

CURRENT SCIENCE

Volume 85 Number 1

10 July 2003

EDITORIAL

Extinction

“What I was going to say”, said the Dodo in an offended tone, “was, that the best thing to get us dry would be a Caucus-race”.

“What is a Caucus-race?” said Alice. . . .

“Why”, said the Dodo, “the best way to explain it is to do it.”’

Lewis Carroll

Alice’s Adventures in Wonderland, 1865

‘He wasn’t alone after all. Standing on a golden perch behind the door was a decrepit-looking bird which resembled a half plucked turkey. Harry stared at it and the bird looked balefully back, making its gagging noise again. . . .

“Fawkes is a Phoenix, Harry. Phoenixes burst into flame when it is time for them to die and are reborn from the ashes.”’

J. K. Rowling

Harry Potter and the Chamber of Secrets, 1998

June 21 is the longest day of the year. This year it was also the day that marked the release of J. K. Rowling’s phenomenal best-seller, *Harry Potter and the Order of the Phoenix*. In the over 130 years that have passed since Lewis Carroll chronicled the adventures of Alice, one constant factor has remained a part of children’s literature; mythical and extinct creatures come to life in a wonderful imaginary world. To many of us the Dodo is an ungainly, pompous looking bird, immortalized in John Tenniel’s marvellous drawing of Alice receiving a thimble as a prize from the Dodo, at the end of the Caucus-race; an event at which the Dodo as the master of ceremonies, magisterially declares, ‘*Everybody has won, and all must have prizes*’.

Potter’s phoenix is mythical, but Alice’s Dodo did live comfortably for centuries on the island of Mauritius; its eventual demise as a species hastened by the arrival of the Portuguese on the island in 1513. Clara Pinto-Correia traces the history of the dodo’s headlong plunge into extinction in a compellingly readable book, *Return of the Crazy Bird: The Sad, Strange Tale of the Dodo* (Copernicus Books, New York, 2003). The dodo has been described as a clumsy, placid, slow moving bird, which laid only one egg at a time and built no defense around it. As Pinto-Correia notes: ‘The dodo had never encountered

any enemies until the Europeans discovered the islands. For the same reason, the dodo had no idea what fear might be, thus acting “dumb” or “feeble of wit” as so many mariners would describe it.’ Unprepared to defend itself against predatory humans, the last known sighting of the dodo occurred in 1681 (Pinto-Correia, p. 98). In less than 200 years after encountering humans, the dodo was extinct. Even in death, the dodo was to be subjected to indignity; the last known stuffed specimen at Oxford’s Ashmolean Museum (an exhibit donated in 1683) was cast away on 8 January 1755. Only the head and foot were preserved and the rest burned as trash (Pinto-Correia, p. 142). It is presumably from drawings and the remnants that Tenniel resurrected the dodo in our imagination. In considering the swift demise of the dodo as a species, Pinto-Correia quotes Charles Lyell, the famous 19th century geologist: ‘Some complain that inscriptions on tombstones convey no general information except that individuals were born and died – accidents which happen alike to all men. But the death of a species is so remarkable an event in natural history, that it deserves commemoration; and it is with no small interest that we learn from the archives of the University of Oxford the exact day and year when the remains of the last specimen of the dodo, which had been permitted to rot in the Ashmolean Museum were cast away.’

Centuries of biology have taught us one irrefutable truth; for the individual there is only one certainty in life and that is death. But, on longer timescales the fate that awaits individuals may also consume entire species. Any discussion of extinction must turn inevitably to the demise of the dinosaurs, another great favourite amongst children. There is something magnetic about the recreations of dinosaurs in print and on film; magnificent, terrible and awesome creatures that roamed the earth long before humans appeared. The word ‘dinosaur’ itself is of relatively recent origin; coined by the English naturalist Richard Owen in 1842. Images of dinosaurs are indelibly imprinted on the minds of those who have visited exhibitions of animated models or reconstructions of genuine fossils; and of course, by viewing Steven Spielberg’s film *Jurassic Park*, based on Michael Crichton’s book, which outlines a tantalizing scenario for resurrecting extinct species. Dinosaur extinction, unlike that of the dodo, appears to have been a cataclysmic event; the result of a mass extinction caused by the impact of a comet or an

asteroid with Earth, 65 million years ago. In a famous paper, the extraterrestrial cause for dinosaur extinction was first proposed by Luis Alvarez, Walter Alvarez and their colleagues (*Science*, 1980, **208**, 1095). The Cretaceous–Tertiary (K–T) mass extinction is the fifth and last great extinction episode in the Earth's history, 'wiping out an estimated 70% of all species worldwide' (Frankel, C., *The End of the Dinosaurs*, Cambridge University Press, 1999, p. 6). The first great mass extinction is estimated to have occurred 440 million years ago and the most recent accounted for the dinosaurs 65 million years ago. Palaeontologists also believe that at least 'twenty lesser mass extinctions have been identified in the fossil record, where the level of species killing exceeds 20%' (Frankel, p. 5).

Species extinction is a subject that should worry us all since ecologists have been increasingly projecting a much more rapid pace of species disappearance, as human activity dominates life on Earth. Robert May notes that the extinction rate has 'accelerated during the past 100 years to roughly 1000 times what it was before humans showed up'. He goes on to project a 'speeding up by a further factor of 10 over the next century or so'. His conclusion is then ominous: 'And that puts us squarely on the breaking edge of the sixth great wave of extinction in the history of life on Earth' (Wayt Gibbs, W., *Scientific American*, Nov. 2001, p. 30). The attempts of conservationists to spread the message of the importance of preserving biodiversity have thus far met with limited public support; in the poorer countries burgeoning populations and the imperatives of development leave little room for conservationist approaches. In the developed world, addictively affluent lifestyles can only be sustained at a high cost; most often by denuding the natural resources in other parts of the world. If the dodo is the first clearly documented example of extinction by human action, there are many more disappearances of species that remain unsung. A recent report highlights the 'catastrophic ape decline in western equatorial Africa' as a consequence of 'commercial hunting, facilitated by the rapid expansion of mechanized logging'. Both gorilla and chimpanzee populations are dramatically falling in Gabon and the Republic of Congo; Ebola haemorrhagic fever acting as an additional factor. A team of authors from three continents conclude rather sombrely: 'The stark truth is that if we do not act decisively our children may live in a world without wild apes' (Walsh, P. D. *et al.*, *Nature*, 2003, **422**, 611).

Extinctions happen too in the unseen world of microorganisms. Biologists estimate that there are about 1.5 million species of fungi, 1.0 million kinds of bacteria and half a million viruses; organisms which at times coexist peacefully with humans, plants and animals, but on occasion attack them. In the case of human pathogens, the smallpox virus is a prime example, a purposeful campaign of eradication has been successfully carried out; reservoirs of viruses presumably exist only in the vaults of the US and Russian biological weapons laboratories. The extinction of a human pathogen is, of course, an event for celebration. But, celebration is not always a unanimous reaction as demonstrated by the case of *Helico-*

bacter pylori. This organism which has been implicated as a causative agent in gastric ulcers and some forms of stomach cancer is rapidly on the decline, following the use of antibiotic therapies and improved sanitation. *H. pylori* has however been a component of our intestinal flora; its extinction may have unforeseen consequences. Murmurs against the purposeful eradication of *H. pylori* are already evident in the biomedical establishment. Curiously enough, this bacterium which survives in our gut, provides a way of tracking human migrations over the course of history (Whitfield, J., *Nature*, 2003, **423**, 583).

Human activity and natural cataclysms may not be the only causes of species extinction. Reductive evolution, when genomes are downsized and genes lost by mutation and rearrangement as organisms adapt to increasingly specialized niche, might eventually lead to the death of a species. The leprosy bacillus is a good example of an organism showing 'massive gene decay'. *Mycobacterium leprae* has a genome size of 3.27 million bases as compared to other mycobacteria which yield a genome size of 4.4 million bases. Indeed, the leprosy genome analysis leads to an estimate of a dramatically reduced number of protein products; a clear sign of an organism with impaired biochemical functions (Cole, S. T. *et al.*, *Nature*, 2001, **409**, 1007). *M. leprae* appears to be a species poised on the downward slope to a natural extinction, guided by poorly understood evolutionary pressures; a phenomenon that may provide some warning of the eventual fate that might await all species.

In wondering about extinction we must turn inevitably to the issue of predictions about the end of the human species. Astronomers and palaeontologists, comfortable with long timescales, are quick to accept a 'premise that the Earth will lose its plants and animals in a billion years or less, its oceans and all life within several billion years, and ultimately become assimilated into the red giant Sun in about 7 billion years' (Brownlee, D., *Nature*, 2003, **423**, 803). Undoubtedly, this is a disturbing future; but hardly one that is likely to cause us sleepless nights at present. Interestingly, Martin Rees, Britain's astronomer royal, raises the possibility that the end might be much nearer, suggesting that there is a good chance that extinction will happen by the end of the 21st century. For Rees, ironically, the end will be hastened by science and technology (*Our Final Hour*, Basic Books, 2003). Reviewing Rees' book, Brownlee asks: 'Can we manage the dark side of science and prove Rees wrong? Only time will tell.'

Nearly a century and a half has passed since Darwin produced his remarkable thesis on the *Origin of Species*. In this period much has been learned about the evolution of organisms. Biology, geology, palaeontology and astronomy provide the backdrop for the study of the birth and death of species. Whatever may be the cause of extinction we can be sure that dead species will not again rise like the phoenix from the ashes.

P. Balam