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Reviews

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Frank Fenner: *Nature*, *Nurture and Chance*: *The Lives of Frank and Charles Fenner*. ANU E Press: Canberra, 2006. xvii + 356 pp., illus., ISBN: 1 920942 62 9 (Print), ISBN: 1 920942 63 7 (Online), $24.95 (Print).

Modern scientific practice is increasingly informed by contiguous historiographical and biographical commentary, but science communities remain generally content to leave such matters to other specialisms. Although this intriguing volume follows suit, its author's high eminence may invite individuals from assorted fields and career levels to reflect more deeply on the underpinnings of critical contexts, concerns and values. Best-known internationally and nationally for outstanding contributions in virology, microbiology and medicine, and perhaps particularly for his research into smallpox and myxomatosis, Frank Fenner is also warmly recognized for his involvement in the Australian Academy of Science and the Australian National University. Over the course of his long and admirable life the world has been repeatedly and profoundly shaken. In *Nature*, *Nurture and Chance* he recounts the backgrounds of the high achieving Fenners without seriously confronting a matrix of anxiety in which science itself is sketched variously triumphant and complicit. Ultimately, however, reliance on a curiously innocent style of reportage contrives reassurance: idealism and the single-minded pursuit of elegant concepts may have been worth the candle, after all.

The title of this book may variously attract and unnerve, but it succeeds in declaring provenance and purpose and tacitly admits the shortcomings. A fine Preface from science historian Ann Moyal leads into Fenner's autobiographical chronology—childhood, War, school and university; War again; the Walter and Eliza Hall and Rockefeller Institutes; and the setting up of the John Curtin School of Medical Research (JCSMR). Fenner then turns to academic administration, the Academy of Science, post-retirement foundation Directorship of the Australian National University's Centre for Resource and Environmental Studies; a long and intimate association with the global eradication of smallpox; and return to the JCSMR as endlessly 'Visiting' Fellow. The narration is spiced with select bibliographies, annotated interludes and encounters (frequently seeking the 'Chance' factor), boxed insertions on influential contemporaries—the constellation includes Macfarlane Burnet, Rene Dubos, Howard Florey and Francis Ratcliffe and others—and brief lists of friends and associates.

Frank's wartime experiences could be made to illustrate any one or all of the nominated explanatory themes. The text inclines towards 'Chance', but may underestimate personal intuition and initiative: for example, a deliberate preparation in tropical medicine led to service as a malariologist in Palestine, and later on in Queensland and New Guinea. On the other hand, if Burnet did not actually spark the celebrated interest in pox viruses he

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appears to have focused it rather well, and early. Contacts with Dubos, the charismatic environmentalist, extended the author's professional agenda. Collectively, the perspicacity and generosity of less stellar players opened doors and suggested goals, ways and means. Canberra became pivotal: as foundation professor at the John Curtin School of Medical Research he was immediately obliged to look to its regional and international presence; collaboration with neighbouring CSIRO colleagues stimulated the great work on rabbits; recollections of changes in university administration and the early growth of the Australian Academy of Science will be of more than local interest; in the Academy he staunchly promoted environmental issues and an overdue cultivation of science history.

The late-career switch to the Centre for Resource and Environmental Studies is cast as reinforcement of an existing orientation—it built upon a long pursuit of applied biology, and of course upon the championship of environmentalism. Sketched alternatively as a return to familial roots, it leads into the promised biographical section and a revisiting of the book's declared mission. As deeply personal as the author's earlier descriptions of a loving marriage, his wife's illnesses and the tragic death of one of their children, in a sense it is also a debt fondly repaid to a talented, hardworking and arguably under-recognized father. It essays a special, personal inheritance from a man who was much closer to the family's problematical German origins and far more constrained by economic, social and academic circumstance. Charles Fenner moved painstakingly through country teaching towards a Melbourne Bachelor of Science in geology in biology and eventually to a Doctor of Science at the same university, and established commanding reputations in educational administration and scientific journalism in South Australia. His lively mind embraced science, education and the production of a wide range of civic or 'outreach' writings, including books. While the youthful Frank enjoyed the contact fields opened up by his father's distinguished reputation and active support for local scientific fraternities, mature regard for Charles' literary output argued against exclusive investment in short scientific articles.

Debatable 'Chance' resurfaces, after a struggle. Frank laments that, despite the accolades, his father remained chronically disappointed about a failed application for Griffith Taylor's vacated position at Sydney University in the late 1920s. The outcome, he suggests, would have been different had the opportunity arisen a few years later, when Charles impressed key geographers in Britain during an extended visit: 'Chance' denied. It is less speculative to say, firstly, that Taylor, a late entry into academia (*cf*., in that regard only, Fenner Senior), had offended local and British proponents of nationalist-imperialism—notably through pugnacious press statements on (what would now be described as) Australia's 'sustainability' crisis; and, secondly, that university advisers in Britain, spooked by destabilizations of a valued pioneering fringe and conscious of entailed (varied and relatively heavy) undergraduate teaching loads, probably felt better disposed towards a younger candidate from the heart of Empire, with proven credentials in the communication of an emerging academic field.

The undoubted utility of this project might have been increased by the provision of forthright personal reflections on the lessons and legacies of modern science, but that conjures a wider prospective audience than was ever envisaged or required—such modest restraint, at 91! Certainly it would have delivered a different and more controversial book. As it stands, *Nature*, *Nurture and Chance* serves rather well to caution historical researchers against casual exci-

sions of targeted individuals from nurturing domestic hearths, while providing essential and timely accompaniment to the Fenner correspondence and other files in the Basser Library Archives of the Australian Academy of Science.

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Ann Moyal: *Maverick Mathematician*: *The Life and Science of J. E. Moyal*. ANU E-Press: Canberra, 2006. xiii + 162 pp., ISBN 1 920942 58 0 (PB), 1 920942 99 0 (Online), $19.95.

This modest biography of a talented but unusual scientist is an intriguing portrait of an important figure in the history of Australian science. Since the book is written by the wife of the subject, I shall refer to José Enriques Moyal as 'Joe' (by which he became generally known) and the author as 'Ann' (Moyal), a pioneer in the history of Australian science.

Joe was born in Jerusalem in 1910, grew up in Palestine under the Ottoman Empire, and became a British citizen with the new British Mandate. When he was just five years old, his French mother left her lawyer husband and her small son and moved to Egypt. In an atmosphere of political upheaval and rejected childhood, Joe found companionship in his father's books, but he would later wander the world seeking stability and contentment.

Joe was educated at a modest high school in Tel Aviv, where he studied the usual subjects, was 'always interested in mathematics' (p. 5), and became proficient in four languages. He read history voraciously, became interested in science through science fiction, and absorbed Russell's *An Introduction to Mathematics*. Here, too, the sea became a life-long passion.

Successful at the British matriculation examinations, in 1927 Joe enrolled at Magdalene College, Cambridge, to study mathematics, but the costs were too great. Seeking a practical profession, he enrolled in France to study electrical engineering but failed to graduate. He returned to Tel Aviv but was soon back in France to complete a diploma at the Ecole Superieure d'Electricité in Paris. Here 'Joe underwent a metamorphosis from the intelligent, outdoor Israeli to an enculturation as a sophisticated and cultivated European' (p. 9).

Now married to Suse, Joe returned to Tel Aviv to resume work as an electrical engineer. By the end of 1937, however, he was 'fed up with engineering … becoming more and more interested in science' (p. 12), and with his growing family he returned to Paris to study mathematical statistics and then advanced theoretical physics. At the outbreak of the Second World War, Joe was working on gaseous diffusion with the Ministère de l'Air, but he was forced to flee across France and then to England. Interviewed by C. P. Snow, he was sent to work with the De Havilland Aircraft Company, where he made important contributions to electronic instrumentation and the mathematics of complex systems.

Also during the war, Joe found time to develop the application of statistical mathematics to the new quantum mechanics. Intermittently from 1940 he explored his ideas with Paul Dirac, but the great theorist offered only 'dogged resistance and criticism' (p. 23). It was 1949 before Joe's seminal paper, 'Quantum mechanics as a statistical theory' appeared in the *Proceedings of the Cambridge Philosophical Society*. A copy of this paper, reproduction and analysis of the extant Moyal/Dirac correspondence that preceded it, and extensive quotations from modern scholars describing its pivotal importance compose the highpoint of this book. Other important papers followed

from Joe's wartime research, but there were also times when his desire for perfection thwarted publication of useful work.

Post-war, Joe worked briefly in P. P. Ewald's Department of Mathematical Physics at Queen's University, Belfast, and then for nine years he was a lecturer in mathematical statistics in the Department of Mathematics at Manchester. Here his pattern of regular visiting appointments at other centres became established, including several periods in America and six months with Harry Messel in Sydney during 1954.

Restless even in a good academic environment, Joe was next appointed to a Readership in the Statistics Department of the new Australian National University (ANU). His marriage was dissolved and he arrived in Australia in August 1958, a few months before Ann's arrival at the ANU; they were married in 1963. The research focus of the early ANU suited Joe, who fulfilled expectations as 'a friendly and cooperative person, popular with his associated and students', and 'a cultivated man, deeply read in philosophy and history, who forged friendships with the younger postgraduates and postdoctoral scientists and humanists and the university staff members who resided in [University] House' (p. 69). He continued to publish sparingly but fruitfully.

Ann suggests that, although he was outwardly happy and settled, Joe thought the ANU was becoming too comfortable, with too many tenured appointments and too few outstanding visitors. In 1964 he accepted an invitation to move as a Senior Scientist to the Argonne National Laboratory in the USA. He would stay for eight years, publishing a series of innovative papers, presenting seminar lecture series, and visiting widely. But he seemed to need new challenges and new environments on a regular basis, and by the early 1970s America was less attractive: Vietnam, the Kennedy assassinations, the Nixon presidency, and the introduction of the modern research culture—from basic to applied research and severe funding cuts. Ann wrote a scathing article, in which she described 'a deep malaise among scientists at Argonne and raised fundamental questions about the management, independence, and future of the national laboratory' (p. 86), which appeared in the journal *Science* to wide acclaim. It was time for the Moyals to move once more; they returned to Australia.

Already in contact with John Ward, Joe was appointed Professor of Mathematics at Macquarie University, where he was a pioneer of its multidisciplinary approach to learning and continued to encourage younger colleagues and students in research in mathematics and physics. A conference was held in his honour when he retired in 1978, and in 2000 Macquarie established the J. E. Moyal Medal and Lecture. Also conferring on him its degree of Doctor of Science *honoris causa* in 1978, the ANU described Joe as 'one of Australia's most remarkable thinkers … one of a diminishing breed of mathematical scientists working in a broad range of fields in each of which he has made fundamental advances' (p. xii). Joe himself reflected, 'I always seemed to work on the fringes' (p. 110); Ann called her biography *The Maverick Mathematician*. Joe enjoyed a happy retirement in Canberra, where his son and daughter visited and a cousin became Israel's Ambassador to Australia. He died in 1998.

This is a traditional biography, focusing on Joe's science and his academic environment. Ann has been well advised by Joe's colleagues and students, and her book will be enjoyed by researchers in the physical sciences. But 'the life' is only a skeleton, and many questions remain unanswered. His parents, his first wife and children, and his friends are invisible, his education and early life are only sketched, his mature thoughts and views on both academic and

wider questions remain unknown, and the breadth of his knowledge beyond science is unexplored. This book also raises the perennial question of the detachment of the biographer. Ann introduces herself in the third person ('Among the stimulating array of colleagues at University House, he met the historian Ann Mozley', p. 71), which she continues thereafter ('Interview with Ann Moyal', in several footnotes). It seems to me that the book should have been written in the first person, as a memoir rather then a biography. But the author acknowledges that it is a 'small' book, and in this limited context it is a useful addition to the history of Australian science. We should be grateful that the achievements of this important but poorly known scholar have been recorded and brought to our attention.

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Mary McEwen (ed.): *Charles Fleming's Cape Expedition Diary*, *Auckland Islands*, *1942–43*. McEwen Associates: Wellington, 2006. 256 pp., B/W illus., incl. maps, ISBN: 0 473 11384 8 (PB), $NZ40.

I opened this book with an enthusiasm that stemmed from my keen interest in the sub-antarctic islands, including New Zealand's Auckland Islands. The book is a record of Charles Fleming's year on Auckland Island, the main island in the Auckland group, in the form of diaries edited by his ecologist daughter Mary McEwen. Fleming (1916–1987), a distinguished scientific polymath especially in the fields of biogeography, palaeontology and ornithology, and an eminent spokesman for conservation, was the subject of a biography by McEwen in 2005 (Reviewed *HRAS*, 17(1), pp. 117–119).

Charles Fleming lived on Auckland Island for a year as a 'Cape Expeditioner'. This phrase was code for a secret operation in which the New Zealand government sent small parties of men to the Auckland and Campbell Islands during World War II as coast watchers. While the publication will help historians and scientists interested in the islands (especially those concerned with birds and rocks), the specialized nature of his diaries makes for less general interest than McEwen's biography.

After a brief introductory piece by McEwen, the diaries begin with Fleming's departure from New Zealand on the A. S. *Tagua*. The first day's entry gives us a fair idea of their scope, and the general shape of days to come:

> 25 February 1942
>
> Moderate, NW breeze; clear and sunny with some cloud. Pulled out from Queen's Wharf, Wellington, at approximately 1.30 P.M. Usual gulls, a few *S. striata*, and an odd *P. carbo* and Nellies in harbour. Not far outside Heads, *P. carneipes* and a single *P. gavia* making hard down towards Palliser. Several more Nellies, several gannets, *P. carneipes* before 3, when a single *Diomedea regia* seen. *P. carneipes* quite abundant at 3.30. One *T. cauta*, pale head, yellow bill. Another *Diomedea* in water. One had white up to carpal joint but the first, seen in flight, had only the inter-scapulars and rump white.
>
> Later others. One with carpal patches. I have seen no *griseus* for sure, though possibles, from silhouette only. Several *gavia*.
>
> 5 P.M. Cloudy Bay, wind and sea dropped. Flocklets of *gavia*. Little else.
>
> 5.30 Shortly after last entry, passed through shoaling Kahawai, with hundreds of *P. gavia* and few *carneipes* in attendance.

Only some readers familiar with the birds of southern New Zealand could match these scientific names with the seabirds of the region. While there are supplementary notes by McEwen in bold face in the text, these are sparing. This is a book crying out for some substantial editorial interpretation.

Footnotes would have been a great asset to the reader, in explaining Fleming's movements, the significance of his observations, and other contextual details. Most non-New Zealanders do not know a *weka* from a *rata*, let alone what they are (the former is a flightless but tasty bird, the latter a tree found as far south as Auckland Island, and belonging to the enormous family which includes, among other trees, the eucalypts).

Those who do buy and read the book are likely to have some familiarity with the islands and their history. But my own knowledge of the islands, principally through journals of another Cape Expeditioner Jack Sorensen and some of the earlier twentieth century Campbell Island whalers, was still not enough to make Fleming's diaries an 'easy read'. It would help to know, for example, the full names of those whom Fleming refers to throughout simply as 'Bart' or 'George', and to explain that party 'No. 3' was at Campbell Island during this year, rather than on Auckland Island. I longed for a comprehensive introductory essay by the editor on the Cape Expeditions, explaining their high proportion of scientists, and spelling out their significance to New Zealand science. The first names of some of Fleming's fellow Cape Expeditioners, one-word descriptions of their occupations, or the fact that the common name for *Nesonetta* is the Auckland Island teal all appeared in the index, but needed to be inserted where we first encountered them.

Most of Fleming's diaries concentrate on scientific observations, and there are relatively few comments on life with the other men at Auckland Island's No. 1 and No. 2 stations. Fleming was a keen and wide reader—among the books he read during the year were works of Pepys and Tacitus, and George Bernard Shaw's *Socialism*. There is, however, little else mentioned to round out the picture of life on a Subantarctic Island.

The diaries showcase the remarkable number of scientific fields in which the young Fleming (who turned 25 during his year on the island) was an able observer. They hold vegetation notes, biological and geological sketches, and ornithological minutiae. On two occasions he searched diligently but unsuccessfully for the Auckland Island merganser, a bird last seen in 1902, and a rare southern hemisphere example of these sea ducks. Occasionally, he could combine mundane household chores with scientific ones—he planned to take a peat profile while digging a new cesspit, for example (p. 114).

A picture emerges from the diaries of Fleming's slow establishment of intimacy with his place—in this case, a rainy, cold, unpeopled place with few signs of past human presence apart from the many imported mammals—cats, pigs, rabbits, sheep, goats—an occasional fingerpost, old depot with a cache of supplies, or the remains of a whaling or sheep-farming camp. His activities show life on the islands through the lens of science, which lent both legitimacy and a strong purpose to daily life. By contrast, his year's coast watching for enemy shipping went past without spotting any suspect vessels. When Fleming found a sooty albatross on an egg at its nest, he commented:

> It's pleasant to have something to record after the last few days of camp routine only. I have now to decide on the eventual fate of the egg which is roughly 40 days advanced, in a probable incubation period of 60 days. I think I'll leave it.

This was a significant decision at a time when collection of eggs, skins and skeletons was more or less automatic, and Fleming and his companions regularly shot prepared skins from birds and seals as museum specimens. They also collected plants, invertebrates, and seal and sea-lion bones.

The diary material was typed at Fleming's instigation during the 1970s and

proofed by him, but publication was delayed until now. McEwen, daughter and fellow scientist, was a natural person to complete the job. Despite the evident carefulness of McEwen's work, the book could also have used comments from fresh eyes unconnected with the family and the place to provide more context for the handsome production.

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Danielle Clode: *Continent of Curiosities: A Journey through Australian Natural History*. Cambridge University Press: Melbourne, 2006. 224 pp., full colour illustrations, ISBN: 0521866209, $59.95.

'There is nothing—absolutely NOTHING—half so much worth doing as simply messing about in boats.' Though readers of *The Wind in the Willows* may or may not agree with Ratty's sentiments, there is some dispute about exactly which species said these words. Was Ratty a water-loving common rat *Rattus rattus*—sharp of snout, naked of tail—or was he the similar-sized but somewhat more attractive European water vole *Arvicola amphibius*? And there is confusion about even this name. Carl Linnaeus, the great 18th century taxonomist and popularizer of binomial nomenclature, described two species of European water vole—*A. amphibius* and *A. terrestris*. Though modern taxonomists have reduced this number to one they differ about which name should be correctly used.

It is here that the notion of museums has, for more than two hundred years, played an important part. The idea is simple. You discover what you think might be a new species. You compare your specimen with specimens or descriptions of similar species. If it differs sufficiently you publish your description together with a new binomial name. Then you deposit your specimen (now the 'type' specimen for that species) with some reputable institution so that later researchers can compare it for themselves. Since the 18th century that institution is very likely to have been a museum. If you have lived in Victoria since 1853, that museum is very likely to be Museum Victoria (which I have every confidence will change its name back to the 'Museum of Victoria' before I die).

Danielle Clode was in the enviable position of being given free access to the collections of Museum Victoria during her 1998 residency there as Thomas Ramsay Science and Humanities Fellow and has now written a book about what she found there. In what are basically a collection of independent essays mostly centred on one or more objects in the museum, she explores topics as diverse as bushfires and beetles, the theories of continental drift and biogeography, the origins of humans and the origins of life itself. Clode is a thoughtful and fluid writer, and can spin a good yarn out of what at first glance might seem unpromising threads. She has strung the stories along a time-line—the last 500 years, the last 250,000 years, the last 250 million years, the last 4.5 billion years. Not only does she describe many plants and animals, extant and extinct, which are to be found in the museum, she introduces us to the people that have helped shaped modern understanding of biology. Charles Darwin and Alfred Russel Wallace make important appearances, as do Frederick McCoy (director of the museum from 1858–1899) and present-day researchers such as palaeontologists Tom Rich and Pat Vickers-Rich. And she has included a wealth of illustrations—old and new paintings, maps and photographs—which not only complement the text but add to the attractive appearance of the book as a whole (the exception being some strange simplistic line drawings). I also admired Clode's use of the 'boxed' insert, each adding to the main text without distracting from it. All in

all, a good read. There is one large problem with the book, though. Its title.

If I pick up a specimen in a museum labelled *Rattus rattus* I expect to see a small furry thing with four legs and a long tail. If I pick up a book called *Continent of Curiosities*: *a Journey through Australian Natural History* I expect to read about Australian plants and animals, or at least about people who study them. I do not expect to read about the history of the Melbourne sewerage system (the pumping station has been converted into Museum Victoria's *Scienceworks*), nor about hominid fossils (none of which came from Australia). The final chapter on possible extra-terrestrial origin of life has only the smallest connection with Australia, via a meteorite that landed near Murchison in Victoria.

Aside from this, I enjoyed the book. I admired its content and its appearance. And there is no doubt that Danielle Clode's book has reinforced my prejudice. I am sorry to disagree with Ratty, but there is nothing—absolutely NOTHING—half so much worth doing as simply messing about in museums.

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Mike Smith and Paul Hesse (eds): *23°S*: *Archaeology and Environmental History of the Southern Deserts*. National Museum of Australia Press: Canberra, 2005. x11 + 436 pp., illus., ISBN: 1 876944 30 7 (PB), $42.95.

Although mid-latitude southern hemisphere deserts comprise less than a quarter of global drylands (which cover approximately 20% of the earth), they are much more diverse than their northern hemisphere counterparts. Diversity is thus one of the guiding themes of the collection. The other uniting motif is the adaptability of the people who inhabit landscapes as disparate as the hyper-arid Namib and Atacama deserts of Africa and South America to the arid grasslands or savannas of the Kalahari, the continental dune fields of Australia, and Argentina's high altitude Puna. The editors are well-suited to their task. Smith is a pioneering Australian desert archaeologist, historian and museum curator; Hesse lectures in physical geography, researching Quaternary environments, aeolian dust and the impact of global climate change on arid environments.

23°S is one of a number of timely collections and monographs dealing with climate or weather and human societies published in Australia in 2005. These include *Desert Peoples: Archaeological Perspectives* (Blackwell: Melbourne) (Smith, Veth and Hiscock, eds.); *A Change in the Weather: Climate and Culture in Australia* (NMA Press: Canberra) (Sherratt, Griffiths and Robin, eds.) (reviewed *HRAS* 16(2): pp. 251–3); and Tim Flannery's *The Weather Makers* (reviewed *HRAS* 16(1): pp. 129–30). The collection builds from the National Museum of Australia's acclaimed exhibition *Extremes: Survival in the Great Deserts of the Southern Hemisphere*, and a major archaeological conference held in January 2003 that focused on the diversity of southern deserts, their histories and peoples.

Its eclectic, multidisciplinary roots—90 scholars presented at the conference, representing 16 countries, and 40 of them appear in *23°S*—are both a weakness and a strength. African, Australian and South American deserts are represented fairly evenly, creating a complex desert sampler that ranges widely across geography, climate, history, ethnography, archaeology and art. But only three essays, including Smith and Hesse's introductory chapter, could be said to be truly comparative. The collection covers five 'big picture' areas: environmental history; dynamics of settlement; rock art; hunters and herders; and historical perspectives. Comparative pieces on

rock art and on hunters/herders are notable absences, and a synthesizing chapter or conclusion could have served to accentuate continuities and differences between the case studies, important given the editors' observation that 'the desert is a confluence of ideas, economic systems, and an environmental fracture line where the effects of climate changes are most keenly felt' (p. 12). But, given the scope and scale of the collection, such criticisms are quibbles.

The popularity of Flannery's *The Weather Makers* points to the currency of climate change concerns. Productions like *23°S* seek a complex understanding of human and environmental interactions through time. Such interactions are particularly revealing in regions at the climatic limits of human habitation as the introductory chapter shows. In this new collection, Smith builds on his far-ranging and erudite chapter on palaeoclimates in *A Change in the Weather* in an essay on the dynamics of settlement, showing that the narrative of human settlement in southern deserts 'is complicated by [their] dynamic environmental history' (p. 93). He asks 'what problems do deserts pose for people?' (p. 94). What end does focus on resemblance and contrast between places and people serve, given the contrivance of comparative studies, relying as they do on the elision of difference and magnification of similarity? Smith's chapter, and less explicitly the collection as a whole, goes some distance to picking out commonalities and differences in human experience, and revealing the mutual entanglement of environmental and social histories within and between geographic regions.

Beautifully presented, scholarly, and engagingly produced for a non-specialist audience, *23°S* is an important entry into the desert studies and environmental history canons.

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Chris Johnson: *Australia's Mammal Extinctions. A 50,000 Year History*. Melbourne: Cambridge University Press, 2006. x + 278 pp., illus., ISBN: 13 978 0 521 68660 0 (PB), $49.95.

In order to preserve contemporary Australian mammalian species that are rare or threatened with extinction, we need to understand the causes behind the prehistoric and recent mammalian extinctions that have taken place. Such was the motivation behind Johnson's book. He writes with the historical depth of a Jared Diamond, and the historical breadth of a Stephen Jay Gould. This is an impressive compilation, combination and comparison of recent research across the different disciplines of archaeology, botany, conservation, ecology, geography, geology, mammalogy and palaeontology.

Johnson identifies and discusses three major periods of Australian mammalian extinction and the species involved therein: late Pleistocene extinction completed by around 46,000 years ago; the Holocene extinctions in the last ten thousand years of mainland marsupi-carnivores; and the parade of mammalian extinctions that have taken place since European invasion and occupation. For each period the departed species are enumerated, their ecological role, distribution and body size noted, and the most significant individual species, either because of size, commonness or ecological niche, are described in full and illustrated, frequently in colour.

The book is a model of scientific argument and analysis. Johnson is proudly attached to Occam's razor, seeking, wherever possible, single-cause hypotheses for the explanation of prehistoric and recent extinctions. For example, he is not tempted to present an easy, compromised complexity of causation for prehistoric extinction; through simply combining the contrasting positions of climate change, the effects of fire, and Blitzkrieg-over-

hunting by Australia's original human invaders into the one fence-sitting explanatory model.

Considering the different discipline positions covered, the book is remarkably free of any pre-conceived intellectual positions; tending neither to the white wrist band of 'man the mighty hunter', nor to the black blindfold of 'the noble savage living in harmony with the environment'. The challenge to any reader embedded comfortably in a narrow, discipline-directed perspective is evident from the time-line given at the very opening of the first chapter, which dates Australian megafaunal extinction to 46,000 years ago, and Aboriginal occupation of the continent to 45,000 years ago. The ordering of these events and the dates attached thereto, is indicative to the reader, of the intellectual ride ahead.

The criticisms and challenges that Johnson throws down on contemporary pre- and mis-conceptions are legion. For example, the reworking of sediments, disarticulation of bones and the re-arrangement of the vegetation as a consequence of herbivore extinctions, coupled with the re-dating of fossil and human artefact material; to Johnson leave but three possible sites for the late survival of the megafauna beyond 46,000 years ago. The romantic perception of the extinct megafauna as 'Dreamtime animals', preserved in rock art and Indigenous oral traditions, unfortunately appears to be just that, romantic, rather than scientific; the dreamtime evidence appearing remarkably thin. There is a delightful cynicism expressed over blind statistical modelling of hypothesized causes of extinction, such as those associated with the dubious hypothesis of megafaunal naivety to new predators.

One editorial flaw, it must be admitted, constantly intrudes on the intellectual pleasure in this book; and that is the author's close to universal use of the nouns 'mammal' and 'megafauna' as adjectives, instead of 'mammalian' and 'megafaunal'. Every two to three pages in the text one finds oneself surprised by meeting the end of a sentence, or encountering a phrase that jars with previous content that necessitates re-reading the entire sentence, and changing one of the nouns to an adjective, in order to understand the author's intent.

Placing such colloquial expression aside, however, this book takes the reader on an electrifying ride, from differing disciplinary perspectives, of the fate experienced by Australia's mammalian species over the past 50,000 years. While it is a prime example of the important role of the book in contemporary academia—Johnson's argument would not be possible in just a series of separately published, journal articles—the book is also deserving of meeting a wider, informed, general audience.

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