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Preface

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Animal coloration: production, perception, function and application

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Research on animal coloration is a vibrant area of biology currently involving evolutionary biologists, behavioural ecologists, psychologists, optical physicists, visual ecologists, geneticists and anthropologists. The proliferation of recent work requires that we take stock of the field, aiming to identify major themes, questions and future directions. This was the goal of the year-long Wissenschaftskolleg zu Berlin 'focus group' (2015–2016), in which many of the authors in this issue participated either as fellows or visitors. The result is this 19-chapter theme issue, in which we pinpoint the breakthroughs and challenges in animal coloration research, focusing on production, perception, function and evolution. We also explore animal coloration research as it applies to humans. This theme issue is by no means exhaustive but our goal has been to summarize and synthesize the state of animal coloration research in 2017 and to chart courses for the future.

The basic principles underlying animal coloration were formulated in a flurry of research during the second half of the 1800s and early part of the last century. These include the functional significance of coloration, involving protective coloration [1], disruptive coloration and countershading [2], sexually selected coloration [3], mimicry [4,5] and aposematism [6]. Use of colour phenotypes as genetic markers to study developmental processes and natural selection in the wild was critical to the early development of genetics and evolutionary theory [7]. In 1940, Cott's important volume [8] was a major milestone in our understanding of the functional significance of colour patterns, while Kettlewell [9] and Ford [10] spearheaded understanding of polymorphisms. In the 1960s and 1970s, we recognized that non-humans see the world differently from us, particularly in relation to ultraviolet perception [11]. Owing to the advent of spectrophotometry and digital imaging—combined with elegant laboratory and field studies, and large-scale comparative analyses—the field has since mushroomed. Now, the diversity and rapid pace of modern animal coloration research make it a particularly exciting interdisciplinary field.

This issue provides an entry point to recent developments in the main areas of animal coloration research: colour production, perception, function and evolution, and application. We present the articles in this order. Each topic covered in this special issue touches on the interdisciplinary nature of animal coloration research [12]. We also emphasize that this field not only draws on many disciplines but also contributes fundamental knowledge to those disciplines, and generates solutions for societal problems too [13]. We hope that this theme issue will enable readers to make better sense of this broad, growing and dynamic area of biology.

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THE ROYAL SOCIETY PUBLISHING

Guest editor profiles

Tim Caro is a Professor of Wildlife Biology at the University of California at Davis. He conducts research on the adaptive significance of mammalian coloration in the field and from a comparative perspective. His recent work has investigated the function of zebra stripes and the coloration of giant pandas. He organized a year-long focus group working on animal coloration at the Wissenschaftskolleg zu Berlin from which this series of papers emerged.

Mary Caswell Stoddard (Cassie) is an Assistant Professor in the Department of Ecology and Evolutionary Biology at Princeton University. She investigates animal sensory ecology and physiology, with a focus on avian vision and coloration. Using a multidisciplinary approach, including techniques from computer vision and optics, she has explored the evolution of structural and pigment-based plumage colours, cuckoo egg mimicry, shorebird clutch camouflage, avian colour perception and pattern recognition.

Devi Stuart-Fox is an Associate Professor at the University of Melbourne. Her research focuses on the function and evolution of animal coloration, particularly colour change and colour polymorphism. She has worked on a wide variety of species in different parts of the world including chameleons in South Africa, gliding lizards in Malaysia and numerous species across Australia. Her research uses a variety of approaches including evolutionary genetics, pigment cell biology, behaviour and macroevolutionary analyses.

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