Preface

Insect Signal Transduction Systems: Current Knowledge and Future Directions

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The papers in this special issue were originally derived from presentations at the International Congress of Entomology, Brisbane, Australia, in 2004. The corresponding authors appeared as speakers in a symposium entitled "Insect Signal Transduction Systems: Current Knowledge and Future Directions," organized by Jozef Vanden Broeck (Leuven, Belgium) and David Stanley (Columbia, MO).

Among the many exciting areas of insect science, it would be extremely difficult to exaggerate the importance of our growing knowledge on signal transduction systems. In recent years, the available molecular information has grown exponentially as a result of genome and EST ("expressed sequence tags") sequencing projects. These projects already have an important impact on signal transduction research and provide novel insights in the evolution of genes coding for important components of signaling processes. Future challenges are to study the functional relationships between (this plethora of) genes, as well as the regulation of their expression. In addition to the more traditional insect physiology and the fruitful combination of *Drosophila* genetics and germline transformation technology, some very powerful methods have now become available for functional genomic analyses in the postgenomic research era.

The four contributions to this issue highlight important advances and illuminate emerging concepts in insect signal transduction research.

Claeys et al. report on new findings relative to the influence of the major insect hormones, juvenile hormone (JH) and 20-hydroxyecdysone (20-E), on expression of genes encoding neuropeptides (NPs), small proteins originally known from the pars intercerebralis–corpus cardiacum complex of the migratory locust brain. Four distinct NPs have been detected in the desert locust. These proteins regulate cellular events in nervous, reproductive, and perhaps other tissues. Claeys et al. now report on hormone-regulated NP gene expression in various desert locust tissues, including ovaries, and place this new information into the biological context of locust reproduction. The study also exemplifies how downstream effects of hormones can be analyzed on a molecular level.

Sun and Song contribute important new details on the regulation of the ultraspiracle protein (USP) in *Drosophila*. The ecdysone receptor (EcR) and its heterodimerization partner, USP, are transcriptional factors that mediate the gene expression actions of 20-E. Their activity can be regulated by transcriptional/translational and also posttranslational mechanisms, including protein phosphorylation. Sun and Song surfaced the question of which protein kinases are responsible for regulating USP phosphorylation. The authors propose that Protein Kinase C (PKC) phosphorylates USP based on their data that inhibition of PKC blocks USP phosphorylation and 20-E-dependent gene expression.

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Taneja-Bageshwar et al. investigated structure–activity relationships of arthropod kinins and kinin receptors. They stably expressed kinin receptors from the cattle tick, *Boophilus microplus*, and from the mosquito *Aedes aegypti* in CHO-K1 cells. This achievement allowed them to test the activity of kinin core analogs using a calcium bioluminescence assay. They report that the kinin core pentapeptide FFSWGa is the minimum sequence required and the C-terminal amide is necessary for receptor-mediated activity. Their assay also revealed substantial differences between the tick and mosquito kinin receptors. The work may form a basis for the development of biologically stable kinin-like analogs.

Finally, Walz et al. report on their advances in understanding the physiology of the cockroach salivary gland at the molecular level. Excitation–secre-

tion coupling is stimulated by two biogenic amines, dopamine and serotonin. Both amines stimulate increases in intracellular cAMP and Ca^{2+} concentrations. However, the quality of the secreted saliva varies according to the stimulating biogenic amine. Serotonin stimulates secretion of a protein-rich saliva, while dopamine stimulates secretion of a protein-free saliva. This work reveals two separate saliva-secreting mechanisms under the control of two distinct receptor ligands. Walz et al. point to future work on the receptors.

We bring these reports together to illuminate progress in the broad field of insect signal transduction systems. The future holds real promise for great advances in a research area that has already contributed important fundamental information about how cells function in their biological context.