

Victorian science and culture.

Yet he was the co-discoverer of one of the most significant scientific theories of all time, and a passionate and articulate public intellectual who held forth on an enormous range of political, social and theological, as well as scientific, issues. An advocate of evolution by natural selection, certainly, and of socialism, spiritualism, anti-vaccination and women's rights, Wallace had an unusual following, more chequered and less strictly scientific than that of his more famous peers, such as Thomas Huxley and Darwin.

The anti-establishment leanings of his varied commitments, along with his unease in the social milieu of elite scientific society, contributed to the fact that Wallace never held a regular paid position, and to the fact that he is neglected and even disdained by some historians and scientists. Although celebrated writers such as A. S. Byatt and Andrea Barrett have found inspiration for their fiction in Wallace's intriguing life, he has not until now received his due from historians. Peter Raby's energetic account of Victorian scientific travellers, *Bright Paradise* (Princeton University Press, 1996), put Wallace's journeys to tropical Brazil and Indonesia in their historical and cultural context. His new book provides a focused and balanced narrative of Wallace's life, in which his exotic travels are placed in the context of his eventful life story.

Born in 1823 in Wales, Wallace made his way from land-surveying in early industrial Britain to working as a naturalist in the wilds of the Amazon basin by the age of 25. A self-taught natural scientist, paying his way by collecting insects and birds to sell to the then-thriving trade in specimens of natural history, Wallace's immodest goal was to find a theory to explain the origin of species.

Raby skilfully draws readers into Wallace's story, which ranges from an unremarkable upbringing to the rapids of the Rio Negro, from tropical shipwreck to strolling in London's Regent's Park. We follow Wallace as he braves London's scientific social world, and departs once again, this time to the islands of the Malaysian archipelago in search of new evidence for his growing "obsession", as Raby calls it, with understanding the laws that govern the variation and distribution of species.

Raby relates with a biographer's remove Wallace's discovery of the dynamic law — subsequently called natural selection — that underlies the formation of new species. And he tackles Wallace's return to England and his subsequent infatuation with spiritualism using a combination of insight and authorial scepticism. Of note is Raby's perception that, when investigating seances and other spiritualist phenomena, "Wallace's conviction threshold was lowered whenever he came across some apparent fact or reference involving a member of his family ... For Fanny

[Wallace's sister] and Alfred, the certainty that they were in touch with their dead brothers and sisters formed the bedrock of their spiritualist convictions." Given that six of Wallace's eight siblings were dead, this adds a personal dimension to Wallace's belief. Subsequent developments of Wallace's scientific and social commitments, and his journey to North America, are also covered.

Raby expands our understanding by his thorough research of manuscript material, particularly letters and other documents in the Wallace family archives, as well as a conscientious use of published and archived letters of his contemporaries. His familiarity with Victorian literature and drama adds sensitivity to his portrait of Wallace, who read widely throughout his life in spite of his lack of higher formal education.

Well researched and ably written — and a definite improvement on the few existing biographies of Wallace — the book is nonetheless mildly disappointing, particularly for historians of science. Raby's thick-brush treatment of the science of Wallace's day is superficially lively, providing an overview from the outside, but only begins to relate the enormous upheaval surrounding the new findings and new interpretations of the history of humankind that so dominated the public intellectual scene in the 1860s. Here, as elsewhere, Raby seems to skim over recent work in the history of science.

In recent decades, the bar has been raised for scientific biography with Adrian Desmond and James Moore's *Darwin*, Janet Browne's *Charles Darwin* and Adrian Desmond's *Huxley*, in which biographical narratives are embedded in finely textured political and social contexts. Raby's strategy of sticking fairly closely to the rich set of sources he has gathered proves to be a double-edged sword. He provides readers with a well-documented biography that covers the principal events of Wallace's life, but a deeper and broader historical sensibility — in which connections are made among the activities of scientists, the content of scientific work, and the broader social, cultural, political and scientific contexts — is wanting.

I would recommend this tastefully illustrated book to general readers as a good introduction to one of Britain's more charismatic and difficult figures of the nineteenth and early twentieth centuries. Historians of science will probably find some new information and will continue to wonder about the unresolved questions of Wallace's role in the history of science. ■

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Unlocking nature's ancient secrets

The Molecule Hunt: Archaeology and the Search for Ancient DNA

by Martin Jones

Allen Lane: 2001. 280 pp. £18.99

Tomas Lindahl

Traditional archaeological research describing skulls and pottery fragments has expanded in recent years to the use of genetic and biochemical methods in pursuit of the origins of humans, domestic animals and agriculture. The rewards have been great, and structural determinations of DNA and other macromolecules in ancient materials have transformed the field almost as much as DNA analysis has enhanced forensic medicine. For example, an unknown genius in southeastern Turkey, about 10,000 years ago, must have dramatically altered human life patterns by domesticating wild cereals, thereby initiating agriculture. The later exploitation of wild maize in America may have been a more gradual process.

DNA sequencing has enabled us to trace the origins of horses, dogs and cattle as human domestic animals in a detail that was hard to imagine a few years ago. The huge and fierce aurochs, depicted in cave paintings and at ancient grave sites, now emerges as a kind of bovine Neanderthal, extinct and not a direct precursor of modern cattle.

Martin Jones tells the intriguing story of the new field of bioarchaeology in this timely book. From his position as the George Pitt-Rivers Professor of Archaeological Science at Cambridge University, and chairman of the UK Ancient Biomolecules Initiative, he has had a broad and unique overview of the rapid evolution of this new area of research,

and his lucid and authoritative writing conveys the excitement of the field. Human migration patterns in ancient times, the causes of terrible epidemics in the distant past, and many similar questions can now be defined by DNA analysis.

Because DNA decomposes by chemical decay with time, it has not been possible to extend molecular analysis into the very distant past, beyond about 100,000 years. However, the development of ultrasensitive sequencing methods for proteins, which are more stable, might push the time barrier a little further. The oldest DNA fragments yet recovered are short stretches of mitochondrial DNA from woolly mammoths and mastodons. Not surprisingly, their DNA sequences show great similarities to modern elephants. But the interesting fact has emerged that there were many quite distinct types of mammoths, and so elephants represent merely a small remnant of a once-great pattern of diversity.

The retrieval of DNA sequences from Neanderthal bones, slightly less old than the mammoths, has been a particular triumph in this field of research, and has greatly elucidated the distinct differences between early humans and Neanderthals. A decade ago, before it was realized that DNA cannot be preserved for millions of years and contamination with modern DNA is a major technical problem, there were several overly optimistic reports on the apparent recovery of DNA from insects entombed in amber and other potential sources more than 100 million years old.

The recovery of DNA from a dinosaur bone made the headlines in both the scientific and daily press. It was followed by the dampening discovery that this particular DNA sequence was identical with a piece of human junk DNA, a fragment of mitochondrial DNA that had found its way to the cell nucleus and been integrated as a pseudogene during evolution. It is not often that molecu-

lar biology turns into farce, but in the published discussion that attempted to explain this amazing finding, the possibilities were raised that a roving dinosaur had entered the laboratory and contaminated a piece of equipment, or that in the distant past intercourse had taken place between a dinosaur and a human individual. Jones recounts the absurd story totally straight.

The contamination problem remains the greatest difficulty in this dynamic new area of research. In a recent conversation with one of the leaders of research into ancient DNA, I was told how he had handed a famous palaeontologist a brownish, ancient human skull from a museum collection with a query as to whether the skull had been coated with varnish. The palaeontologist gripped the skull with both hands, stretched out his tongue, licked the top of the skull and decided from the taste that the skull indeed had been varnished. In the process, large amounts of modern human DNA would have been transferred to the skull, hampering any future search for traces of remaining ancient DNA fragments. Perhaps archaeologists should change their field techniques and use sterilized instruments, protective clothing, plastic gloves and face masks during their digs.

The book's final chapters describe how the molecule hunt continues. Jones is more circumspect and less authoritative here dealing with microbiological problems, in particular with regard to recent bizarre claims that very ancient bacterial spores might be revived. It requires considerable wishful thinking to believe that bacteria recovered from an excavated fossil or salt crystal are as old as the fossil itself, especially if the bacteria are common extant ones. The only credible way to retrieve very ancient inherited information would be by identifying a slowly propagating organism, halted in its evolution and possessing unique properties clearly not shared by other existing species.

Perhaps some cold and hostile ecological niche, with a reducing, anoxic environment similar to that of Earth a couple of billion years ago, continues to shelter a lurking primitive microorganism that has retained an inefficient early version of the genetic code, or even a chemical precursor form of modern DNA. The isolation and propagation of such a molecular coelacanth would be received with astonishment even by the scientific world, and would teach us much about the origins of life.

The chances of finding something may not be great, but very little work has been done on anaerobic systems from this point of view. In fact, the odds seem rather better than those on the futile and costly search for life on Mars. ■

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Modern values in post-modernism

The One Culture?

A Conversation about Science

edited by Jay A. Labinger & Harry Collins
Chicago University Press: 2001. 322 pp.
\$17, £12 (pbk)

John Ziman

Without a doubt, people ought to have a better understanding of the status of scientific knowledge. Yet most scientists know little — and care even less — about the 'science wars'. This courteous exchange of views between a few of the active partisans may help them to resolve some of their mutual misconceptions, but does little to enlighten the ignorant eavesdropper. What is all the argy-bargy about?

The bogey word, and one that is not much mentioned in *The One Culture*, is 'post-modernism'. Despite all the intellectual atrocities committed in its name, this was a legitimate reaction against the doctrine of 'modernism'. It questioned the idea that formal rationality was the sure way to happiness, goodness and beauty. At first, the 'culture wars' raging in the arts and humanities seemed of no concern to natural scientists, but the post-modernists also unmasked many social pathologies that claimed 'scientific' authority. Science itself, the traditional stronghold of modernism, became a strategic target of their critique.

The gates of the citadel were inadvertently opened by Thomas Kuhn in 1962. His admirable historical study of scientific revolutions could be read as a scholarly justification for complete metaphysical relativism. He seemed to be saying that apparently secure scientific knowledge was never more than the collective opinion of a particular social group, and could thus be debunked by reference to the views of other groups. Philosophically speaking (as several of the contributors to *The One Culture* point out), total scepticism is old hat, and essentially vacuous. Nevertheless, it remains the principal (unsmart) weapon in the 'science wars', and is not adequately countered by equally naive mantras (also uttered here) that scientific knowledge is really, really true.

More constructively, Kuhn was drawing attention to the social factors that influence the production of scientific knowledge. Strangely, this influence had been systematically denied by philosophers. Perhaps they were so focused on the hypothetical ideal of finally revealing scientific truth that they felt they could overlook the messy human processes along the way. Unfortunately, scientific knowledge is always on the road, so its current state is inevitably affected by where it is or has just come from — that is, by the ideas and interpersonal communications of

