BOOK REVIEWS

Invertebrate Immunology

Phylogenetic Perspectives in Immunity. The Insect Host Defense. JULES A. HOFFMANN, CHARLES A. JANEWAY, JR., and SHUNJI NATORI, Eds. Landes, Georgetown, TX, 1994 (distributor, CRC Press, Boca Raton, FL). xviii, 197 pp., illus. $89.95 or £74. Molecular Biology Intelligence Unit.

Like other scientists, immunologists seek basic understandings of complex biological processes; when it comes to complexity, adaptive immunity has few equivalents. An "evolutionary" study provides one means of gathering a simpler or (more realistically) different view of a fundamental form, relationship, or mechanism. However, there are some problems with this approach, not the least of which is that the clues being sought may have long since been erased. Furthermore, the mammalian system, clearly the dominant focus of present biological interest, is so specialized as to be inappropriate for comparison with organisms (such as insects) that pass through major life points in periods that are insignificant relative to the decades that mark the lives of mammals. Ironically, it was studies of invertebrate innate immunity by Elie Mechnikoff in the 1880s that provided the foundation of modern cellular immunology. After more than a hundred years of controversy over the issue of invertebrate immunity, it seems that at least one major group of invertebrate models, the insects, have come into their own. *Phylogenetic Perspectives in Immunity: The Insect Host Defense* summarizes the foundations of our current concepts of the character of immunity in this highly diversified group.

The strength of this work is that its various chapters are focused on critical interpretations of data that largely reflect relevant immune challenges to the species at issue. In case the reader is looking for T and B cells, somatic gene arrangement, and positive selection for increasing affinity of antigen receptors, contributors Boman and Davidson, as well as co-editors Janeway and Hoffmann, clarify the lack of evidence for and improbability of their existence outside of the vertebrates. Along with the excellent introduction to the volume, Boman's opening chapter contains a critical interpretation of his own and others' work, giving the reader a framework for interpreting entomological immunology.

Although little previously unpublished information is put forward in the book, past discoveries, misdirected lines of investigation, and incorrect inferences as well as possible future areas of endeavor are depicted clearly. Several chapters contain summaries of properties of antibacterial or antifungal peptides and other substances and take on an encyclopedic character, but these mercifully avoid farfetched claims of amino acid identities and speculative leaps that postulate homology with the primary mediators of vertebrate adaptive immunity. Even in the encyclopedic approach there is considerable merit—perhaps these molecules afford some new concepts for design of antibiotics, a matter worthy of concern as the dwindling resources of the pharmacologist and chemist are being outpaced by deadly genetic accommodations of infectious agents. The book consistently focuses on immunity in the insect; but you can take what you want from the descriptions of some of the well-established linkages between invertebrate and mammalian immunity—the complement system, mannose-binding proteins, cytokines, and so on. The issues of general similarities between insect immune responses and acute-phase reactants in mammals are not overlooked.

The organization is logical, and as a result of careful ordering of the chapters as well as through that rarest of multi-contributor phenomena, accurate cross-referencing, the book can be read from cover to cover with relative ease. Given these stylistic endorsements, what messages come through? First, the evidence for antibacterial and other responses to infectious agents is compelling. A wide variety of molecules exhibit the effects, and homologs of some can be found in the vertebrates. Certain antibacterial responses are inducible, and Hoffmann *et al.* and Hultmark show that the genes flanking some mediators of antibacterial activity contain transcriptional regulatory sequences that have been implicated in the control of immune processes in mammals. Thus, in the broadest evolutionary context, a thread can be drawn through not only constitutively expressed genes but also the inducible systems.

Perhaps this is not all coincidental. Davidson develops the single most significant evolutionary theme in this text—how major regulatory systems emerge and change. This is not a dissertation on a molecular clock ticking away residue by residue on the face of a structural domain, but rather a consideration of macro events that abruptly alter or integrate developmental and other genetic control processes. Viewed in this light, it is evident that the mediators of insect immunity are unrelated by any stretch of molecular systematics to antibody, but the transcriptional regulation of an immunoglobulin locus and a *Drosophila* inducible response may have much in common. One need not look further than the work emerging recently from the laboratories of Fred Alt and others, in which ancient DNA repair processes lie at the heart of one of the key mechanisms that somatically diversify antibodies and T cell antigen receptors, to comprehend the scope of integration of preexisting systems.

If it is answers that you want as to how the sophisticated mechanisms of segmented gene rearrangement and somatic hypermutation found in all jawed vertebrates evolved, there are several protochordate subphyla and an entire vertebrate class (the Agnatha, or jawless vertebrates) that probably hold more immediately relevant information than can be garnered through studies of insects; however, this book comes as close as any that I have seen to objectively addressing the topic of immunity in a nonvertebrate metazoan and documenting that you do not necessarily need B cell activation and an Fc receptor on a macrophage to kill a bacterium. Given the extraordinary diversity of life form within the insects, it would come as no surprise that there is much more to be learned from these species about the most basic aspects of host response to disease.

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Diffusion Phenomena

Chemical Waves and Patterns. RAYMOND KAPRAL and KENNETH SHOWALTER, Eds. Kluwer, Norwell, MA, 1995. x, 641 pp., illus. $272 or £179 or Dfl. 425. Understanding Chemical Reactivity, vol. 10.

It might seem that the effect of diffusion in a spatially distributed, unstirred molecular system would be to make homogeneous the spatial concentration distribution of chemical species. However, the opposite can be true. It occurs in complex reacting systems with appropriate feedback loops in their