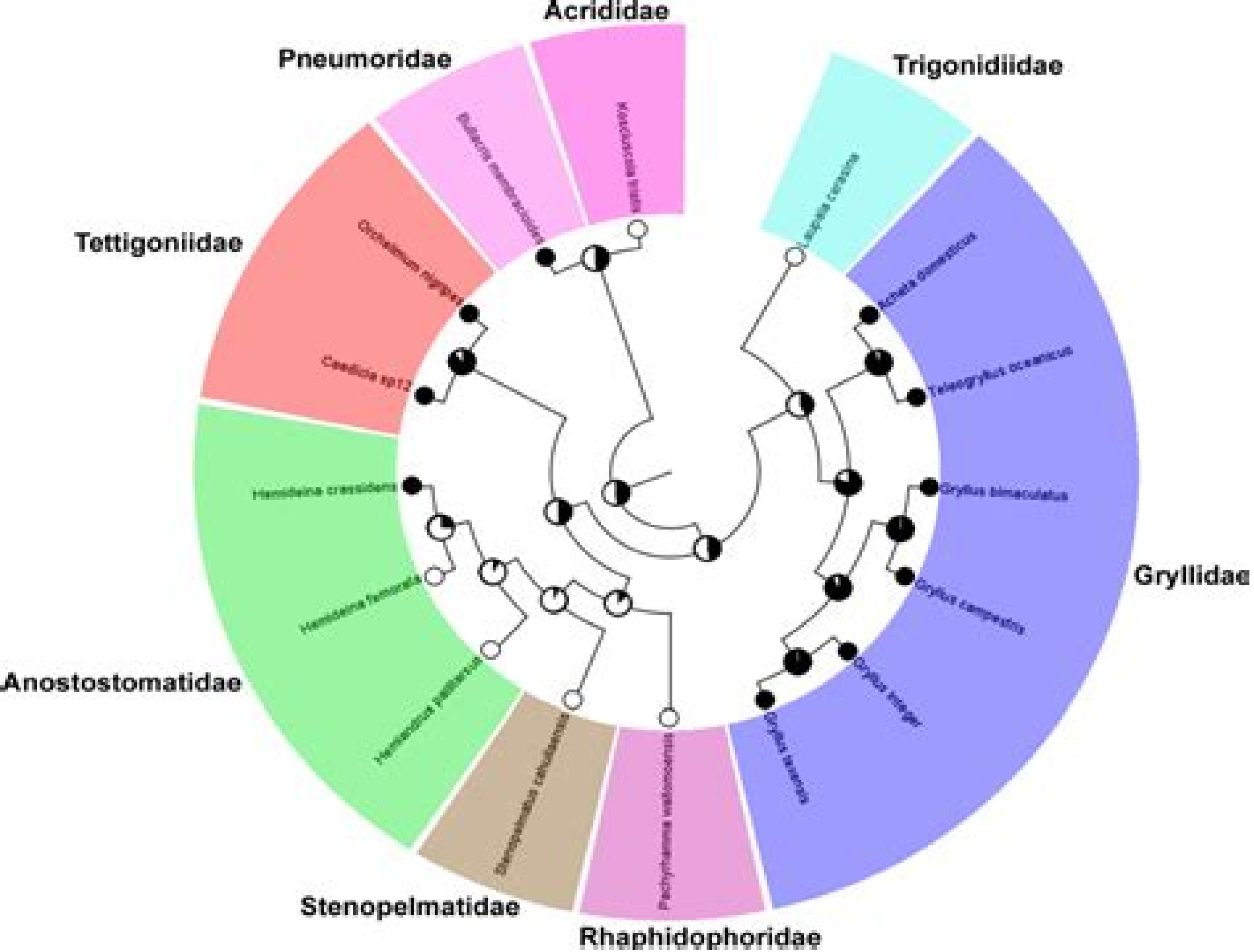




Orthopteran Mating Systems

Peter K. McGregor



Orthopteran Mating Systems:

Orthopteran Mating Systems Darryl T Gwynne, Glenn K Morris, 1983 *The Evolution of Orthopteran Mating Systems and the Reproductive Ecology of New Zealand Cave Wētā* Murray Fea, 2018 Sexual selection has long been recognised as driving the evolution of diverse morphological and behavioural traits in animals Decades of concerted research into the topic has uncovered reproductive adaptations ranging from the beautiful to the horrific and insects provide some of the most striking examples from all parts of that spectrum The diversity of insects their mating systems and their reproductive adaptations has made them crucial to our understanding of sexual selection and the evolution of sexual reproduction itself Their natural amenability to observation and experimentation has granted us many useful and informative model systems for that endeavour In particular the Orthoptera crickets grasshoppers katydids w t and their allies have provided many model species for the study of acoustic mate calling nuptial provisioning intrasexual combat the economics of reproduction that contribute to sexual conflict and countless other topics in the realm of reproductive ecology The current research delves into the diversity of mating system traits exhibited by the order with a comprehensive review of the literature as well as targeted evolutionary hypothesis testing via the phylogenetic comparative method I then investigate in detail the reproductive ecology of New Zealand cave w t which are fascinating representatives of a globally distributed but hardly studied orthopteran family the Rhaphidophoridae Firstly I investigate orthopteran reproductive ecology with analyses of sexual evolution across the order I test for phylogenetic signal ancestral character states and correlated evolution with data derived from a comprehensive literature search using a synthetic supertree assembled for that purpose by tree grafting The results of this approach indicated trends of strong evolutionary conservatism in orthopteran sexual traits and a probable ancestral mating system that involved protandry male male combat and mate guarding acoustic mate calling and female biased sexual size dimorphism but without coercive mating or exaggerated weaponry Although I was able to model the evolution of these traits phylogenetic comparisons did not provide evidence in support of correlated evolution between them I then move from broad questions to detailed examination of sexually dimorphic antennal structures in New Zealand cave w t Rhaphidophoridae *Pachyrhamma* sp Using scanning electron microscopy I describe the morphology of microsensory hairs sensilla in *P waitomoensis* and *P acanthocera* and test for sexual dimorphism in the length as well as presence and absence of these This reveals numerous sensilla with unique morphology that may be particular to the group and suggests possible sensory functions based on their individual characteristics In addition I provide the first detailed examination of intriguing horn like antennal cuticular structures that are restricted to males of these species The two kinds of protrusive structure have some qualities that suggest a secretory function indicating that male pheromonal communication may be an important aspect of those species ecology Subsequently I investigate New Zealand cave w t behavioural ecology with field based approaches to observing *P waitomoensis* I examine the role of sexually dimorphic elongated hind legs in that species in the context of mate

guarding a central topic in the study of sexual selection Interestingly although males doggedly guard their mates with their exaggerated hind legs the limbs do not appear to function in warding off rivals Because of that observation I tested the novel hypothesis that the mate guarding behaviour and morphology of male *P. waitomoensis* instead serves to reduce disturbance to females by organisms other than sexual rivals of the male Through several simple experiments with the w t in their natural environment I show a reduction in pair duration when females are disturbed a disturbance protection effect of male presence a mating advantage to males that can guard their mates for longer and a negative correlation between male hind leg length and the likelihood of disturbance to the female Taken together these results provide an example of a mate guarding role in exaggerated trait evolution and a novel function of mate guarding that may occur in other taxa In addition this highlights the importance of considering environmental context when examining behaviour as well as raising the possibility that more potential female benefits of mate guarding may be observed if study organisms are observed in nature After examining mate guarding I continue the investigation of exaggerated trait evolution in *P. waitomoensis* by looking at the additional role of their elongated hind legs in male male combat and competitive assessment By comparing morphometric data with video recordings of intrasexual contest behaviour in the field I showed that males with longer legs have greater chances of victory in combat In addition when the difference in leg length between contestants was greater fights escalated to a lesser degree The observed relationship between contestant leg length and contest escalation matched the predictions of the selfonly model of assessment according to current contest theory The results highlight the fact that fighting and weaponry are an important part of cave w t reproductive ecology and indicate that other Rhabdophoridae with similar morphology may represent an overlooked trove of examples for exaggerated weaponry research in the Orthoptera Lastly I approach the question of exaggerated weapon evolution from a different angle Using software designed for entertainment war gaming I edited matches in order to pitch artificial intelligence contestants against one another under varied experimental conditions By doing so I was able to test the hypothesis that one on one duel scenarios favour arms superiority a potential explanatory factor in the presence of extreme weaponry among various taxa and in the occurrence of arms races in non animal systems I found that strong contestants enjoyed a greater advantage when fighting head to head in contrast to the lack of any advantage in more chaotic skirmishes with multiple opponents The advantage of superior weaponry showed the same pattern in two different forms of contest This suggests that conflict scenarios that are restricted to duels may contribute to weaponry escalation in diverse systems I thereby demonstrate a novel technique for approaching a difficult to test broad evolutionary question and show the potential for widely available and user friendly consumer software to provide simulators for approaching scientific questions Overall this thesis summarises sexual selection research in the Orthoptera offers a hypotheses regarding ancestral mating systems in the order provides new data on a poorly studied family and tests a general hypothesis in a novel way As well as reviewing and analysing existing knowledge and providing new discoveries in an

overlooked group this research opens and highlights novel avenues for investigation of orthopteran reproductive ecology the examination of sexual selection and the evolution of extreme weaponry *Orthopteran Mating Systems* Darryl T Gwynne, Glenn K Morris, 1983 *Sperm Competition and the Evolution of Animal Mating systems* Robert L. Smith, 2012-12-02 Sperm Competition and the Evolution of Animal Mating Systems describes the role of sperm competition in selection on a range of attributes from gamete morphology to species mating systems This book is organized into 19 chapters and begins with the conceptualization of sperm competition as a subset of sexual selection and its implications for the insects The following chapter describes the relationship between multiple mating and female fitness with an emphasis on determining the conditions under which selection on females is likely to counteract selection on males for avoiding sperm competition Other chapters consider the female perspective on sperm competition the evolutionary causation at the level of the individual male gamete and the correlation of high paternal investment and sperm precedence in the insects The remaining chapters are arranged phylogenetically and explore the sperm competition in diverse animal taxa such as the *Drosophila* Lepidoptera spiders amphibians and reptiles These chapters also cover the evolution of direct versus indirect sperm transfer among the arachnids or the problem for kinship theory presented by multiple mating and sperm competition in the Hymenoptera This book further discusses the remarkable potential for sperm competition among certain temperate bat species whose females store sperm through winter hibernation and the mixed strategies and male caused female genital trauma as possible sperm competition adaptations in poeciliid fishes The concluding chapter examines the predictions concerning testes size and mating systems in the primates and the possible role of sperm competition in human selection This book is of great value to reproductive biologists and researchers Sensory Systems and Communication in Arthropods Wiese, Gribakin, 2013-11-21 Acoustic Communication in Insects and Anurans H. Carl Gerhardt, Franz Huber, 2002-07-15 Walk near woods or water on any spring or summer night and you will hear a bewildering and sometimes deafening chorus of frog toad and insect calls How are these calls produced What messages are encoded within the sounds and how do their intended recipients receive and decode these signals How does acoustic communication affect and reflect behavioral and evolutionary factors such as sexual selection and predator avoidance H Carl Gerhardt and Franz Huber address these questions among many others drawing on research from bioacoustics behavior neurobiology and evolutionary biology to present the first integrated approach to the study of acoustic communication in insects and anurans They highlight both the common solutions that these very different groups have evolved to shared challenges such as small size ectothermy cold bloodedness and noisy environments as well as the divergences that reflect the many differences in evolutionary history between the groups Throughout the book Gerhardt and Huber also provide helpful suggestions for future research

Sound Communication in Insects Russell Jurenka, 2021-11-17 *Advances in Insect Physiology* Volume 61 highlights new advances in the field with this new volume presenting interesting chapters on a variety of timely topics including Acoustic

signaling in Orthoptera Sound production in *Drosophila melanogaster* and Communication by surface borne mechanical waves in insects Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in the Advances in Insect Physiology series **Katydid and Bush-crickets** Darryl T. Gwynne, 2001

Sexual Selection Malte Andersson, 2019-12-31 Bright colors enlarged fins feather plumes song horns antlers and tusks are often highly sex dimorphic Why have males in many animals evolved more conspicuous ornaments signals and weapons than females How can such traits evolve although they may reduce male survival Such questions prompted Darwin's perhaps most scientifically controversial idea the theory of sexual selection It still challenges researchers today as they try to understand how competition for mates can favor the variety of sex dimorphic traits Reviewing theoretical and empirical work in this very active field Malte Andersson a leading contributor himself provides a major up to date synthesis of sexual selection The author describes the theory and its recent development examines models methods and empirical tests and identifies many unsolved problems Among the topics discussed are the selection and evolution of mating preferences relations between sexual selection and speciation constraints on sexual selection and sex differences in signals body size and weapons The rapidly growing study of sexual selection in plants is also reviewed This volume will interest students teachers and researchers in behavioral ecology and evolutionary biology **Insect Reproduction** S. R. Leather, 2018-01-18 This

book consisting of ten review chapters contributed by leading workers in their respective fields from around the world covers the whole subject of insect reproduction It begins with the basic physiological questions of insect reproduction moves on to discuss the new advances seen in the fields of behavioural and ecological mechanisms and culminates by examining the recent work on evolutionary biology and its application in the field Each chapter although including a brief review of the basic seminal work focuses mainly on the advances made within the last ten years and highlights those areas in which the respective authors see the greatest scope for further important advances **Alternative Reproductive Tactics** Rui F.

Oliveira, Michael Taborsky, H. Jane Brockmann, 2008-03-13 The study of alternative reproductive tactics the behavioural strategies used by individuals to increase their reproductive success is an evolutionary puzzle and one of great interest to researchers For instance why do some males guard both nest and eggs while others sneak into nests while pairs are spawning and fertilise those eggs The field offers a special opportunity to study the evolution and functional causes of phenotypic variation which is a general problem in the field of evolutionary biology By integrating both mechanistic psychological and evolutionary behavioural ecology perspectives and by covering a great diversity of species **Alternative Reproductive Tactics** addresses this integrated topic of longstanding interest bringing together a multitude of otherwise scattered information in an accessible form that is ideal for graduate students and researchers **Animal Acoustic**

Communication Steven L. Hopp, Michael J. Owren, Christopher S. Evans, 2012-12-06 The last decades have brought a significant increase in research on acoustic communication in animals Publication of scientific papers on both empirical and

theoretical aspects of this topic has greatly increased and a new journal Bioacoustics is entirely devoted to such articles. Coupled with this proliferation of work is a recognition that many of the current issues are best approached with an interdisciplinary perspective requiring technical and theoretical contributions from a number of areas of inquiry that have traditionally been separated. With the notable exception of a collection edited by Lewis 1983 there have been few volumes predominately focused on technical issues in comparative bioacoustics to follow up the early works edited by Lanyon and Tavolga 1960 and Busnel 1963. It was the tremendous growth of expertise concerning this topic in particular that provided the initial impetus to organize this volume which attempts to present fundamental information from both theoretical and applied aspects of current bioacoustics research. While a completely comprehensive review would be impractical this volume offers a basic treatment of a wide variety of topics aimed at providing a conceptual framework within which researchers can address their own questions. Each presentation is designed to be useful to the broadest possible spectrum of researchers including both those currently working in any of the many and diverse disciplines of bioacoustics and others that may be new to such studies.

The Origins of Music Nils L. Wallin, Bjorn Merker, Steven Brown, 2001-07-27. The book can be viewed as representing the birth of evolutionary biomusicology. What biological and cognitive forces have shaped humankind's musical behavior and the rich global repertoire of musical structures? What is music for and why does every human culture have it? What are the universal features of music and musical behavior across cultures? In this groundbreaking book musicologists, biologists, anthropologists, archaeologists, psychologists, neuroscientists, ethologists, and linguists come together for the first time to examine these and related issues. The book can be viewed as representing the birth of evolutionary biomusicology, the study of which will contribute greatly to our understanding of the evolutionary precursors of human music: the evolution of the hominid vocal tract, localization of brain function, the structure of acoustic communication signals, symbolic gesture, emotional manipulation through sound, self-expression, creativity, the human affinity for the spiritual, and the human attachment to music itself. Contributors: Simha Arom, Derek Bickerton, Steven Brown, Ellen Dissanayake, Dean Falk, David W. Frayer, Walter Freeman, Thomas Geissmann, Marc D. Hauser, Michel Imberty, Harry Jerison, Drago Kunej, Francois Bernard Mache, Peter Marler, Bjorn Merker, Geoffrey Miller, Jean Molino, Bruno Nettl, Chris Nicolay, Katharine Payne, Bruce Richman, Peter J. B. Slater, Peter Todd, Sandra Trehub, Ivan Turk, Maria Ujhelyi, Nils L. Wallin, Carol Whaling.

Signalers and Receivers Michael D. Greenfield, 2002. In most terrestrial and aquatic habitats the vast majority of animals transmitting and receiving communicative signals are arthropods. This book presents the story of how this important group of animals use pheromones, sound, vibration, and light for sexual and social communication. Because of their small to minute body size, most arthropods have problems sending and receiving acoustic and optical information, each of which has its own severe constraints. Because of these restraints, they have developed chemical signaling, which is not similarly limited by scale. Presenting the latest theoretical and experimental findings from studies of signaling, it suggests that close parallels exist between arthropods and

vertebrates reflect a very limited number of solutions to problems in behavior that are available within the confines of physical laws

Sperm Competition and Its Evolutionary Consequences in the Insects Leigh W. Simmons, 2019-12-31 One hundred years after Darwin considered how sexual selection shapes the behavioral and morphological characteristics of males for acquiring mates Parker realized that sexual selection continues after mating through sperm competition Because females often mate with multiple males before producing offspring selection favors adaptations that allow males to preempt sperm from previous males and to prevent their own sperm from preemption by future males Since the 1970s this area of research has seen exponential growth and biologists now recognize sperm competition as an evolutionary force that drives such adaptations as mate guarding genital morphology and ejaculate chemistry across all animal taxa The insects have been critical to this research and they still offer the greatest potential to reveal fully the evolutionary consequences of sperm competition This book analyzes and extends thirty years of theoretical and empirical work on insect sperm competition It considers both male and female interests in sperm utilization and the sexual conflict that can arise when these differ It covers the mechanics of sperm transfer and utilization morphology physiology and behavior Sperm competition is shown to have dramatic effects on adaptation in the context of reproduction as well as far reaching ramifications on life history evolution and speciation Written by a top researcher in the field this comprehensive up to date review of the evolutionary causes and consequences of sperm competition in the insects will prove an invaluable reference for students and established researchers in behavioral ecology and evolutionary biology

Hearing and Sound Communication in Amphibians Peter M. Narins, Albert S. Feng, Richard R. Fay, 2006-12-11 As models for vertebrate auditory systems amphibians have been the source of extensive ground breaking research on hearing the nervous system and acoustic communication This comprehensive review covers key issues in amphibian hearing and communication in depth Topics are relevant to auditory research neuroethology herpetology animal behavior and bioacoustics

Playback and Studies of Animal Communication Peter K. McGregor, 2013-11-11 Playback is the technique of rebroadcasting natural or synthetic signals to animals and observing their response The ability to present a putative signal in isolation without the potential confounding effects of other activities of the signaller is the main reason for the depth and range of our knowledge of communication systems To date playback of sound signals has predominated but playback of electric signals and even video playback of visual signals suggests that playback will become just as prevalent in studies of communication in other sensory modalities This book is one of the outcomes of a workshop on playback held at Thombridge Hall in the Peak District National Park England during August 1991 There were two reasons for organising the workshop First the considerable and lively debate in the literature about the design and analysis of playback experiments the pseudoreplication debate was in danger of generating more heat than light A workshop forum seemed the obvious place to clarify and if possible resolve the debate Second with the number of new playback and analysis techniques increasing rapidly it seemed an opportune moment to

discuss these techniques and to review some rapidly developing areas of interest in sound communication

Insect Learning Daniel R. Papaj, Alcinda C. Lewis, 2012-12-06 Insect Learning is a comprehensive review of a new field Until recently insects were viewed as rigidly programmed automatons now however it is recognized that they can learn and that their behavior is plastic This fundamental change in viewpoint is causing a re examination of all aspects of the relationship between insects and their environment This change in perspective is occurring at a time of heightened interest in brain function in both vertebrates and invertebrates Insects potentially play a major role in this expanding area Because of their experimental tractability and genetic diversity they provide unique opportunities for testing hypotheses on the ecology and evolution of learning As organisms of economic importance they are perennial objects of research by both basic and applied scientists Insect Learning covers both social and non social insects from multiple perspectives The book covers mechanisms syntheses of work on physiology behavior and ecology and micro and macroevolution The concluding section discusses future directions for research including applications to pest management

Animal Behavior Desk Reference Edward M. Barrows, 2000-12-28 Revised and updated containing over 5 000 entries with over 1 100 more entries than in the previous edition Animal Behavior Desk Reference Second Edition A Dictionary of Behavior Ecology and Evolution provides definitions for terms in animal behavior biogeography evolution ecology genetics psychology statistics systematics and other

The Evolution of Parental Care Tim H. Clutton-Brock, 2019-12-31 Synthesizing studies of parental care in a wide variety of animals this book is the first attempt to provide general answers to the following important questions Why does the extent of parental care vary so widely between species Why do only females care for eggs and young in some animals only males in others and both parents in a few To what extent is parental care adjusted to variation in its benefits to offspring and its costs to parents How do parents divide their resources between their sons and daughters In this book separate chapters examine the evolution of variation in egg and neonate size of viviparity and other forms of bearing and of differences in the duration of incubation gestation and lactation The book reviews theoretical and empirical predictions concerning the evolution of parental care and examines the extent to which these are supported by empirical evidence The author examines the distribution of parental care among offspring reviews the empirical evidence that parents invest to different extents in their sons and daughters and discusses the degree to which parents manipulate the sex ratio of their progeny in relation to the availability of resources

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