

Evolutionary Concepts In Immunology

Evolutionary Concepts in Immunology Robert Jack, Louis Du Pasquier. 2019-06-13 Immunology is a nodal subject that links many areas of biology. It permeates the biosciences, and also plays crucial roles in diagnosis and therapy in areas of clinical medicine ranging from the control of infectious and autoimmune diseases to tumour therapy. Monoclonal antibodies and small molecule modulators of immunity are major factors in the pharmaceutical industry and now constitute a multi billion dollar business. Students in these diverse areas are frequently daunted by the complexity of immunology and the astonishing array of unusual mechanisms that go to make it up. Starting from Dobzhansky's famous slogan, "Nothing in biology makes sense except in the light of evolution", this book will serve to illuminate how evolutionary forces shaped immunity and thus provide an explanation for how many of its counter intuitive oddities arose. By doing so it will provide a conceptual framework on which students may organise the rapidly growing flood of immunological knowledge.

Evolutionary Mechanisms of Defense Reactions Vaclav Vetvicka, P. Sima. 1998-07-21

Avian Immunology Karel A. Schat, Bernd Kaspers, Pete Kaiser. 2012-12-02 The second edition of Avian Immunology provides an up-to-date overview of the current knowledge of avian immunology. From the ontogeny of the avian immune system to practical application in vaccinology, the book encompasses all aspects of innate and adaptive immunity in chickens. In addition, chapters are devoted to the immunology of other commercially important species such as turkeys and ducks, and to ecoimmunology summarizing the knowledge of immune responses in free-living birds often in relation to reproductive success. The book contains a detailed description of the avian innate immune system, encompassing the mucosal, enteric, respiratory and reproductive systems. The diseases and disorders it covers include immunodepressive diseases and immune evasion, autoimmune diseases, and tumors of the immune system. Practical aspects of vaccination are examined as well. Extensive appendices summarize resources for scientists including cell lines, inbred chicken lines, cytokines, chemokines, and monoclonal antibodies. The world-wide importance of poultry protein for the human diet, as well as the threat of avian influenza pandemics like H5N1 and heavy reliance on vaccination to protect commercial flocks makes this book a vital resource. This book provides crucial information not only for poultry health professionals and avian biologists, but also for comparative and veterinary immunologists, graduate students and veterinary students with an interest in avian immunology. With contributions from 33 of the foremost international experts in the field, this book provides the most up-to-date review of avian immunology so far. Contains a detailed description of the avian innate immune system reviewing constitutive barriers, chemical and cellular responses; it includes a comprehensive review of avian Toll-like receptors. Contains a wide-ranging review of the ecoimmunology of free-living avian species, as applied to studies of population dynamics, and reviews methods and resources available for carrying out such research.

Origin and Evolution of the Vertebrate Immune System L. Du Pasquier, G.W. Litman. 2012-12-06 The comparative approach to immunology can be traced to the era of Pasteur and Metchnikov in which observations regarding foreign recognition in invertebrates was a factor in the development of the principal concepts that created the foundation of what now is the broad field of immunology. With each major experimental and conceptual breakthrough, the classical, albeit essential, question has been asked: are the immune systems of phylogenetically primitive vertebrates and invertebrates similar to that of mammals? Somewhat surprisingly for the jawed vertebrates, the general answer has been a qualified form of yes, whereas for agnathans and invertebrate phyla it has been no so far. The apparent abruptness in the appearance of the immune system of vertebrates is linked to the introduction of the somatic generation of the diversity of its antigen specific receptors. Therefore the questions regarding the origin and evolution of the specific immune system revolve around this phenomenon. With respect to the origin of the system (aside from the origin of the rearranging machinery itself, the study of which is still in its infancy) one can ask questions about the cellular and molecular contexts in which the mechanism was introduced.

Janeway's Immunobiology Kenneth Murphy, Paul Travers, Mark Walport, Peter Walter. 2010-06-22 The Janeway's Immunobiology CD-ROM, Immunobiology Interactive, is included with each book, and can be purchased separately. It contains animations and videos with voiceover narration, as well as the figures from the text for presentation purposes.

Molecular Evolution on Rugged Landscapes Alan S. Perelson. 2018-03-08 This book lays out a number of the general issues concerning the structure of rugged fitness landscapes and examines both the history and the current status of experimental work on somatic mutation and the maturation of the immune response.

Changing Views of the Evolution of Immunity Gary W. Litman, Larry J. Dishaw. 2014-01-22 The multitude of cells, signaling pathways, receptors, novel genetic recombination mechanisms and interactive pathways of receptor function and cell differentiation that constitute the vertebrate adaptive immune system are integrally linked with the multicomponent innate immune system. At first glance, the levels of complexity seen in both systems at the phylogenetic level of mammals present what seem to be insurmountable hurdles in terms of achieving a systematic understanding of the evolution of immunity. New research directions and approaches suggest that resolution of many long-standing questions in this area is now possible. Historically, immunologists considered lower vertebrates and invertebrates as "simpler" forms, i.e., they were expected to possess more basic (less layered) levels of immunological complexity and thus potentially would serve as important resources. By considering the systematic placement of representative species in the context of phylogeny, characterizing their immune receptors, co-receptors as well as accessory molecules and evaluating responses to immunologic stimuli, it was thought that a clearer picture of immune evolution would emerge. There is no doubt that this approach has achieved some notable successes but for the most part it has fallen short in terms of achieving a broad understanding of the immunologic needs of many relevant models and how adaptive change in immune function is effected. Even if a structurally relevant ortholog of an immune effector is identified in a model organism, there is no reason to assume that it functions in a corresponding manner in disparate phylogenetic taxa. For example, survival of a sessile marine invertebrate, whose anatomical form puts it in open and contiguous contact with a literal sea of microorganisms and viruses, would be thought to depend, at least in part, on a "capable" immune response; however, at present, we have no real understanding of how this is achieved in an integrated manner. Furthermore, questions arise as to whether or not phenomena that are considered integral components of vertebrate-type immunity such as memory, tolerance, somatic change and clonal selection exist in invertebrates and if their functions parallel those recognized in mammals. More often than not, our interpretations are guided by preconceived notions that are based on observations made in distant species that often do not apply to far-removed taxa. We anticipate that major advances in our understanding of this broad subject are now forthcoming as resources exist or are being developed for examining important model organisms in their natural environments instead of within the confines of in vitro systems of potentially remote physiological significance. Taking a wide range of hypotheses, observations and interpretations into account, in this special topic, contributors have developed a comprehensive overview emphasizing new directions and interpretations for understanding basic aspects of immunity that consider unique features inherent to various model systems, their life histories and habitats. Approaches applied with key model organisms maintained and confronted with relevant challenges under natural conditions are emphasized. Current concepts of self and nonself are addressed not only in terms of immunity but also reproductive fitness. How genetic variation in immune effector molecules is achieved and maintained in natural populations is examined; particular attention is directed to response interfaces that factor in symbiotic interactions. Gene expansion and mechanisms of genetic diversification are explored. How diverse molecules and a variety of effector cells contribute to our broad understanding of the evolution of a remarkably complex, integrated system and how this work is facilitating our understanding of mammalian immunity is addressed.

Evolutionary Parasitology Paul Schmid-Hempel. 2021-07-15 Parasites and infectious diseases are everywhere and represent some of the most potent forces shaping the natural world. They affect almost every aspect imaginable in the life of their hosts, even as far as the structure of entire ecosystems. Hosts, in turn, have evolved complex defences, with immune systems being among the most sophisticated processes known in nature. In

response, parasites have again found ways to manipulate and exploit their hosts. Ever since life began, hosts and parasites have taken part in this relentless co-evolutionary struggle with far-reaching consequences for us all. Today, concepts borrowed from evolution, ecology, parasitology, and immunology have formed a new synthesis for the study of host-parasite interactions. Evolutionary parasitology builds on these established fields of scientific enquiry but also includes some of the most successful inter-disciplinary areas of modern biology such as evolutionary epidemiology and ecological immunology. The first edition of this innovative text quickly became the standard reference text for this new discipline. Since then, the field has progressed rapidly and an update is now required. This new edition has been thoroughly revised to provide a state-of-the-art overview, from the molecular bases to adaptive strategies and their ecological and evolutionary consequences. It includes completely new material on topics such as microbiota, evolutionary genomics, phylodynamics, within-host evolution, epidemiology, disease spaces, and emergent diseases. Evolutionary Parasitology is suitable for advanced undergraduates, graduate level students, and interdisciplinary researchers from a variety of fields including immunology, genetics, sexual selection, population ecology, behavioural ecology, epidemiology, and evolutionary biology. Those studying and working in adjacent fields such as conservation biology, virology, medicine, and public health will also find it an invaluable resource for connecting to the bases of their science.

Discovery and Explanation in Biology and Medicine Kenneth F. Schaffner.1993 Kenneth F. Schaffner compares the practice of biological and medical research and shows how traditional topics in philosophy of science—such as the nature of theories and of explanation—can illuminate the life sciences. While Schaffner pays some attention to the conceptual questions of evolutionary biology, his chief focus is on the examples that immunology, human genetics, neuroscience, and internal medicine provide for examinations of the way scientists develop, examine, test, and apply theories. Although traditional philosophy of science has regarded scientific discovery—the questions of creativity in science—as a subject for psychological rather than philosophical study, Schaffner argues that recent work in cognitive science and artificial intelligence enables researchers to rationally analyze the nature of discovery. As a philosopher of science who holds an M.D., he has examined biomedical work from the inside and uses detailed examples from the entire range of the life sciences to support the semantic approach to scientific theories, addressing whether there are laws in the life sciences as there are in the physical sciences. Schaffner's novel use of philosophical tools to deal with scientific research in all of its complexity provides a distinctive angle on basic questions of scientific evaluation and explanation.

Comparative Immunology Edwin Lowell Cooper.1976

The Limits of the Self Thomas Pradeu.2012-02-27 Immunology asserts that an individual can be defined through self and nonself. Thomas Pradeu argues that this theory is inadequate, because immune responses to self constituents and immune tolerance of foreign entities are the rule, not the exception.

Genetics and Evolution of Infectious Diseases Michel Tibayrenc.2010-12-17 Genetics and Evolution of Infectious Diseases is at the crossroads between two major scientific fields of the 21st century: evolutionary biology and infectious diseases. The genomic revolution has upset modern biology and has revolutionized our approach to ancient disciplines such as evolutionary studies. In particular, this revolution is profoundly changing our view on genetically driven human phenotypic diversity, and this is especially true in disease genetic susceptibility. Infectious diseases are indisputably the major challenge of medicine. When looking globally, they are the number one killer of humans and therefore the main selective pressure exerted on our species. Even in industrial countries, infectious diseases are now far less under control than 20 years ago. The first part of this book covers the main features and applications of modern technologies in the study of infectious diseases. The second part provides detailed information on a number of the key infectious diseases such as malaria, SARS, avian flu, HIV, tuberculosis, nosocomial infections and a few other pathogens that will be taken as examples to illustrate the power of modern technologies and the value of evolutionary approaches. Takes an integrated approach to infectious diseases Includes contributions from leading authorities Provides the latest developments in the field

Somatic Selection and Adaptive Evolution E.J. Steele.2012-12-06 The origins of the idea to write this book are impossible to trace. What I can say with some certainty, is that the book would not have emerged without the pleasing interplay of two contingent pleasures which occurred in the summer of 1978. The first was the penetrating sense of awe experienced when I finished reading Koestler's recent book 'Janus A Summing Up', 1978. His philosophy provided that necessary inspiration to tackle, in a rational way, a long held dissatisfaction with the conventional Darwinian explanation of evolution. The second was the more subliminal pleasure of camping and exploring that beautiful panorama of the lake district of Northern Ontario. The book, written in an argumentative style, reviews the case for the inheritance of acquired characteristics and proposes a simple, feasible mechanism to drive this process. It is written from the narrow perspective of an experimental Immunologist with an interest in the evolution of multicellular organisms. Much attention is given to current ideas in Immunology, and at times we dive deeply into its heartland to grasp those threads relevant to a general theory of evolution. In these excursions, I take pains not to lose the general reader (although I run the risk of annoying some Immunologists), I do this so that the argument is understood by Biologists as a whole. This narrow approach path, however, eliminates areas of interest to some Biologists, e. g.

Ecoimmunology Gregory Demas,Randy Nelson.2012-01-17 The role of parasites and pathogens in the evolution of life history traits is of increasing interest to both ecologists and evolutionary biologists. Immunology, which was once studied almost exclusively by immunologists, has become an important area of proximate investigation to animal physiologists as a means for understanding changes in disease susceptibility and the neural and neuroendocrine mechanisms that mediate these changes. The coalescence of these different perspectives has given rise to the field of ecological immunology, an interdisciplinary research field that examines interactions among host physiology and disease ecology in a wide range of environmentally relevant contexts. The goal of ecological immunology is to understand immune function in the context of life-history traits across a wide range of organisms. Research within the field combines diverse approaches from a wide range of scientific disciplines including evolution, ecology, and life history theory to endocrinology, neuroscience, molecular biology, and behavior. This book critically reviews recent advances in the discipline of ecoimmunology. Chapters are written by experts in their respective fields and cover diverse topics including how environmental factors can affect host immune function, the complex dynamics among host immunity, pathogen prevalence and disease susceptibility, and the physiological mechanisms that lead to adaptive changes in immune responses. By integrating analyses of immune system function within animal biology, investigators will gain a more comprehensive and satisfying understanding of organism-environment interactions at both ultimate and proximate levels of analysis.

Evolution in Four Dimensions, revised edition Eva Jablonka,Marion J. Lamb.2014-03-21 A pioneering proposal for a pluralistic extension of evolutionary theory, now updated to reflect the most recent research. This new edition of the widely read Evolution in Four Dimensions has been revised to reflect the spate of new discoveries in biology since the book was first published in 2005, offering corrections, an updated bibliography, and a substantial new chapter. Eva Jablonka and Marion Lamb's pioneering argument proposes that there is more to heredity than genes. They describe four “dimensions” in heredity—four inheritance systems that play a role in evolution: genetic, epigenetic (or non-DNA cellular transmission of traits), behavioral, and symbolic (transmission through language and other forms of symbolic communication). These systems, they argue, can all provide variations on which natural selection can act. Jablonka and Lamb present a richer, more complex view of evolution than that offered by the gene-based Modern Synthesis, arguing that induced and acquired changes also play a role. Their lucid and accessible text is accompanied by artist-physician Anna Zeligowski's lively drawings, which humorously and effectively illustrate the authors' points. Each chapter ends with a dialogue in which the authors refine their arguments against the vigorous skepticism of the fictional “I.M.” (for Ipcha Mistabra—Aramaic for “the opposite conjecture”). The extensive new chapter, presented engagingly as a dialogue with I.M., updates the information on each of the four dimensions—with special attention to the epigenetic, where there has been an explosion of new research. Praise for the first edition “With courage and verve, and in a style accessible to general readers, Jablonka and Lamb lay out some of the exciting new pathways of Darwinian evolution that have been uncovered by contemporary research.” —Evelyn Fox Keller, MIT, author of Making Sense of Life: Explaining Biological Development with Models, Metaphors, and Machines “In their beautifully written and impressively argued new book, Jablonka and Lamb show that the evidence from more than fifty years

of molecular, behavioral and linguistic studies forces us to reevaluate our inherited understanding of evolution.” —Oren Harman, *The New Republic*
“It is not only an enjoyable read, replete with ideas and facts of interest but it does the most valuable thing a book can do—it makes you think and reexamine your premises and long-held conclusions.” —Adam Wilkins, *BioEssays*

Kuby Immunology Jenni Punt, Sharon Stranford, Patricia Jones, Judy Owen. 2018-10-16 Janis Kuby’s groundbreaking introduction to immunology was the first textbook for the course actually written to be a textbook. Like no other text, it combined an experimental emphasis with extensive pedagogical features to help students grasp basic concepts. Now in a thoroughly updated new edition, *Kuby Immunology* remains the only undergraduate introduction to immunology written by teachers of the course. In the Kuby tradition, authors Jenni Punt, Sharon Stranford, Patricia Jones, and Judy Owen present the most current topics in an experimental context, conveying the excitement of scientific discovery, and highlight important advances, but do so with the focus on the big picture of the study of immune response, enhanced by unsurpassed pedagogical support for the first-time learner. Punt, Stranford, Jones, and Owen bring an enormous range of teaching and research experiences to the text, as well as a dedication to continue the experiment-based, pedagogical-driven approach of Janis Kuby. For this edition, they have worked chapter by chapter to streamline the coverage, to address topics that students have the most trouble grasping, and to continually remind students where the topic at hand fits in the study of immunology as a whole.

Immunobiology Charles Janeway, Paul Travers. 1996 The central thesis of this text is that the immune system exists to protect its host from infection and that its evolutionary history was shaped by this challenge. The first part summarises the basic immunological concepts, the middle three parts deal with main aspects of adaptive immunity, while the final part integrates the material at the level of the complete organism in both health and disease.

Aging L. Robert, T. Fulop. 2014-05-16 Aging inspired a large number of theories trying to rationalize the aging process common to all living beings. In this publication the most important environmental and intrinsic mechanisms involved in the aging process and in its pathological consequences are reviewed. Furthermore theoretical and experimental evidence of the most important theoretical elements based on Darwinian evolution, cellular aging, role of cell membranes, free radicals and oxidative processes, receptor-mediated reactions, the extracellular matrix and immune functions as well as the most important environmental and intrinsic mechanisms involved in the aging process and in its pathological consequences are discussed. These presentations of theories and related experimental facts give a global overview of up to date concepts of the biology of the aging process and are of essential reading not only for specialists in this field but also for practitioners of scientific, medical, social and experimental sciences.

Killer Cell Dynamics Dominik Wodarz. 2007-04-05 This book reviews how mathematical and computational approaches can be useful to help us understand how killer T-cell responses work to fight viral infections. It also demonstrates, in a writing style that exemplifies the point, that such mathematical and computational approaches are most valuable when coupled with experimental work through interdisciplinary collaborations. Designed to be useful to immunologists and virologists without extensive computational background, the book covers a broad variety of topics, including both basic immunological questions and the application of these insights to the understanding and treatment of pathogenic human diseases.

Immunology and the Quest for an HIV Vaccine Dr. Omar Bagasra, MD, PhD and Dr. Donald Gene Pace, PhD. 2012-01-13 How many human immune systems are there? How old are they? Why is there no AIDS vaccine? Is a new approach needed? Why is public opinion growing skeptical of the scientific community after three decades of public awareness about HIV/AIDS? Consider answers to these puzzling questions. Learn from the decades of experience of two senior scholars: Dr. Omar Bagasra (an eminent molecular biologist, immunologist, and retrovirologist) and Dr. Donald Gene Pace (a highly published writer who examines public health policy). Explore intriguing new possibilities about human immunity, and the development of an effective AIDS vaccine. Read *Immunology and the Quest for an HIV Vaccine*. Benefit from an informed synthesis backed by a wealth of peer-reviewed scientific references. Review basic concepts of immunology, and stretch your perspective by contemplating this creative synthesis that provides a provocative treatise on the origin, evolution, and etiology of several forms of immune systems. Consider compelling ideas that will have an important bearing on HIV vaccine development. Enjoy this informative volume designed for anyone interested in the development of a safe AIDS vaccine, for anyone curious about present knowledge about human immunity, and for anyone yearning for a solution to the global pandemic that is AIDS.

Evolution of Immune Reactions Petr Sima, Vaclav Vetvicka. 1990-08-27 This book on phylogeny and immunity reconstructs the history and evolutionary pathways of immunity among the various forms of life. The authors argue that the immunity could have evolved different adequately successful patterns in the animal sub-regnum which are strictly determined by the morpho-physiological possibilities of the animals. They state that the vertebrate type of immunity evolved only in the chordate branch. The publication devotes special attention to the arthropods and molluscs, as they have attracted more investigative efforts than any other invertebrate taxa. The authors selected Agnatha, Chondrichthyes, and Osteichthyes from the vertebrate taxa in order to show where and how the morphofunctional basis of the truly adaptive immunity of the endothermic tetrapods gradually evolved. Each chapter gives the description of the origin and interrelationships of the representatives of the taxon in question. Also given are the main biological, morphological, non-morphological and immune attributes. Emphasized throughout the book is the central idea that immunological reactions are a part of the overall biological phenomena and should be studied only from this aspect. The authors express that the fields of comparative and evolutionary immunology will provide inspiration for further investigations in biomedicine in the near future.

The Evolution of the Immune System Davide Malagoli. 2016-07-21 *The Evolution of the Immune System: Conservation and Diversification* is the first book of its kind that prompts a new perspective when describing and considering the evolution of the immune system. Its unique approach summarizes, updates, and provides new insights on the different immune receptors, soluble factors, and immune cell effectors. Helps the reader gain a modern idea of the evolution of the immune systems in pluricellular organisms Provides a complete overview of the most studied and hot topics in comparative and evolutionary immunology Reflects the organisation of the immune system (cell-based, humoral [innate], humoral [adaptive]) without introducing further and misleading levels of organization Brings concepts and ideas on the evolution of the immune system to a wide readership

Evolutionary Mechanisms of Defense Reactions Vaclav Vetvicka, P. Sima. 2012-12-06 At present, we do not fully understand at what stage of the evolution of living matter the first traces of defense reactions occurred. We even do not fully understand how and why immune systems reached their contemporary state in advanced vertebrates and man. It may be expected that in the near future these questions will be answered by comparative and developmental biology. Together with an extraordinary explosion of our knowledge about immunity of mammals including man, an increase in the interests concerning origin and development of immune mechanisms at lower stages of the phylogeny can be observed. The search for simple types of immune mechanisms in less complex but still evolutionary successful animals is promising and may contribute to better understanding of highly complex immune adaptive responses in mammals. It is important to note that comparative and evolutionary immunology differs greatly from other branches of biomedical science. Apart from immunology and molecular biology, a specialist in this discipline has to be familiar with every detail of taxonomy, comparative anatomy, physiology, embryology, and even with the phyletic relationships of animals. Probably no monography could deal with the entire animal kingdom, because, in many cases, the insights into questions about immune mechanisms of many animal groupings or phyla, and their possible evolutionary implications, are unknown or just now beginning to take shape. For the moment, our knowledge on such matters relies upon reconstructions of ideas that we have deduced from studies on members of relative taxa.

The Gastro-Archeologist Jeremy Woodward. 2021-02-03 In order to understand common conditions such as coeliac disease and Crohn’s disease, one must view the gut in its evolutionary context. This is the novel approach to the gut and its diseases that is adopted in this book. The first part tells the story of the evolution of the gut itself – why it came about and how it has influenced the evolution of animals ever since. The second part focuses on the evolution of immunity and how the layers of immune mechanisms are retained in the gut, resembling the strata revealed in an archeological dig. The final part, ‘The Gastro-Archeologist’, ties the first two together and highlights how understanding the gut and immune system in their evolutionary context can help us understand diseases affecting them. Ambitious in its scope but telling a unique story from a refreshingly novel

perspective, the book offers an informative and enjoyable read. As the story of the gut, immunity and disease unfolds, the author aims to endow readers with the same sense of awe and excitement that the subject evokes in him. Difficult concepts are illustrated using simple and colourful analogies, and the main content is supplemented with anecdotes and unusual and amusing facts throughout the book. The book is intended for anyone with an interest in the gut, its immunity and diseases, ranging from school and college biology and biomedical students, to professionals working in the field, and to patients suffering from intestinal diseases who want to understand more about their conditions.

Host and Microbe Adaptations in the Evolution of Immunity Larry J. Dishaw, Gary W. Litman. 2019-12-31 The evolution of metazoans has been accompanied by new interfaces with the microbial environment that include biological barriers and surveillance by specialized cell types. Increasingly complex organisms require increased capacities to confront pathogens, achieved by co-evolution of recognition mechanisms and regulatory pathways. Two distinct but interactive forms of immunity have evolved. Innate immunity, shared by all metazoans, is traditionally viewed as simple and non-specific. Adaptive immunity possesses the capacity to anticipate new infectious challenges and recall previous exposures; the most well-understood example of such a system, exhibited by lymphocytes of vertebrates, is based on somatic gene alterations that generate extraordinary specificity in discrimination of molecular structures. Our understanding of immune phylogeny over the past decades has tried to reconcile immunity from a vertebrate standpoint. While informative, such approaches cannot completely address the complex nature of selective pressures brought to bear by the complex microbiota (including pathogens) that co-exist with all metazoans. In recent years, comparative studies (and new technologies) have broadened our concepts of immunity from a systems-wide perspective. Unexpected findings, e.g., genetic expansions of innate receptors, high levels of polymorphism, RNA-based forms of generating diversity, adaptive evolution and functional divergence of gene families and the recognition of novel mediators of adaptive immunity, prompt us to reconsider the very nature of immunity. Even fundamental paradigms as to how the jawed vertebrate adaptive immune system should be structured for “optimal” recognition potential have been disrupted more than once (e.g., the discovery of the multicuster organization and germline joining of immunoglobulin genes in sharks, gene conversion as a mechanism of somatic diversification, absence of IgM or MHC II in certain teleost fishes). Mechanistically, concepts of innate immune memory, often referred to as “trained memory,” have been realized further, with the development of new discoveries in studies of epigenetic regulation of somatic lineages. Immune systems innovate and adapt in a taxon-specific manner, driven by the complexity of interactions with microbial symbionts (commensals, mutualists and pathogens). Immune systems are shaped by selective forces that reflect consequences of dynamic interactions with microbial environments as well as a capacity for rapid change that can be facilitated by genomic instabilities. We have learned that characterizing receptors and receptor interactions is not necessarily the most significant component in understanding the evolution of immunity. Rather, such a subject needs to be understood from a more global perspective and will necessitate re-consideration of the physical barriers that afford protection and the developmental processes that create them. By far, the most significant paradigm shifts in our understanding of immunity and the infection process has been that microbes no longer are considered to be an automatic cause or consequence of illness, but rather integral components of normal physiology and homeostasis. Immune phylogeny has been shaped not only by an arms race with pathogens but also perhaps by mutualistic interactions with resident microbes. This Research Topic updates and extends the previous eBook on Changing Views of the Evolution of Immunity and contains peer-reviewed submissions of original research, reviews and opinions.

Eco-immunology Davide Malagoli, Enzo Ottaviani. 2014-04-11 This book represents a cutting-edge contribution giving an all-around perspective of eco-immunology today. Beside questions of the utmost importance for the whole community of immunologists, e.g. the intrinsic limits of immunological experiments performed at the bench on a limited number of selected models, the book covers several other facets of the eco-immunological approach, including host-parasite interactions, human aging and population immunology. Throughout the book the importance of population dynamics and evolutionary diversification of immune systems is frequently recalled, and makes the reader aware of the basic similarities and differences existing between humans and the models adopted for studying human immune system. The evidenced differences have been recently challenging the reliability of several established animal models and in the book it is discussed for the first time in analytical terms whether mice are reliable models of human inflammatory disorders.

The Cheating Cell Athena Aktipis. 2020-03-24 A fundamental and groundbreaking reassessment of how we view and manage cancer When we think of the forces driving cancer, we don't necessarily think of evolution. But evolution and cancer are closely linked because the historical processes that created life also created cancer. The Cheating Cell delves into this extraordinary relationship, and shows that by understanding cancer's evolutionary origins, researchers can come up with more effective, revolutionary treatments. Athena Aktipis goes back billions of years to explore when unicellular forms became multicellular organisms. Within these bodies of cooperating cells, cheating ones arose, overusing resources and replicating out of control, giving rise to cancer. Aktipis illustrates how evolution has paved the way for cancer's ubiquity, and why it will exist as long as multicellular life does. Even so, she argues, this doesn't mean we should give up on treating cancer—in fact, evolutionary approaches offer new and promising options for the disease's prevention and treatments that aim at long-term management rather than simple eradication. Looking across species—from sponges and cacti to dogs and elephants—we are discovering new mechanisms of tumor suppression and the many ways that multicellular life-forms have evolved to keep cancer under control. By accepting that cancer is a part of our biological past, present, and future—and that we cannot win a war against evolution—treatments can become smarter, more strategic, and more humane. Unifying the latest research from biology, ecology, medicine, and social science, *The Cheating Cell* challenges us to rethink cancer's fundamental nature and our relationship to it.

Origin of Anti-Tumor Immunity Failure in Mammals Ivan Bubanovic. 2007-05-08 The history of science has shown the majority of hypotheses to be wrong. Sharp scientific criticism and strictly controlled experimental studies reject most of the hypotheses, leaving behind only a small number of assumptions and ideas. Nevertheless, each logical assumption should have its rightful place on the scientific “battlefield” supposed to assess its validity and determine its final fate. Even when a hypothesis is wrong, it still finds its place in the entire efforts of the humankind towards attaining the scientific truth. Namely, the wrong hypotheses serve largely to illuminate the way towards the correct ones or, at least, to show which way not to follow. Correct or not, ideas and hypotheses are necessary for the progress of science. They epitomize the efforts of human thought to elucidate nature without experimental verification and in the circumstances of scant data availability. Finally, hypotheses and ideas represent a symbiotic creation of our knowledge and imagination, the two most impressive appearances in the evolution of humans.

Amphioxus Immunity An-Long Xu. 2015-12-31 *Amphioxus Immunity: Tracing the Origin of Human Immunity* covers a remarkable range of information about Amphioxus and its evolutionary context. This compilation of what is currently known about Amphioxus, with a sharp focus on its immune system, includes 13 topics, such as: Amphioxus as a model for understanding the evolution of vertebrates basic knowledge of immunology immune organs and cells of amphioxus a genomic and transcriptomic view of the Amphioxus immunity pattern recognition system in Amphioxus transcription factors in Amphioxus the complement system of Amphioxus the oxidative burst system in Amphioxus immune effectors in Amphioxus lipid signaling of immune response in Amphioxus apoptosis in amphioxus; primitive adaptive immune system of Amphioxus and future research directions This valuable reference book is loaded with information that will be useful for anyone who wishes to learn more about the origin of vertebrates and adaptive immunity. Provides new evidence on the origin of the adaptive immune system, the evolution of innate immunity, and evolution-stage specific immune defense mechanisms Not only presents the cells and molecules involved in the adaptive immune response in Amphioxus, but also characterizes the origination and evolution of the gene families and pathways involved in innate immunity Includes much pioneering work, from the molecular, genomic, and cellular to the individual level

The Immune System Rodney E. Langman. 1989-01-01 (5E 1991) Concer

Insect Infection and Immunity Jens Rolff, Stuart Reynolds. 2009-06-25 This book is published on the occasion of the Royal Entomological Society's Symposium on Insect infection and immunity in Sheffield, July 15-17 2009.

Immunology and Evolution of Infectious Disease Steven A. Frank. 2020-10-06 From HIV to influenza, the battle between infectious agents and the immune system is at the heart of disease. Knowledge of how and why parasites vary to escape recognition by the immune system is central to vaccine

design, the control of epidemics, and our fundamental understanding of parasite ecology and evolution. As the first comprehensive synthesis of parasite variation at the molecular, population, and evolutionary levels, this book is essential reading for students and researchers throughout biology and biomedicine. The author uses an evolutionary perspective to meld the terms and findings of molecular biology, immunology, pathogen biology, and population dynamics. This multidisciplinary approach offers newcomers a readable introduction while giving specialists an invaluable guide to allied subjects. Every aspect of the immune response is presented in the functional context of parasite recognition and defense--an emphasis that gives structure to a tremendous amount of data and brings into sharp focus the great complexity of immunology. The problems that end each chapter set the challenge for future research, and the text includes extensive discussion of HIV, influenza, foot-and-mouth disease, and many other pathogens. This is the only book that treats in an integrated way all factors affecting variation in infectious disease. It is a superb teaching tool and a rich source of ideas for new and experienced researchers. For molecular biologists, immunologists, and evolutionary biologists, this book provides new insight into infectious agents, immunity, and the evolution of infectious disease.

A History of Immunology Arthur M. Silverstein.2009-06-17 In this innovative, short, new textbook, Rod Langman offers a conceptual framework within which students can understand the evolution of the immune system. Evolutionary selection for resistance to infectious disease is shown to be the driving force that has shaped the immune system into a remarkably effective and efficient system of defense. In the midst of the current information explosion in immunological science, when many students are under the impression that the immune system is almost too complex to understand as a whole, *The Immune System* can be used alone as a text for an introductory course or used in conjunction with any of the several descriptive texts already on the market.

War in the Body W David Wick,Otto O Yang.2013-07-10 In the relatively few decades since the introduction of HIV into the human population, variants of the virus have diverged to such an extent that, were the discussion about something other than viruses, said variants could easily be classified as different species. This book will consider these evolutionary variations, as well as the different and, at times, opposing theories attempting to explain them. It will compare and contrast the ways in which the immune system and drugs affect the virus's evolution, and the implications of these for vaccine development. The issue will be explored and explained through ecological genetics, which postulates that all living organisms have, besides rivals, enemies. This is divergent from the more traditional school of population genetics, which emphasizes that evolution occurs among rival species (or variants thereof) that compete for niches or resources in a fixed, unreactive environment. Both models will be formulated using mathematical models, which will be included in the book. Finally, it will consider the possibilities for designing a vaccine that blocks HIV from escaping the immune system.

Immunity Alfred I. Tauber.2017-01-02 Modern immunology traditionally conceives of the immune system as providing defense against pathogens. Alfred I. Tauber criticizes this conception of immunity as too narrow, because it discounts much of the immune system's other normal functions. These include active tolerance of nutritional exchanges with the environment and the stabilization of cooperative relationships with resident micro-organisms. An expanded account extends immunity's functional role from singular 'defense' to broadened discernment of environmental 'exchange.' This ecological perspective has profound theoretical implications, for the basic notion of immune identity is reconfigured: highlighting the organism as a holobiont (a consortium of diverse organisms living in cooperative relationships) challenges prevailing concepts of individuality and the self/nonself dichotomy heretofore organizing immune theory. Indeed, if theoretical interest is focused on the challenges of maintaining immune balance in the full ecological context of the organism, then immune regulation assumes new complexity. Tauber maintains that the key to unravelling that puzzle requires a critical re-assessment of the cognitive processes that underlie immune effector functions. Accordingly, he provides the outline of a re-formulated 'cognitive paradigm' that dispenses with agent-based models and adopts an ecologically conceived understanding of perception and information processing. The implications of this revised configuration of immunity and its deconstructed notions of individuality and selfhood have wide significance for philosophers and life scientists working in immunology, ecology, and the cognitive sciences.

The Immune System Rodney Langman.1989-03-28 9780124365858 *The Immune System: Evolutionary Principle Guide our Understanding of this Complex Biological Defense System* provides the conceptual framework of immunology and the evolutionary events that have shaped the understanding of the immune system. This book contains 10 chapters, and begins with a brief discussion on the evolutionary aspects of immunology considering the Darwinian principles of evolution. This topic is followed by a presentation of the selective pressures that are likely to have molded the immune system, as well as the laws of the immune system and their corollaries concerning host defense mechanism. The subsequent chapters are devoted to cellular components of the immune system, including the B and T cells, immunoglobulins, interleukins, major histocompatibility complex, and lymphoid organs. The structural information and the evolutionary events in these immune system components are provided. A chapter focuses on the evolutionary successful components of the inflammatory system. The concluding chapter deals with the conflicting conventional wisdoms on functional immune system. This book will prove useful to immunologists and research workers in immunology and related fields.

Immunologic Phylogeny W. Hildemann.2013-06-29 There are two now classic reasons for the widespread and continuing interest in the phylogeny of immune reactivities and structure. First is the fundamental concern of biologists with the evolution of defense mechanisms. We are eager to discover origins, mechanisms, and adaptive specializations of immunocompetence because the very existence of individuals and entire species is involved in a most essential way. Second is the strong biomedical interest in adaptive immune mechanisms to increase understanding of health and disease in man. If man and placental mammals represent the quintessence of immunoresponsiveness with complex interdependent pathways, the less elaborate but fully functional systems of immunity in lower animals proffer insights applicable to immediate concerns in medicine. Recent approaches to organ transplantation, immunotherapy of cancer and repair of immunodeficiency diseases, to name just a few areas, have depended greatly on phylogenetic perspectives. In a larger sense, intelligent wildlife conservation, utilization of food resources, and adequate environmental protection all hinge on knowing how diverse species survive or otherwise succumb to insults, injuries, and disease. The phylogenetic immunologist also seeks detailed information on the structure of the immunoglobulins which relates directly to the evolutionary history of living animals. Perhaps genetic mechanisms responsible for the evolution of these proteins may be revealed as spin-off information. The vast number of immunoglobulin specificities and effector structures, coupled with the remarkable phylogenetic conservation of certain polypeptide regions, makes these molecules especially useful to protein chemists as well as immunologists.

Lessons in Immunity Lorian Ballarin,Matteo Cammarata.2016-04-08 *Lessons in Immunity: From Single-cell Organisms to Mammals* stems from the activity of the Italian Association of Developmental and Comparative Immunobiology (IADCI), represented by the editors. This book is presented as a series of short overviews that report on the current state of various relevant fields of immunobiology from an evolutionary perspective. The overviews are written by authors directly involved in the research, and most are members of the IADCI or have otherwise been involved in the related research for their respective overview. This publication offers scientists and teachers an easy and updated reference tool. Provides simple and updated reviews on the immunobiology of a wide spectrum of organisms, considered in an evolutionary context Focuses on both cells and humoral components of a variety of non-classical model organisms Offers in a single volume many contributions which can help with understanding the evolution of immune responses and the main adaptations in animal phyla Presents a valuable holistic cross-sectional approach for teaching immunology and its applications

Concepts of Biology Samantha Fowler,Rebecca Roush,James Wise.2018-01-07 *Concepts of Biology* is designed for the single-semester introduction to biology course for non-science majors, which for many students is their only college-level science course. As such, this course represents an important opportunity for students to develop the necessary knowledge, tools, and skills to make informed decisions as they continue with their lives. Rather than being mired down with facts and vocabulary, the typical non-science major student needs information presented in a way that is easy to read and understand. Even more importantly, the content should be meaningful. Students do much better when they understand why biology is relevant to their everyday lives. For these reasons, *Concepts of Biology* is grounded on an evolutionary basis and includes exciting features that highlight careers in the biological sciences and everyday applications of the concepts at hand. We also strive to show the interconnectedness of topics

within this extremely broad discipline. In order to meet the needs of today's instructors and students, we maintain the overall organization and coverage found in most syllabi for this course. A strength of Concepts of Biology is that instructors can customize the book, adapting it to the approach that works best in their classroom. Concepts of Biology also includes an innovative art program that incorporates critical thinking and clicker questions to help students understand--and apply--key concepts.

Immunobiology of the Shark Sylvia L. Smith, Robert B. Sim, Martin F. Flajnik. 2014-12-04 Sharks belong to the oldest vertebrate species that possess immune systems similar to that of mammals. This makes them a great model species to study the fundamentals of the mammalian immune system. This book describes the cellular, genetic, and molecular specifics of immune systems in sharks and uses them to understand shark immunity as well as the evolution of immune systems in more recently-evolved vertebrates. Written by global experts, the book will be a resource for immunologists, geneticists, ecologists, evolutionary and conservation biologists, and investigators engaged in shark research.

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