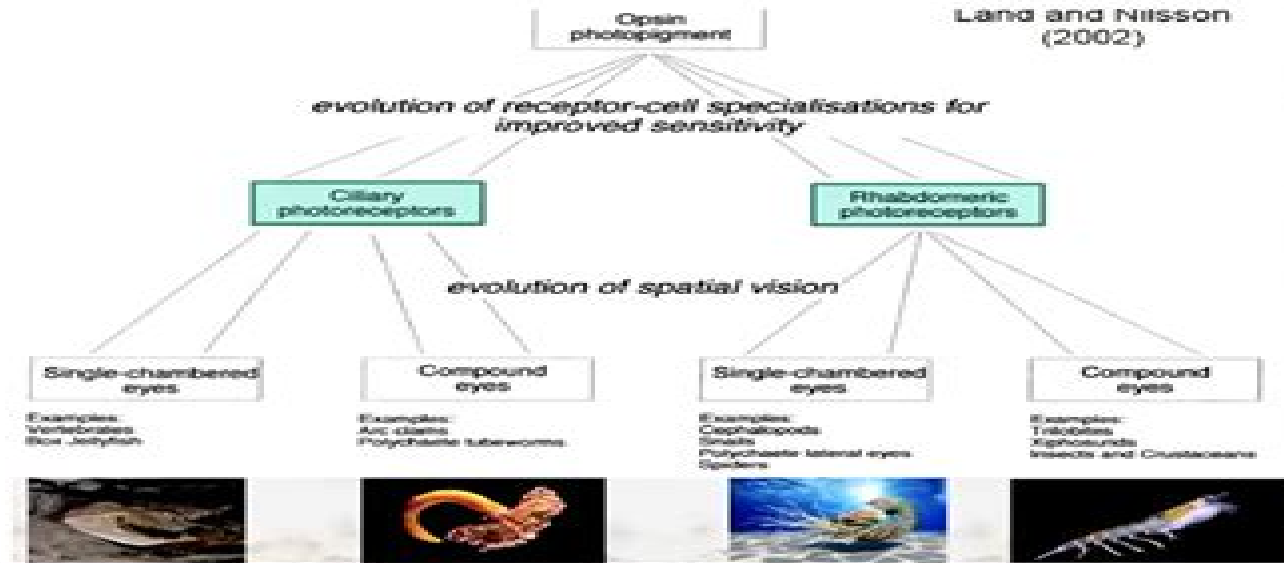


## LECUTRE 7: INVERTEBRATE VISION



### Opsins

- Pigment that is sensitive to light

### Ciliary photoreceptors

- Single chambered eyes
- Humans
- Box jelly fish
- One big lens at the front and photoreceptors lined on the retina on the back of it until you get a big lens opening and the light reaches the back
  - Compound eyes
- Made up of individual eye lids
- Each eye has a photoreceptors

### Difference between single and compound

- Single
  - Single lens at the front that projects the image Upside down to the retina where it is read by photoreceptors
    - Compound
  - Each photoreceptor (8 photoreceptors) in one unit which is called an ommatidium, each unit has its own lens, they are arranged so tightly so it is like pixels on a camera.
  - The difference is the size of the lens. Bigger the lens the more light goes in and the better quality of the camera

# Invertebrate Vision Invertebrate Vision

**H. Autrum, M. F. Bennet, B. Diehn, K.  
Hamdorf, M. Heisenberg, M.  
Järvilehto, P. Kunze, R. Menzel, W. H.  
Miller, A. W. Snyder, D. G. Stavenga, M.  
Yoshida**

## **Invertebrate Vision Invertebrate Vision:**

**Invertebrate Vision** Eric Warrant, Dan-Eric Nilsson, 2006-10-05 Publisher description      **Comparative Physiology and Evolution of Vision in Invertebrates** H. Autrum, M. F. Bennet, B. Diehn, K. Hamdorf, M. Heisenberg, M. Järvilehto, P. Kunze, R. Menzel, W. H. Miller, A. W. Snyder, D. G. Stavenga, M. Yoshida, 2012-12-06 In the comparative physiology of photoreception by the Protista and the invertebrates two aspects are emphasized 1 the diversity of visual processes in these groups and 2 their bearing upon general mechanisms of photoreception Invertebrates have evolved a far greater variety of adaptations than vertebrates modifications aiding survival in the remarkably different biotopes they occupy The number of species in itself suggests this multiformity each of them has peculiarities of its own in morphology as well as in physiology and behavior But these special adaptations are variations on a few great themes Although the catalogue of invertebrate species is immense the literature concerning them nearly rivals it in extent even if one considers only that fraction dealing with visual physiology Taxonomy proceeds by grouping the species categorizing them in genera families orders and progressively larger units Similarly comparative physiology aims at an analogous more or less comprehensive classification This Part A of Volume VII 6 like Part B that follows it emphasizes the broad questions that concern groups larger than the individual species in some cases these questions have general applicability The middle course between approaches that are too specialized and those that are too general is often elusive but here we attempt to follow it The vast number of special adaptations probably as we have said as large as the number of species is beyond the range even of a handbook

*Photoreception and Vision in Invertebrates* M. A. Ali, 2013-03-09 I see a man's life is a tedious one Cymbeline Act III Sc 6 It is well known that the best way to learn a subject is to teach it Along the same lines one might also say that a pleasant way of learning a subject and at the same time getting to know quite a few of the workers active in it is to arrange and to attend an Advanced Study Institute ASI or a workshop lasting about two weeks This was and is the wisdom behind the NATO ASI programme and much as people fear that a fortnight may be too long before it is over everyone feels that it was too short especially if the weather had cooperated Organising this ASI which resulted in this volume has been a very good learning experience I started my career in research with invertebrates and retained an interest in them over the years due to my teaching a course and working sporadically on various aspects of photoreception in Polychaetes Crustaceans and Insects Thus the thought of organising an ASI on photoreception and vision in invertebrates had been brewing in my mind for the past half a dozen years or so It was felt that it will be desirable to do a bit of stock taking and discuss possible new approaches to the study of this matter      *Comparative physiology and evolution of vision in invertebrates* C Hansjochem et. al Autrum, 1981      Comparative Physiology and Evolution of Vision in Invertebrates M.F. Land, S.B. Laughlin, D.R. Nässel, N.J. Strausfeld, T.H. Waterman, 2012-08-14 Morphology and physiology are two fields which cannot be separated This statement needs to be amplified purely factual results of a morphological or physiological nature only have real value when

they are gained in the context of certain guiding embracing questions By themselves they are mostly of little value because only a guiding hypothesis or theory is of any importance Equally a physiological question will always raise questions as to the morphological substrate and vice versa Thus Wiedemann s discovery for instance that the visual cells in each ommatidium of the dipterans have differing fields of vision has revived the question as to what the optical properties of individual visual cells and the complete ommatidium might be and how neighboring ommatidia interact These questions in turn led to that of the morphological neuronal wiring diagram of the visual cells in the optical ganglia Within the realm of invertebrates the morphological and physiological problems of visual perception have been resolved in very different ways on various levels from the photo receptor to higher centers despite many investigations however there remain unsolved problems The first chapter of Vol VII 6B deals with the neuroarchitecture in the visual system of two groups crustaceans and insects These systems are best known through recent investigations The second chapter is devoted to the neural principles in the visual system of insects It could not have been written without parallel research into morphology

**Human Color Vision** Jan Kremers,Rigmor C. Baraas,N. Justin Marshall,2016-12-06 Our understanding of human color vision has advanced tremendously in recent years helped along by many new discoveries ideas and achievements It is therefore timely that these new developments are brought together in a book assembled specifically to include new research and insight from the leaders in the field Although intentionally not exhaustive many aspects of color vision are discussed in this Springer Series in Vision Research book including the genetics of the photopigments the anatomy and physiology of photoreceptors retinal and cortical pathways color perception the effects of disorders theories on neuronal processes and the evolution of human color vision Several of the chapters describe new state of the art methods within genetics morphology imaging techniques electrophysiology psychophysics and computational neuroscience The book gives a comprehensive overview of the different disciplines in human color vision in a way that makes it accessible to specialists and non specialist scientists alike About the Series The Springer Series in Vision Research is a comprehensive update and overview of cutting edge vision research exploring in depth current breakthroughs at a conceptual level It details the whole visual system from molecular processes to anatomy physiology and behavior and covers both invertebrate and vertebrate organisms from terrestrial and aquatic habitats Each book in the Series is aimed at all individuals with interests in vision including advanced graduate students post doctoral researchers established vision scientists and clinical investigators The series editors are N Justin Marshall Queensland Brain Institute The University of Queensland Australia and Shaun P Collin Neuroecology Group within the School of Animal Biology and the Oceans Institute at the University of Western Australia

*Encyclopedia of Neuroscience, Volume 1* Larry R. Squire,2009-06-12 The Encyclopedia of the Neuroscience explores all areas of the discipline in its focused entries on a wide variety of topics in neurology neurosurgery psychiatry and other related areas of neuroscience Each article is written by an expert in that specific domain and peer reviewed by the advisory board before acceptance into the

encyclopedia Each article contains a glossary introduction a reference section and cross references to other related encyclopedia articles Written at a level suitable for university undergraduates the breadth and depth of coverage will appeal beyond undergraduates to professionals and academics in related fields

**Neurophysiological Aspects of Color Vision in Primates** E. Zrenner, 2012-12-06 To explain all nature is too difficult a task for anyone man or even for anyone age Tis much better to do a little with certainty and leave the rest for others that come after you than to explain all things Sir Isaac Newton 1642 1727 This book describes and discusses some new aspects of color vision in primates which have emerged from a series of experiments conducted over the past 8 years both on single ganglion cells in monkey retina and on the visually evoked cortical potential in man corresponding psychophysical mechanisms of human perception will be considered as well An attempt will be made to better understand the basic mechanisms of color vision using a more comprehensive approach which takes into account new mechanisms found in single cells and relates them to those found valid for the entire visual system The processing of color signals was followed up from the retina to the visual cortex and to the perceptual centers as far as the available techniques permitted

**Comparative Physiology and Evolution of Vision in Invertebrates** M.F. Land, S.B. Laughlin, D.R. Nässel, N.J. Strausfeld, T.H. Waterman, 2012-02-12 Morphology and physiology are two fields which cannot be separated This statement needs to be amplified purely factual results of a morphological or physiological nature only have real value when they are gained in the context of certain guiding embracing questions By themselves they are mostly of little value because only a guiding hypothesis or theory is of any importance Equally a physiological question will always raise questions as to the morphological substrate and vice versa Thus Wiedemann's discovery for instance that the visual cells in each ommatidium of the dipterans have differing fields of vision has revived the question as to what the optical properties of individual visual cells and the complete ommatidium might be and how neighboring ommatidia interact These questions in turn led to that of the morphological neuronal wiring diagram of the visual cells in the optical ganglia Within the realm of invertebrates the morphological and physiological problems of visual perception have been resolved in very different ways on various levels from the photo receptor to higher centers despite many investigations however there remain unsolved problems The first chapter of Vol VII 6B deals with the neuroarchitecture in the visual system of two groups crustaceans and insects These systems are best known through recent investigations The second chapter is devoted to the neural principles in the visual system of insects It could not have been written without parallel research into morphology

**Comparative Physiology and Evolution of Vision in Invertebrates** Hans Jochem Autrum, 1979

**Evolution of Visual and Non-visual Pigments** David M. Hunt, Mark W. Hankins, Shaun P Collin, N. Justin Marshall, 2014-10-04 Photopigments are molecules that react to light and mediate a number of processes and behaviours in animals Visual pigments housed within the photoreceptors of the eye such as the rods and cones in vertebrates are the best known however visual pigments are increasingly being found in other tissues including other retinal cells the

skin and the brain Other closely related molecules from the G protein family such as melanopsin mediate light driven processes including circadian rhythmicity and pupil constriction This Volume examines the enormous diversity of visual pigments and traces the evolution of these G protein coupled receptors in both invertebrates and vertebrates in the context of the visual and non visual demands dictated by a species ecological niche *Encyclopedia of Animal Behavior* ,2019-01-21 Encyclopedia of Animal Behavior Second Edition Four Volume Set the latest update since the 2010 release builds upon the solid foundation established in the first edition Updated sections include Host parasite interactions Vertebrate social behavior and the introduction of overview essays that boost the book s comprehensive detail The structure for the work is modified to accommodate a better grouping of subjects Some chapters have been reshuffled with section headings combined or modified Represents a one stop resource for scientifically reliable information on animal behavior Provides comparative approaches including the perspective of evolutionary biologists physiologists endocrinologists neuroscientists and psychologists Includes multimedia features in the online version that offer accessible tools to readers looking to deepen their understanding *The Science of Photobiology* Kendric C. Smith,2013-03-08 The first edition of The Science of Photobiology was published in 1977 and was the first textbook to cover all of the major areas of photobiology The science of photobiology is currently divided into 14 subspecialty areas by the American Society for Photobiology In this edition however the topics of phototechnology and spectroscopy have been combined in a new chapter entitled Photophysics The other subspecialty areas remain the same i e Photochemistry Photosensitization UV Radiation Effects Environmental Photobiology Photomedicine Circadian Rhythms Extraretinal Photoreception Vision Photomorphogenesis Photomovement Photosynthesis and Bioluminescence This book has been written as a textbook to introduce the science of photobiology to advanced undergraduate and graduate students The chapters are written to provide a broad overview of each topic They are designed to contain the amount of information that might be presented in a one to two hour general lecture The references are not meant to be exhaustive but key references are included to give students an entry into the literature Frequently a more recent reference that reviews the literature will be cited rather than the first paper by the author making the original discovery The chapters are not meant to be a repository of facts for research workers in the field but rather are concerned with demonstrating the importance of each specialty area of photobiology and documenting its relevance to current and or future problems of man *Photochemistry of Vision* Herbert J.A. Dartnall,2012-12-06 Radiation can only affect matter if absorbed by it Within the broad range of 300 1000 nm which we call the visible light quanta are energetic enough to produce excited electronic states in the atoms and molecules that absorb them In these states the molecules may have quite different properties from those in their dormant condition and reactions that would not otherwise occur become possible About 80 % of the radiant energy emitted by our sun lies in this fertile band and so long as the sun s surface temperature is maintained at about 6000 C this state of affairs will continue This and the transparency of our atmosphere and waters have allowed the

generation and evolution of life Before life began the atmosphere probably also transmitted much of the solar short wave radiation but with the rise of vegetation a new product oxygen appeared and this by a photochemical reaction in the upper atmosphere led to the ozone layer that now protects us from the energetic short wave quanta that once perhaps took part in the generation of life molecules Light is an ideal sensory stimulus It travels in straight lines at great speed and consequently can be made to form an image from which an animal can make true continuous and immediate assessments of present and impending events *Comparative Physiology and Evolution of Vision in Invertebrates* Hansjochem Autrum,1979

Sensory Biology of Aquatic Animals Jelle 1987,Richard R. Fay,William N. Tavalga,2012-12-06 This volume constitutes a series of invited chapters based on presentations given at an International Conference on the Sensory Biology of Aquatic Animals held June 24 28 1985 at the Mote Marine Laboratory in Sarasota Florida The immediate purpose of the conference was to spark an exchange of ideas concepts and techniques among investigators concerned with the different sensory modalities employed by a wide variety of animal species in extracting information from the aquatic environment By necessity most investigators of sensory biology are specialists in one sensory system different stimulus modalities require different methods of stimulus control and generally different animal models Yet it is clear that all sensory systems have principles in common such as stimulus filtering by peripheral structures tuning of receptor cells signal to noise ratios adaption and disadaption and effective dynamic range Other features such as hormonal and efferent neural control circadian reorganization and receptor recycling are known in some and not in other senses The conference afforded an increased awareness of new discoveries in other sensory systems that has effectively inspired a fresh look by the various participants at their own area of specialization to see whether or not similar principles apply This inspiration was found not only in theoretical issues but equally in techniques and methods of approach The myopy of sensory specialization was broken in one unexpected way by showing limitations of individual sense organs and their integration within each organism For instance studying vision one generally chooses a visual animal as a model Night Vision R. F. Hess,L. T. Sharpe,K.

Nordby,1990-09-27 This detailed 1990 book describes the light and dark adaptation of receptor and post receptor mechanisms from a number of perspectives The authors emphasise the importance of the study of achromatopsia a rare congenital condition in which the visual mechanisms that mediate day vision are absent whilst those that mediate night vision remain intact *Sensory Processing in Vision and Olfaction - Common Features of Key Players* Thor Eysteinnsson,Debra Ann

Fadool,Wallace B. Thoreson,2022-03-09 *Biologically Inspired Computer Vision* Gabriel Cristobal,Laurent

Perrinet,Matthias S. Keil,2015-11-16 As the state of the art imaging technologies became more and more advanced yielding scientific data at unprecedented detail and volume the need to process and interpret all the data has made image processing and computer vision increasingly important Sources of data that have to be routinely dealt with today s applications include video transmission wireless communication automatic fingerprint processing massive databanks non weary and accurate

automatic airport screening robust night vision just to name a few Multidisciplinary inputs from other disciplines such as physics computational neuroscience cognitive science mathematics and biology will have a fundamental impact in the progress of imaging and vision sciences One of the advantages of the study of biological organisms is to devise very different type of computational paradigms by implementing a neural network with a high degree of local connectivity This is a comprehensive and rigorous reference in the area of biologically motivated vision sensors The study of biologically visual systems can be considered as a two way avenue On the one hand biological organisms can provide a source of inspiration for new computational efficient and robust vision models and on the other hand machine vision approaches can provide new insights for understanding biological visual systems Along the different chapters this book covers a wide range of topics from fundamental to more specialized topics including visual analysis based on a computational level hardware implementation and the design of new more advanced vision sensors The last two sections of the book provide an overview of a few representative applications and current state of the art of the research in this area This makes it a valuable book for graduate Master PhD students and also researchers in the field

Adaptive Mechanisms in the Ecology of Vision S. Archer, M.B. Djamgoz, E. Loew, J.C. Partridge, S. Vallerga, 2013-04-17 John Lythgoe was one of the pioneers of the Ecology of Vision a subject that he ably delineated in his classic and inspirational book published some 20 years ago 1 At heart the original book aimed generally to identify inter relationships between vision animal behaviour and the environment John Lythgoe excelled at identifying the interesting questions in the ecology of an animal that fitted the answers presented by an analysis of the visual system Over the last twenty years however since Lythgoe's landmark publication much progress has been made and the field has broadened considerably In particular our understanding of the adaptive mechanisms underlying the ecology of vision has reached considerable depths extending to the molecular dimension partly as a result of development and application of new techniques This complements the advances made in parallel in clinically oriented vision research 2 The current book endeavours to review the progress made in the ecology of vision field by bringing together many of the major researchers presently active in the expanded subject area The contents deal with theoretical and physical considerations of light and photoreception present examples of visual system structure and function and delve into aspects of visual behaviour and communication Throughout the book we have tried to emphasise one of the major themes to emerge within the ecology of vision the high degree of adaptability that visual mechanisms are capable of undergoing in response to diverse and dynamic environments and behaviours



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