



Some birds evolve signature egg colours and patterns to confuse nest parasites such as the cuckoo finch. Each column shows eggs from one host species.

## ORNITHOLOGY

# Oology unshelled

John M. Marzluff extols a rich history of ornithology's debt to egg collecting.

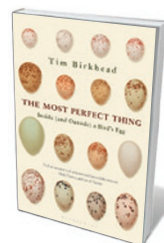
Tim Birkhead has spent much of the past four decades watching birds, and in particular mucking around guano-covered ledges on which seabirds breed. His insights have revolutionized ornithologists' understanding of mate fidelity; his ability to distil complex science for the general reader, for example in *Bird Sense* (Bloomsbury, 2013), has revealed what it is like to be a bird. Now, with an eye on past discoveries and persistent puzzles, *The Most Perfect Thing* reveals what it is like to become a bird — from nascent ovum to shelled egg and beyond.

Birkhead starts his story in the nineteenth century, on English cliffs where eccentric collectors wait anxiously for daring "climbers" to fetch unusually shaped and patterned eggs from the nests of common guillemots (*Uria aalge*). Especially prized was a sequence of eggs laid by the same bird throughout her life: each was identically marked with a design of splotches and scribbles. The extensive collections of early oologists, such as George Lupton, who amassed more than 1,000 guillemot eggs,

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fascinate Birkhead even as he laments this now illegal and inadmissible practice. He tracked down many old collections to learn more about the evolution of shape and colour. Through careful evaluation of alternative hypotheses, he dispels the common explanation that the pear shape of the guillemot's egg evolved mainly to keep it from rolling off the nest precipice. Rather, the shape probably provides legroom for the developing chick, enables the egg to tip above the faecal stew that often surrounds it, and increases surface area — improving heat transfer during incubation.

With equal thoroughness, Birkhead shows that the unusual markings — from light peppering, squiggling and blotching to completely blackened ends or dark rings around the midline — that entranced collectors enable guillemot parents to recognize their



**The Most Perfect Thing: Inside (and Outside) a Bird's Egg**  
TIM BIRKHEAD  
Bloomsbury: 2016.

own eggs. This, however, is only part of the story of egg colour. Other species' eggs are marked to camouflage them: the Japanese quail (*Coturnix japonica*), for example, lays heavily mottled eggs in nest sites with matching patterns. Some eggs, such as that of the ostrich (*Struthio camelus*), are white to protect the developing chick from the heat of the Sun. Others are brightly coloured, as with the American robin (*Turdus migratorius*), whose blue eggs advertise the quality of the brooding female. Still others may be lightly pigmented to raise their internal temperatures or to increase light penetration, which can speed up chick development. This mechanism may be used to synchronize hatching within a clutch: the last eggs laid are often the lightest in colour. Through the eye of this careful evolutionary ecologist, and a series of high-quality colour plates, we come to appreciate the beauty and functionality of eggs.

Having considered the whole egg, Birkhead next describes its making. He writes clearly, with accuracy and wit, about the ovum's development in the bird's ovary and its journey through the oviduct. We learn about the microstructure of the shell — much like a rigid sieve — and how pores and cuticle adapt

the egg to local atmospheric conditions, as well as repelling water, hydrophilic microbes and contaminants that can diffuse in and challenge the developing embryo. Foreign bodies that make it past the shell are dealt with in the albumen, which Birkhead describes as a “sophisticated biochemical firewall against microbes”. He then explains how the yolk provides fats and proteins manufactured in the mother’s liver to the growing chick; it also furnishes the chick with crucial antioxidants, vitamins and hormones such as testosterone.

The embryo’s survival may be enhanced by the odorous, oily secretions of the mother’s preen gland that grease the eggs’ shells during laying and incubation. In some species, such as the hoopoe (*Upupa epops*), this oil mixes with the copious droppings in the nest to produce a notorious ‘filth’, which may include beneficial bacteria that enhance hatchability. Conservation biologists working to restore rare species may find that the lack of such bacteria helps to explain why many eggs are difficult to hatch without at least a modicum of parental incubation.

Along the way, Birkhead introduces many colourful characters little known to science. Sequences of eggs collected from the 1970s to the early 2000s by John Colebrook-Robjent in Zambia were crucial to our understanding of the ‘arms race’ in egg coloration between nest parasites and their hosts. Birds such as cuckoo finches (*Anomalospiza imberbis*), for instance, sneak their eggs into the nests of others, but must continually adjust the background colour and pattern to fool the hosts — which in turn evolve unique markings to foil the parasite’s disguise. Lupton’s guillemot-egg collection inspired and informed current understanding of the adaptive value of egg shape. British physician Allen Thomson speculated that the yolk is built up in layers. Birkhead’s ability to weave together history and science shows the human nature of research.

He has a marvellous way with words, writing of monogamous albatrosses living like “long-distance truck drivers — at home with their partner only occasionally and making the most of it when they are”. And he tantalizes with unsolved mysteries. Why, for example, does the egg of a chicken travel through the hen pointed end first until the very last minute, when it turns through 180° on the horizontal plane to be laid blunt end first?

Birkhead’s historical acumen and sharp pen had me seeing eggs in a new light. He has convinced me that they are splendid, if not indeed most perfect. ■

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## Books in brief



### The Great Departure: Mass Migration from Eastern Europe and the Making of the Free World

Tara Zahra W. W. NORTON (2016)

As many as 58 million Europeans seeking “bread and freedom” poured into the Americas from 1846 to 1940. Millions returned — worn down by the punishing, ill-paid labour driving the New World’s booms. Historian Tara Zahra’s timely, myth-busting chronicle shows how, early on, European states attempted to “scientifically” manage masses of people to serve their own and international goals. The impacts ranged all the way from the Holocaust to a shift in the concept of freedom, to the right to stay or leave.



### 15 Million Degrees: A Journey to the Centre of the Sun

Lucie Green VIKING (2016)

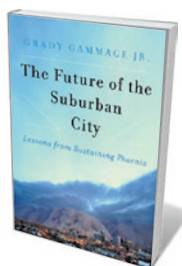
Earth may be 150 million kilometres from the Sun, but few relationships are as intimate. Aside from the star’s centrality to life, our planet is embraced by the magnetic bubble of the heliosphere. Solar physicist Lucie Green’s engrossing primer clearly explicates the science and its star-studded history. That stretches from Galileo’s work on sunspots to astronomer Cecilia Payne-Gaposchkin’s 1925 discovery that helium is the most abundant element in the Sun — and physicist Sami Solanki’s 2004 finding that the past 70 years of grand-maximum solar activity may be a rare blip.



### Show Me the Bone: Reconstructing Prehistoric Monsters in Nineteenth-Century Britain and America

Gowan Dawson UNIVERSITY OF CHICAGO PRESS (2016)

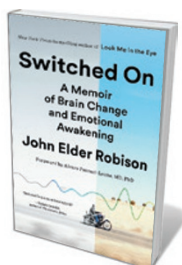
A putative knack for mentally constructing a beast entire from a scattering of fossilized remains lent early palaeontologists a sorcerer-like glamour. As the field’s founder, Georges Cuvier, put it: “Give me the bone, and I will show you the animal.” Science historian Gowan Dawson lucidly traces the afterlife of Cuvier’s incorrect “law of correlation” in Victorian Britain and the United States. The idea seeped into science, irking biologist T. H. Huxley and, argues Dawson, subtly influencing Charles Darwin’s thinking on natural variation.



### The Future of the Suburban City: Lessons from Sustaining Phoenix

Grady Gammage Jr ISLAND (2016)

The car, the shopping centre and the single-family home, reveals urban specialist Grady Gammage Jr, created the “suburban city” — sprawls clustered in the US southwest and associated with rampant development. In his study of their potential for sustainable transition, Gammage focuses on Phoenix, Arizona — vast, traffic-ridden and caught between aridity and a per capita water consumption more than twice that of New York. He argues that its historic reliance on renewable surface water rather than groundwater, and openness to low-carbon light transport, point to a potential for future resilience.



### Switched On: A Memoir of Brain Change and Emotional Awakening

John Elder Robison SPIEGEL & GRAU (2016)

In 2007, John Elder Robison published *Look Me in the Eye* (Crown), a raw memoir about growing up with Asperger’s syndrome. The following year, cognitive neurologist Alvaro Pascual-Leone invited him to participate in a study involving transcranial magnetic stimulation (TMS). Here, Robison chronicles the “powerful mojo” that ensued as his emotions, empathy and perceptions deepened, colouring work and intimate relationships unexpectedly, even after the TMS effects faded. The science and ethical quandaries are deftly interlaced. [Barbara Kiser](#)