INSECT PHEROMONE

Insect Pheromone Biochemistry and Molecular Biology

The biosynthesis and detection of pheromones and plant volatiles

This book provides an up-to-date and in-depth coverage of how insects produce pheromones and how they then detect both pheromones and plant volatiles. Well over half the species on the planet are insects - more than 800,000 in all. Their perception of each other and their world is achieved through the production and reception of chemical odors that provide essential information for the location of prospective mates and food supplies. These chemical messages are unique for each species and thus represent a vast landscape in which we may explore the evolution of behavior and communication.

Many insects such as moths, beetles, aphids and grasshoppers are also pests of crops. Attracted by the specific smells released by these plants, they not only find food, but also each other, aided further by the odorous pheromones that they synthesize and release. Feeding and breeding are thus equally served by their extraordinary sense of smell. Understanding the underlying mechanisms of odor detection and pheromone biosynthesis offers us the means to disrupt their predations and populations without the use of harmful and poisonous pesticides. In the realm of disease transmission, insects such as mosquitoes, ticks and fleas feed on the blood of humans and other animals and in so doing transfer the dangerous pathogens which cause illnesses such as malaria, lime disease and plague. As with the plant feeders, these insects find their hosts by smell. Again, understanding the underlying mechanism of odor detection can help us to combat the process and contribute to improving human health. Continuing research into insect olfaction, founded on the study of insect pheromones, thus provides tremendous scope for mitigating the profound socio-economic impact of insects.

Gary Blomquist and **Richard Vogt** have been leaders in pheromone production and reception, respectively, for over 20 years. Blomquist was co-editor of the very successful 1987 book "Pheromone Biochemistry", and has organized and been part of numerous symposia on the biosynthesis and endocrine regulation of pheromone production. Vogt was involved in the pioneering work on the biochemistry and molecular biology of pheromone reception in insects and has remained a leader in this area. He has organized and participated in numerous symposia and written several reviews ion the subject.

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Blomquist • Vogt

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Gary J. Blomquist
Richard G. Vogt

NEW BOOK

"Insect pheromone Biochemistry and Molecular Biology: the biosynthesis and detection of insect pheromones and plant volatiles."

Edited by Gary J. Blomquist and Richard G. Vogt
Department of Biochemistry, University of Nevada
Department of Biological Sciences, University of South Carolina

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The 1987 book "Pheromone Biochemistry" summarized what was then known about the production and reception of insect pheromones. Remarkable advances in our understanding of pheromone production have occurred in the last one and a half decades, which is mirrored by similar advances in our understanding of pheromone reception. This progress is detailed herein by selected authors who are the leaders in the field. We have assembled contributed chapters from experts who are at the frontiers of pheromone chemistry, neurobiology, chemical ecology, molecular biology and biochemistry.

1. Gary J. Blomquist and Richard G. Vogt
Introduction and Overview.

Part 1. Pheromone Production (from Preface...) The first deals with the biosynthesis and endocrine regulation of pheromone production in those species that have been extensively studied. It emphasizes work done on moths, and is balanced by chapters on beetles, flies, cockroaches. and social insects. Studies on the biochemistry and endocrine regulation of pheromone production have been emphasized in pest insects, insects that produce large amounts of pheromone and as extensions of related work in certain species.

2. Biology and ultrastructure of pheromone producing tissue.
Michael Ma and Sonny Ramaswamy; Department of Entomology, University of Maryland; Department of Entomology, Kansas State University

3. Biochemistry of lepidopteran pheromones.
Russell Jurenka; Department of Entomology, Iowa State University

4. Molecular Biological Investigations of Pheromone Desaturases
Douglas C. Knipple and Wendell L. Roelofs; Department of Entomology, Cornell Experiment Station

5. PBAN regulation of pheromone biosynthesis in female moths
Ada Fafaeli and Russell Jurenka; Department of Stored Products, ISRAEL, Department of Entomology, Iowa State University

6. Biosynthesis and endocrine regulation of pheromone production in Coleoptera.
Steven J. Seybold and Desiree Vanderwel; Department of Entomology, University of Minnesota, Department of Chemistry, University of Winnipeg

7. Molecular Biology of Pheromone Production in Bark Beetles.
Claus Tittiger; Department of Biochemistry, University of Nevada, Reno

8. Biosynthesis and endocrine regulation of hydrocarbon derived sex pheromones in the housefly.
Gary J. Blomquist; Department of Biochemistry, University of Nevada

9. Genetic studies on pheromone production in Drosophila
Jean-Marc Jallon and Claude Wicker-Thomas; CNRS URA 1491 Neurobiologie, University of Paris XI South

10. Regulation of pheromone biosynthesis, transport, and emission in cockroaches
Coby Schal, Yongliang Fan, and Gary J. Blomquist; Department of Entomology, North Carolina State University, Department of Biochemistry, University of Nevada

11. Pheromone production in social insects.
Gary J. Blomquist and Ralph Howard; Department of Biochemistry, University of Nevada

12. Alkaloid-derived pheromones and sexual selection in Lepidoptera.
Thomas Eisner and Jerrold Meinwald; Section of Neurobiology and Behavior and Department of Chemistry, Cornell University

Part II: Detection of Pheromones and other Odor Molecules (from Preface) The second part deals with odor reception, focusing on those proteins known to be uniquely expressed in the antennae and with likely roles in processing pheromone and other odorant signals. These processes are placed in a broader context in chapters adressing the biomechanics of how antennae are designed to capture odors and the physiological responses in the antenna and brain that result from odor reception. A chapter is also included which discusses floral scents and the coevolution of floral scent chemistry and insect response.

13: The Biochemistry of Odor Detection and its Future Prospects.
Laurence J. Zwiebel; Departments of Biology, Vanderbilt University

.**14. Biochemical Diversity in Odor Detection: OBPs, ODEs and SNMPs.**
Richard G. Vogt; Department of Biological Sciences, University of South Carolina

15. Proteins that Make Sense
Walter Leal; Department of Entomology, University of California Davis

16. The peripheral pheromone olfactory system in insects: targets for species-selective insect control agents.
Erika Plettner; Department of Chemistry, Simon Fraser University

17. Biochemistry and diversity of insect Odorant-Binding Proteins.
Patricia Nagnan-Le Meillour, Emmanuelle Jacquin-Joly; INRA , Versailles

18. Biochemistry and Evolution of OBP and CSP proteins.
Jean-Francois Picimbon; Department of Ecology, University of Lund

19 Diversity and Expression of Odor Receptors in Drosophila.
Leslie Vosshall; Laboratory of Neurogenetics and Behavior, The Rockefeller University

20 Transduction Mechanisms of Olfactory Sensory Neurons
Heinz Breer, Jurgen Krieger; Institut fur Physiologie, Universitat Stuttgart-Hohenheim

21. The Biomechanical Design of an Insect Antenna as an Odor Capture Device.
Catherine Loudon; Department of Ecology and Evolutionary Biology, University of Kansas

22. Olfactory Landscapes and Deceptive Pollination: Signal, Noise and Convergent Evolution in Floral Scent.
Robert Raguso; Department of Biological Sciences, University of South Carolina

23. Physiology and Genetics of Odor perception in Drosophila;
Marien de Bruyne; Institut für Biologie – Neurobiologie, Freie Universität Berlin

24. Plasticity and coding mechanisms in the insect antennal lobe.
Mikael A. Carlsson and Bill S. Hansson; Department of Crop Science, Swedish University of Agricultural Sciences