

# Human world

Evolution is essential to understanding human biology, and the evolutionary impact of humans is an important factor in understanding the biology of other species.

Evolutionary biologists and ecologists exist in a state of cognitive dissonance when it comes to humans. They are at the same time exceptional and not exceptional. Humans are a mere twig somewhere in the middle of an enormous phylogenetic tree, and as scientists we spend a lot of time fighting against lazy ideas about humans being the inevitable pinnacle of a linear evolutionary trajectory. However, at the same time, we are fascinated by the evolutionary underpinnings of our unique cultural and cognitive abilities, and by how these attributes have enabled us to dominate the planet to the extent that the evolution and ecology of every other species are affected by us. This issue of *Nature Ecology & Evolution* highlights the deep two-way relationship between humanity and evolution. Our articles explore the ongoing and important evolutionary pressures on humans, and the extensive effect of human actions on the evolution of the rest of the biosphere.

Like every other species, *Homo sapiens* is the product of a complex evolutionary history, and is also subject to contemporary selection. It is interesting that the attraction of human exceptionalism has been so strong that this latter point has been a matter of contention for much of the history of evolutionary biology. It is only with the recent advent of extensive genomic data that it has become widely accepted that selection has an ongoing role in shaping human phenotypes. Rodríguez *et al.* (article no. 0055) bring such genomic data to the question of human ageing, showing that the well-known evolutionary theories that explain senescence patterns in non-human populations also shape patterns of age-related disease onset in humans.

In a similar vein, two articles show the importance of understanding evolutionary processes for dealing with contemporary issues in reproductive health. The Comment by Ball (article no. 0073) describes how an understanding of evolutionary context can be applied to infant sleep in order to improve breastfeeding rates. The authors used their evolutionary knowledge of mammalian behaviour to devise mother and infant sleeping arrangements in hospitals that would facilitate easier breastfeeding. In a randomized trial, adoption of these arrangements dramatically improved the

retention of breastfeeding, a major objective for infant and women's health. The Article by Howard & Gibson (article no. 0049) and accompanying News & Views by Wander (article no. 0079) show that we need to take a cultural evolutionary perspective to understand, and hopefully combat, a long-standing global concern — female genital cutting (FGC). By examining data on FGC and ethnic identity across five West African countries, the authors show that there is a positive frequency-dependent relationship between the chances of FGC occurring to an individual and the prevalence of it in the individual's ethnic group. Moreover, in groups with high rates of FGC, the practice confers a reproductive advantage despite being physically and psychologically detrimental. Understanding this evolutionary explanation for the persistence of FGC is key to designing successful interventions to eradicate it.

The studies above have mainly shown that modern humans are no exception in being shaped by evolution. However, the FGC study points to something that does arguably make humans unique — the capacity for substantial levels of cultural evolution, which is analogous to biological evolution but transmitted through different inheritance mechanisms. In their Comment (article no. 0070), Brewer *et al.* set out an agenda for the study of cultural evolution based on the collective wisdom of members of the newly formed Cultural Evolution Society (<http://go.nature.com/2ktS7VQ>). The challenge is to bring our understanding of cultural evolutionary processes up to approach the level of our biological evolutionary knowledge. To do so, we need to understand exactly how cultural traits are transmitted, how they can be adaptive, and how they each relate to other cultural traits and also to biological traits. The authors argue that understanding cultural evolution in this way will allow great progress in social justice and sustainable behaviour akin to the way that knowledge of biological evolution has advanced food production and health.

The flip side of our capacity for seemingly boundless cultural and technological progress is that we now live in the Anthropocene. The ecological consequences of human domination are severe,

ubiquitous and well-known. One example of this domination is the construction of anthropogenic fire-prone landscapes, as Bowman *et al.* discuss (article no. 0058). The consequences of human domination are also evolutionary, with several documented examples of evolutionary change in response to anthropogenic factors such as climate change, and even the suggestion of an increased speciation rate in response to the massive ecological disturbance that is the sixth mass extinction (C. D. Thomas, *Nature* 502, 7; 2013). These developments are not new, as Sullivan *et al.* explore in their Review of both contemporary and archaeological human-induced evolution (article no. 0065). Humans have had an elevated effect on the evolution of other species for several hundred thousand years, and this effect has had global consequences for most of the Holocene. These evolutionary effects have been caused by a range of human activities, including hunting, harvesting, habitat modification and trophic disruption. Although some effects, such as fisheries-induced evolution, can be relatively straightforward to detect, we should not assume that the effects of human behaviour on evolution will always be obvious and straightforward. There is still much to learn about the complexities of human–environment relationships, both past and present. For example, Roberts *et al.* (article no. 0044) demonstrate that the relationship between environmental change and human behaviour during the early history of agriculture is more nuanced than many have suggested. Using data from the New Guinea highlands they show that the transition to agriculture was not a universal and unidirectional step, rather a patchy and contingent one.

The examples in this issue help to illustrate the fact that the interplay between evolution and human behaviour is one of the most important themes underpinning the entire biological, environmental and social sciences. Without it, nothing about our health and wellbeing, or about our attempt to live sustainably, makes very much sense. Similarly, the Earth's biosphere is so ubiquitously affected by human actions that there is almost no aspect of it that can be fully understood without considering anthropogenic evolutionary forces. □