

Book reviews

HUMANS, NATURE, AND BIRDS: SCIENCE ART FROM CAVE WALLS TO COMPUTER SCREENS

By Darryl Wheye and Donald Kennedy

2008. Published by Yale University Press, New Haven, CT. 240 pp., 75 colour illustrations. Hardback, \$US37.50, ISBN 978-0-300-12388-3.

This book is published by Yale University press ‘with assistance from the Alfred P. Sloan Foundation’s Public Understanding of Science and Technology Program’, and improving public understanding is evidently its key aim. It is to some extent an examination of art and science as separate cultures (see the discussion around C. P. Snow’s *Two Cultures*, pp. 64–68). However, the book is primarily a serious attempt to formally define one area where art and science do make a joint contribution, bringing together subjective and objective views of nature.

In any work of this sort it is important to define terms. Here Darryl Wheye and Donald Kennedy suggest that Science Art “neatly describes a merging of both science and art that weakens neither and aids both. Adding the phrase “that portrays nature” would tighten the focus . . .” (p. 137). The authors have chosen to move beyond the broad relationship between science and art in general, concentrating on birds in art to demonstrate how the two fields can contribute to each other. This is legitimate given that images of birds date back to the very early days of recognisable art, and birds and bird art remain important in linking modern humans with nature. Birds have played many roles in human perceptions of the natural world and this book discusses several: birds as food, as spiritual icons, as teaching tools, as means of understanding biology and as means of promoting conservation.

The authors approach their topic in the style of a tour through an art gallery, via a series of galleries, levels and rooms. These take the reader through an eclectic selection of 60 images which the authors use to demonstrate the differing aims and intentions of artists who have rendered birds down the ages. The key divisions are into a Lower Gallery, largely concerned with a historical perspective and dealing with images up to 30 000 years old; a mezzanine, which touches on the aesthetics of painting nature; and the Upper Gallery for Science Art proper. Along the way, the authors attempt to classify artistic approaches and motivations (p. 65). As both a biologist and a bird-illustrator, I was intrigued by the choice of images and the accompanying texts based around the art and science of each image. I was pleased to see some personal favourites as well as much that was new to me, such as the wonderful *Animals Sketched from Nature* by Xiesheng Zhenqin Tu (plate 19, p. 32).

The authors make much of the use of captions as part of Science Art: “To qualify as Science Art and to work well, the rendering should be accompanied by an underlying caption that helps the viewer decode the underlying science” (p. xiii). The value of a caption in appreciating art is debateable; it is certainly valid where the artist is attempting to inform and clarify, as in most illustration, but less obviously so for an artist seeking to engage emotion or intrigue the onlooker. Perhaps scientists love captions and artists don’t. The authors seem to feel justified in finding linkages in a work that were not, and could not have been, the

intention of the artist (e.g. Wyeth’s *Winter Fields*, p. 14, which the Science caption refers to the modern impact of West Nile Virus). This approach sees the work as an entity distinct from the intentions of the artist, with its significance shifting in time as perceptions change and knowledge develops.

Treating art in this way seems more a historical commentary than a coherent linking of science and art, and has limited enduring validity, however interesting the connections uncovered by the commentator. The authors do touch on this issue in the Preface (p. xiii): “a sense that a subject is connected with, and can help explain, relationships sometimes emerge(s) only because the artist’s execution is sensitive and faithful to these relationships”. To me this is dangerously close to suggesting that some art is only validated by a scientific commentary. For instance, how useful is it to suggest that Lars Jonsson’s cover image of Northern Pintails “neatly portrays hemispheric sleep” if birds are only “thought to be hemispheric sleepers”? The artist has simply rendered birds resting, preening and sleeping in a wetland habitat, and he himself seems to see the image primarily as a pleasing composition built around these components, which are observed and rendered extraordinarily well. Likewise Holbein’s painting of a Lanner falcon in the Frontispiece *Portrait of Robert Cheseman* is certainly remarkable and centuries ahead of its time in its precisely observed realism, but the bird is a merely a prop in a portrait of a wealthy patron. A painter can appreciate Holbein’s wonderful draftsmanship and control of paint. A falconer can admire the details of sixteenth century jesses, bell, hood and glove, a birdwatcher can identify the bird’s species, sex (from relative size) and age (old enough to have two ages of wing coverts apparent). It is a masterpiece of rendering ‘jizz’, the essential character of the species, even when the falcon’s head is covered by its hood. In the end, however, this is still a portrait of a man and any other interpretation is *post hoc* and depends on context.

The range of bird-related images is appropriately varied, and certainly not confined to the conventional. However, some of the chosen imagery seems to stray from the point: surely there are more apposite examples of collaboration between bird art and science than M. C. Escher’s *Ascending and Descending* (pp. 84–85). One other distraction for me is the use of Wheye’s artwork as additions to historical images (see e.g. pp. 6, 18, 30, 54, 74). This goes beyond clarifying obscure elements and seems more about juxtaposing modern and ancient, without adding to the impact of the originals. If the historical images need interpretation, this could be done more clearly and objectively by strengthening key outlines and features, and relying on the Science portion of the caption to do its job. For me, Wheye’s artwork makes a more substantial contribution where it stands alone, e.g. Room 9 of the Upper Gallery, p. 125 onwards. Sometimes undue significance is placed on an image: the 10 000 year old pictograph of ostriches caught in a net (p. 18) is referred to in relation to hunting with nets (p. 19) but also, more dubiously, stalking in disguise (p. 55).

The book concludes with two valuable Appendices. Appendix 1 *A Timeline linking Art, Technology and the Study of Birds* details artists, technical innovations, trends and events in science and technology. Appendix 2 provides a *Science Art Checklist for Practitioners* and deals with contacts, appropriate

labelling, collaborations between artists and scientists, exhibiting and using Science Art to involve and educate the community in environmental issues. It also touches on the important issue of metatags for online searches. Although it deals with institutions in the United States, the principles will apply more broadly. Importantly, the authors have also attempted to give Science Art a consistent and defined identity with some real potential for general adoption. More details are available at the related website www.scienceart-nature.org

This book is an interesting attempt to structure and define something which ultimately remains intangible. The authors claim: "Decoding the science is key, and this book

demonstrates why" (p. xix). They have made a substantial attempt to define one area of synergy between science and art, but I don't believe they fully succeed. Such definition may not be possible, or even useful. In the end this book comprises a highly personal collection of images and ideas, which is bound to provoke argument, though in a positive way. It is as much about social perceptions of nature as it is about science, nature, birds or art. It is not a straightforward read, but it will reward anyone interested in art, birds and science.

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HANDBOOK OF THE BIRDS OF THE WORLD. VOLUME 13: PENDULINE TITS TO SHRIKES

Edited by Josep del Hoyo, Andrew Elliott and David A. Christie 2008. Published by Lynx Edicions, Barcelona. 879 pp., 60 colour plates, 611 maps, 536 colour photographs. Hardback, €212, \$AU380, ISBN 978-84-96553-45-3.

The Handbook of the Birds of the World (or *HBW* as it is known) is a grand and ambitious project to document all of the world's bird species in a single scholarly work. With the recent publication of Volume 13 (the first appeared in 1992), the project would appear to be on track for completion in 2011 (Volume 16).

Each volume follows a tried and tested format that begins with an essay-styled foreword documenting one or another of the most important aspects of ornithology. These are contributed by leaders in the field and typically serve as a valuable introduction and review of the topic covered. This is followed by the bread and butter for the series: introductory family accounts, then individual species accounts, all prepared by well-qualified experts. Family introductions are illustrated with photographs, while species accounts are accompanied by plates that illustrate all species and seek to document all significant sexual and sub-specific differences. As a consequence, to date each volume has been packed with meticulous text, plates of a typically high standard, and glorious photographs that document a very high proportion of the species covered. Volume 13 is no exception to this and if anything the high standard set by earlier volumes has been further improved upon.

In this volume the *Foreword*, by renowned ornithologist Ian Newton, addresses bird migration [Ian Newton is also author of *The Migration Ecology of Birds* (2008) Academic Press]. At 33 pages of text it seems a little crude to pigeonhole this as a foreword; rather it is a well referenced review and introduction to the topic. It begins with *Migration as a product of natural selection*, explores *Global patterns of migration* and draws *Comparisons between hemispheres*. Of particular relevance in an Australian context is a section on *Nomadism* and the response of birds to (mostly) arid or semiarid environments with unpredictable environments. *Migratory flight* details flight energetics and dynamics and the strategies employed by different species to move varying distances. The

mechanisms that exert some *Control of migration* and the remarkable physiological adaptations for *Migratory fuelling* also receive valuable attention. 'Just how do they know where they are going?' is well addressed in *Navigation* and provides all the current answers to this oft-asked question. The foreword concludes with a brief review of *Birds as colonisers*; Australian avian examples that have settled in New Zealand are at the fore. This is a very useful and accessible introduction to a topic that has relevance for so many of the world's bird species. To his credit Newton has clearly laboured to ensure this is a truly international piece.

With the publication of Volumes 12 and 13 the Australo-Papuan corvid passerines have now received the treatment that was so eagerly awaited (see Joseph 2007 *Emu* **107**, 245–246). Notably, Volume 13 covers significant radiations such as the Meliphagidae (honeyeaters) and Pardalotidae (pardalotes), and there is much to interest Austral ornithologists in the broader sense also, as families with African origins include the Nectariniidae (sunbirds), Promeropidae (sugarbirds) and (possibly) the Laniidae (shrikes). Other large families included are the Dicaeidae (flowerpeckers) and Zosteropidae (white-eyes), while more northern-orientated groups to receive treatment are the penduline and long-tailed tits, nuthatches, (northern) treecreepers, and orioles. Enigmatic families with just a handful of members include the Melanocharitidae (New Guinea berrypeckers and longbills), Tichodromidae (the Eurasian wallcreeper) and Rhabdornithidae (the Philippine rhabdornis). Appropriately, families with an Australasian bent are authored by some familiar names in the local ornithological scene including Peter Higgins, Les Christidis and Hugh Ford (honeyeaters), John Woinarski (pardalotes), Phil Gregory (berrypeckers and longbills) and Brian Coates (painted berrypeckers).

So what is the value of *HBW* when compared with the plethora of avian guides and family monographs that are published these days? While it is true that monographs do exist for a number of families that receive treatment (e.g. Cheke and Mann 2001 *Sunbirds: A guide to Sunbirds, Flowerpeckers, Spiderhunters and Sugarbirds of the World* Christopher Helm), other families have never before received such attention. One such example is the white-eyes: a very successful radiation (98 extant species) that has been poorly documented in the past. Occupying so many remote islands and 'mountain islands' as they do, one would have had to amass a collection of dozens of field guides to simply cover

their identification, while information pertaining to the ecology of many (most?) species has been inaccessible or non-existent. Fortunately for ornithologists and birders worldwide all of this information now exists in a single resource. In introducing the Zosteropidae, much text is devoted to the systematics of the family, while morphological aspects, habitat and general habits are covered in easily digested detail before sections on voice, food and feeding and breeding are presented. The family introduction, which spans 40 pages, concludes with sections on relationships with man and conservation and status. Being 'island' specialists, white-eyes are particularly prone to extinction and as a consequence no fewer than 20 species, more than one-fifth, are globally threatened. Our very own White-chested White-eye (*Zosterops albogularis*) (Norfolk Island) makes the list of Critically Endangered species, though sadly even this dire assessment now seems optimistic. Ninety-eight species' accounts containing substantially more text than is ever possible in a field guide and superb plates with around 130 images round out *HBW*'s contribution to the Zosteropidae. Presenting this information for such a speciose family in a single resource highlights the real value of this work for ornithologists. To appreciate that *all* bird families and species will be similarly treated when the project in complete in just two years time is truly remarkable.

A careful review of many of the families finds very few errors or inconsistencies, but with such a massive undertaking at a global scale it is inevitable that the occasional one will creep through. My minor gripes mostly relate to common names. I find it odd that Green Oriole has replaced Yellow Oriole as a common name for *Oriolus flavocinctus* given the 'Recommended English Names' project undertaken by Birds Australia, that the species is largely restricted to Australia (and neighbouring areas of PNG and Indonesia) and that there are no other orioles with the accepted common name of Yellow Oriole. Another hitch with common

names sees the inclusion of both Spur-winged Plover for *Vanellus spinosus* and Masked Lapwing for *V. miles* as recent colonists of New Zealand from Australia (p. 47). Of course Spur-winged Plover is an alternative name for Masked Lapwing and *V. spinosus* has never been recorded from either NZ or Australia.

Moving to the plates, they are generally of a very high standard. For those species with which I have some field experience, for the most part, the figures seem to be excellent renditions of the birds in life. One exception though is the first four plates of the Meliphagidae (plates 38–41). While the plumage is, for the most part, rendered accurately (it did take a moment to register that a black and yellow honeyeater was the endangered Helmeted Honeyeater, *Lichenostomus melanops cassidix*), body shapes are all wrong: these are depicted as squat full-breasted birds on spindly legs when in fact most honeyeaters are substantially thinner and more streamlined in life. As is the nature of such a global work I can only assume the artist for these particular plates has not had the pleasure to observe these species in life.

HBW is an amazing series, though if you haven't already started collecting volumes, at roughly \$AU4000 for the back catalogue (Vols 1–13), the 'start-up' cost may prove prohibitive. Of course there is also no reason why ornithologists would not purchase individual volumes relevant to their research. To this end, I highly recommend *HBW* Volume 13 as a stand alone work for researchers with interests in avian nectarivory (most notably honeyeaters and sunbirds), sexual dimorphism (flowerpeckers and sunbirds) or island biogeography (white-eyes), because this volume has much to offer.

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BIRD SONG: BIOLOGICAL THEMES AND VARIATIONS (SECOND EDITION)

By Clive K. Catchpole and Peter J. B. Slater
2008. Published by Cambridge University Press, Cambridge, UK. 335 pp., 91 monochrome figures and line drawings. Hardback, £40, \$A130, ISBN 978-0-521-87242-3.

Elvis Costello once said that writing about music is like dancing about architecture (White 1983). Costello will be hard pressed to extend the same criticism to writing about bird song, should he read Catchpole and Slater's new book. With clarity and artistry, *Bird Song* orchestrates a complex and disparate literature ranging from the physiology of sound production to the influence of sexual selection on the design, delivery and organisation of song types. With a warm and engaging voice, the authors guide the reader through the field, giving just enough historical background to place the current literature in context. The authors cut through the sometimes-tangled acoustic terminology to explain ideas and assess how hypotheses have endured theoretical and experimental scrutiny.

They summarise controversies with politeness, and on occasion a touch of poetry, as in a discussion of skylarks: "Shelley's blithe spirits, with their beautiful aerial songs".

Bird Song is designed as an introduction to the biology of bird song for students and researchers, but the lucid style makes it accessible to anyone with an interest in birds and animal behaviour. The chapters are well structured with logical subheadings, and the authors highlight influential papers and reviews for further reading. The authors have made it easy for readers to dip in and out of the text by explaining concepts as they occur or referring the reader to earlier explanations, and by providing a thorough index and detailed table of contents. The numerous figures are simple yet informative, and are enlivened by Nigel Mann's vignettes. This edition is the place to start for anyone curious about bird song, and will meet the high expectations of everyone who treasured the first edition, published in 1995.

The study of bird song has moved rapidly in the past 12 years and the authors have kept abreast of the new literature. Considerably revised sections include that on neurobiology in Chapter 2; how and why birds learn their songs (Chapter 3);

problems of sound transmission (Chapter 4); the costs of song production in Chapter 7; duetting and chorusing, and matched counter-singing, both in Chapter 8; eavesdropping in Chapters 6 and 7; and the causes and consequences of geographic variation in song (Chapter 9). Less extensive but important changes have been made to sections about vocal production in Chapter 2, sexual selection and repertoire size in Chapter 7, and the effect and production of “sexy syllables” in Chapter 7. The revised section exploring the nature and causes of the dawn chorus is now perhaps the most successful explanation of both hypotheses and current evidence (in Chapter 5). Useful changes have been made to the section on methods (Chapter 1), including an overview of recording equipment and the limitations of computer-automated analysis of sonograms. There and in Chapter 6 the authors review recent use of interactive playback, in which researchers alter the timing or choice of playbacks depending on the bird’s own singing behaviour. Given the importance of playback, perhaps it would have been useful to provide further comment on the difficulties of interpreting behavioural responses to playback (Searcy and Nowicki 2000; Collins 2004; de Kort *et al.* 2009).

A personal highlight of this edition is the expansion of the section on duetting and chorusing in what might be considered the title track of the book (Chapter 8: *Themes and Variations*). Our understanding of these behaviours has grown as more researchers focus on birds from the tropics and southern hemisphere where these behaviours are widespread. The book documents the significant progress in testing hypotheses for duetting, including the contributions made from studies on Australian species such as Eastern Whipbirds and Magpie Larks. The functional significance of duetting remains controversial but there is broad support for a role in joint territorial defence and mutual mate-guarding. In contrast, researchers are only just beginning to identify the complexities of chorusing behaviours. Choruses can be highly coordinated, such as the astonishingly complex and precise choruses of the Plain-tailed Wren. In this South American species, groups of individuals of different sex sing in precise alternation, while those of the same sex sing the same song type in perfect synchrony (Mann *et al.* 2006). It is clear from this section and others in Chapter 8 that we are still to describe the diversity of acoustic strategies employed by birds around the globe, much less fully understand them.

The new section on ‘Communication in a noisy environment’, in Chapter 4, highlights important new research, particularly on the problems birds face from noise produced by humans. Traffic and other urban noises make it more difficult for birds to send vocal messages to others. Birds can respond to urban noise by singing more loudly or by using songs of a different pitch to the noise pollution, like tuning to a different radio station. The problem of anthropogenic noise is also acute for sea mammals, and the issue featured prominently in a recent conference honouring Peter Slater’s contribution to acoustic research, held at the University of St Andrews in 2008. While we do know that birds are affected by urban noise, a new challenge is to understand how it affects populations.

How birds learn their songs continues to be a fruitful area of research justifying the substantial expansion of Chapter 3. This is now one of the most detailed chapters of the book, yet the authors identify areas for research, such as the role of

learning in the development of female song preferences, the surprising importance of sleep in the development of accurate singing, at least in young Zebra Finches, and the distribution of vocal learning in the subfamilies of birds. The assumption that song learning is primarily restricted to the oscine passerines is being challenged as the vocalisations of more sub-oscines, hummingbirds and parrots are studied in detail. The deafening “donk” call of the Three-wattled Bell-Bird, a sub-oscine, contributes to this re-evaluation by showing evidence of dialects, cultural drift and mimicry. Mann’s illustration ensures the species’ contribution to the book is memorable. A smaller but important addition is the mention of less-invasive techniques to investigate song learning, compared with historical, surgical techniques. Similar advances in techniques are described in Chapters 6 and 7 but some readers may have liked a more detailed discussion of ethical concerns in Chapter 2. Chapter 3 concludes with an intriguing review of current hypotheses for why birds have evolved to learn songs – a difficult question still to be resolved.

In a telling departure from the original edition, the authors have revised the definition of bird song itself (Chapter 1). This change consists mainly of extra exceptions both about who sings and the structure of the vocalisation. While the basic definition is unchanged and “songs tend to be long complex vocalisations produced by males in the breeding season”, the new edition adds that “especially in the tropics it is common for females to sing as well as males” and “both sexes may (sing) throughout the year” (citing Langmore 1998). Since the majority of the world’s birds are tropical, it may be appropriate to re-define song, and in so doing encourage research into these neglected singers (Riebel *et al.* 2005). The authors have expanded the section on female song in Chapter 5 (*When do birds sing?*) to include two recent studies on female song (one on superb fairy-wrens), but female song could feature more centrally. The book’s focus on song, rather than bird vocalisations more generally, also reflects the comparative neglect of calls in the wider literature and indirectly highlights opportunities for research (Marler 2004).

The revision of *Bird Song* makes this the most up-to-date introduction to bird song as well as the most accessible. The authors exceed their aims by making *Bird Song* an important text for scientists of bird song, as well as for students, bird-watchers and scientists of other disciplines. This book remains the definitive work on the biology of bird song, and a lesson in lucid and elegant presentation. We look forward to the next edition in another 12 years.

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NEUROSCIENCE OF BIRDSONG

Edited by H. Philip Zeigler and Peter Marler
2008. Published by Cambridge University Press, Cambridge, UK. 542 pp., 165 monochrome and 4 colour illustrations. Hardback, £80, SA325, ISBN 978-0-521-86915-7.

Neuroscience of Birdsong brings together the fascinating fields of birdsong and neuroscience research. The investigation of birdsong has a long-lasting history as it represents one of the most impressive animal behavioural traits, and has many similarities to human language. In the 1970s the neural structures that underlie song learning and song production were discovered and have since inspired a vast number of studies. Indeed the investigation of the neural basis of song has become a successful vertebrate model system to study brain–behaviour relationships. *Neuroscience of Birdsong* is the first book that provides a comprehensive state-of-the-art summary of birdsong neurobiology.

The book has over 500 pages and is divided into seven parts and 37 chapters each of which has a clear outline and deals with a distinct sub-discipline of the field. Each part starts with an informative introduction by the editors. They have done a very good job in highlighting the most interesting topics of the respective chapters and, where appropriate, they provide cross-references to relevant topics of other chapters. This is a valuable feature as these introductions lead like a thread through the whole book. The layout is exclusively black and white except for four colour plates in the middle of the book that appear a bit misplaced at that position. The book starts with Part I 'Foundations: singing and the brain' in which Allison Doupe and Patricia Kuhl give memorable examples of the parallels between birdsong and human language. After an informative overview of song behaviour and an introduction to the two main model species, the Zebra Finch and the domesticated Canary, by Heather Williams, Gisela Kaplan makes a case for the study of the Australian Magpie as an alternative model.

The first part of the book is complemented by two chapters that highlight the avian song system from an evolutionary perspective. Reiner *et al.* review the shortcomings of the conventional avian brain nomenclature and the process that led to the adoption of the new terminology in 2004. Michael Farries and David Perkel, who set a comparative framework for avian and mammalian brain regions, emphasise that the understanding of the neural basis of song production and song learning can tell us much about the neural mechanisms in mammals, including humans.

Part II is about song production and song control and all five chapters give clearly outlined and comprehensive overviews of

peripheral and neural mechanisms of birdsong. The content is very conceptual and can be regarded as a paradigm for any textbook dealing with mechanisms of behaviour.

A large portion of the book (Part IV, 100 pages) is devoted to the learning of song and starts with an interesting comparative approach on song learning by Henrike Hultsch and Dietmar Todt explaining the different strategies of song learning and song memorisation. This is followed by a detailed description of Zebra Finch song learning. Sigal Saar and coauthors in Ofer Tchernichovski's group show so-called dynamic vocal development maps, constructed by sound analysis software (SAP) that the authors devised for Zebra Finch song analysis and which is now used in many laboratories. The following chapters give a thorough introduction to the anterior forebrain pathway and Patrice Adret concludes with an updated two-step model of vocal learning.

Less information is provided on hearing and recognising song (Part III, 45 pages), which probably represents the paucity of studies that deal with the respective fields. In fact, except for the short introduction by Peter Marler, this part is missing a more general framework. Although it is largely about electrophysiological studies, this work has undoubtedly advanced our understanding of song perception. A central topic is the selective response of auditory neurons not only to the songs of other birds, but rather to the birds' own song. This seems to be important for the song learning process and is emphasised in the chapters of Frédéric Theunissen and colleagues and as well as in the one by Jonathan Prather and Richard Mooney. The latter propose that in Swamp Sparrows the auditory representation of bird's own song is placed in the same temporal framework as the motor program that produces it by establishing an exact sensorimotor correspondence.

An endocrine approach is provided in Part V 'Mechanisms of modulation and plasticity' by Cheryl Harding, Gregory Ball and coauthors, Eliot Brenowitz and Carolyn Pytte and coauthors. Hormones, especially steroid hormones, are important for the modulation of function in the song control system and are well known to affect development of neuroanatomy as well as sexual dimorphism in the brain. In his introduction to Part V, Peter Marler notes that further study of females is required. This is well justified, although the reason for sex-biased studies is obvious. In temperate zones, song is produced predominantly by males, while females sing less or do not sing at all and the initial research bias has been on sound production. Gregory Ball and colleagues tackle this topic by presenting comparative studies of sex differences in brain and behaviour. They further highlight the importance of phylogenetic history to explain the relationship between song complexity and song control nuclei size.

Part VI, on the genomic revolution, highlights the great potential that studies on gene expression have for our understanding of perception and production of birdsong. In particular, the chapter of Claudio Mello and Erich Jarvis provides a visionary view on the evolution of vocal learning pathways. As three groups of birds have evolved the ability of vocal learning (parrots, hummingbirds and oscine songbirds), there are three alternative evolutionary hypotheses: (i) this ability has evolved independently three times; (ii) all ancestors had the ability and since the Tertiary it was subsequently lost four times; or (iii) vocal learning and song control regions are present in a rudimentary form in all birds and are just amplified in three groups.

The book concludes 'On A Personal Note' by four forebears of birdsong research, Robert Hinde (about William Thorpe to whom the volume is dedicated), Masakazu Konishi, Fernando Nottebohm and Peter Marler. This final part is introduced by H. Philip Zeigler, one of the editors of the volume and it starts with a subtle note about the historical connection of these researchers as he states: "And Thorpe begat Marler and Marler begat Konishi

and Nottebohm. Of the number of their offspring there is no end" (page 409). In fact, these "offspring" have provided the chapters of this book. Peter Marler concludes that there are many open questions that still need to be addressed, such as "How does production of an innate call become linked in ontogeny to the external referents that govern its use, such as a food object or a predator or certain social companions? Where are these links to be found in the brain and when are they established?" This conclusion seems to be at the right place because it becomes obvious while reading the book that many of advances in our understanding of the neurobiology of birdsong have been conducted on birds kept in the laboratory. However, studies in the field are still needed to get an idea of the various external cues that shape brain-behaviour relationships. In summary, together with the reasonable price, the book can be recommended in every respect.

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