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**