, extension and teaching efforts
  - Action Items:
    - Collaborate with Iowa Department of Agriculture for arthropod surveillance programs;
    - Generate research-based knowledge for improved management and application;
    - Increase research grant support from nationally competitive sources;
    - Provide leadership and collaborations that advance research, instruction and extension/outreach;
- J. Crop Entomology:** Managing known insect pests of field and horticultural crops, identifying and adjusting to invasive/emerging pests such as emerald ash borer, Japanese beetle, soybean aphid, brown marmorated stink bug and others that have significant economic impact. Currently, exciting advances arise from understanding the genetic basis of ecologically important traits, such as pesticide resistance or disease transmission. Expand collaborations with faculty (plant breeding, plant pathology, others) that enhance knowledge and understanding of ecology and behavior of plant pests and natural enemies for the development of sustainable crop/agricultural systems.
  - Outcomes/Indicators:
    - Applied and basic research that provides the fundamental knowledge needed for pest management solutions. Development of novel technologies such as RNAi for tomorrow's insect management;
    - Knowledge of potential invasive/emerging species and introductions that impact Iowa citizens.
    - Development of recommendations (scouting plans, insecticide effectiveness, economic thresholds) for managing recurring and new invasive pests with existing technologies and novel methods as they become available (resistant crops, new pesticide chemistry, etc.).
  - Action Items:
    - Continue to strengthen collaborator relationships with state and federal agencies and private industry
    - Build an understanding of insect-plant interactions at both the organismal and sub-organismal levels, through research in bioinformatics, evolution, and genomics, which are fundamental to developing pest management solutions.
    - Provide leadership to advance research, instruction and deliver extension/outreach
- K. Resistance management:** First field case of western corn rootworm (WCR) resistance to Cry3Bb1 corn has been recently documented and poses serious consequences for Iowa corn producers and the biotech industry. Increasingly resistance management programs to conserve genetic, technological and chemical management techniques will require knowledge of population genetics, bioinformatics, biochemistry, molecular biology, and ecology to provide solutions. Other potential resistance management issues include soybean aphid, northern CRW, pesticide resistance, and insect resistance to new technologies (RNAi etc.)
  - Outcomes/Indicators:

- Continued leadership in identifying new resistance situations and understanding resistance mechanisms. Biotechnology will support this area.
    - Participate in state and federal and private industry partnerships in developing sustainable practices for resistance management.
    - Competitive grant funding to support research, extension and teaching efforts
  - Action Items:
    - Partnerships in surveillance activities for insect resistance development;
    - Increase awareness of differences in biology and mechanisms for resistance management solutions that are insect-specific;
    - Knowledge of new technologies, management techniques and mechanisms of potential resistance;
    - Provide leadership and collaborations that advance research, instruction and extension/outreach.
- L. **Biodiversity, Ecosystem Services:** Understand insect biodiversity, trophic relationships and ecological services to improve knowledge of Iowa's many environmental systems. Knowledge of the complexity of aquatic and terrestrial communities that focus on entomological components increase our understanding of ecosystem resiliency and sustainability. Studies of aquatic insects as bio-indicators of Iowa's water quality contribute to quantifying ecosystem services that insects provide.
  - Outcomes/Indicators:
    - Collaborate with a variety of professionals to broadly address environmental issues that include water quality and aquatic systems;
    - Curator of the Iowa State Insect Collection to support local, national and international research activities
      - On-line access to collection
    - Contribution to BugGuide for on-line identification services
  - Action Items:
    - Assessment of environmental quality through indicator species; contribute to an understanding of entomological-based complex relationships within aquatic and terrestrial habitats
    - Identify and describe ecological services that insects provide
    - Maintain and contribute to the Insect Museum as a state, regional and international resource
- M. **Biorational Pest Management and Green Chemistry:** Development of innovative green chemistries and organismal and biochemical-level action of pheromones for pest management technologies. Study of natural product insecticides for spectrum of activity, mode of action and environmental impact. Physiological and biochemical modes of actions and sex pheromone biosynthesis provide fundamental knowledge for pest management strategies.
  - Outcomes/Indicators:
    - Continue to discovery novel toxins, biochemical and physiological impacts and their properties;
    - Collaborate with state and federal agencies and private industry in describing toxicological properties and potential environmental impacts;
    - Continue to patent novel chemistries, and products.

- Action Items:
  - Continue to identify and develop new green chemistry technology
  - Continue to explore new chemistry families and environmental impacts;
  - Continue collaborations and develop new partnerships.

**N. Departmental Needs:**

1. Vector biology for infectious and emerging disease transmission is related to the Integrative and Innovative Health Initiative (VPRED). This position would benefit from interdisciplinary collaborations with USDA-ARS affiliated faculty and the National Centers for Animal Health and campus faculty in Microbiology and Immunobiology, GDCB, BBMB, Toxicology and Public Health.
2. Insect genetics – Critical skill set that underlies the crop entomology, resistance management, and biodiversity areas. As insect management solutions are increasingly genetic, knowledge of insect population genetics and insect-plant interactions at the cellular and molecular level are needed for future solutions. Insect genetics would offer stronger linkages with EEOB, GDCB, MBB, and Plant Pathology and Microbiology. Expertise in insect genomics is needed to develop tomorrow’s pest management solutions.
3. Bioinformatics expertise would support all areas of entomology and support the Integrative and Innovative health Initiative (VPRED) through storage, analysis, and interpretation of complex biological data sets; particularly in the areas of gene expression, gene-protein interactions, and molecular biology.
4. Resistance Management has important economic consequences for the Iowa agricultural community. Identifying areas where resistance has developed, and techniques for mitigating resistance is important for current and future technology. Developing guidelines for stalling resistance development would increase the sustainability of pest management systems particularly for corn and soybean pest management.
5. Research Assistantships had been protected during previous budget cuts at the expense of other reductions. Research assistantships are used to convert/supplement funding from M.S. to Ph.D. students and enable faculty to be more competitive in recruiting the top graduate students.
6. Although current faculty may have some activities in the following, these are areas for potential future specialization and growth; biological control, chemical ecology, forest entomology

**O. Institutional Resources:**

- Modern facilities that support applied and fundamental research including space for growth chambers, greenhouses with environmental controls, appropriately equipped laboratories

Adopted: October 19, 2012