important precursor to our modern understanding of atomic structure.

She strove throughout, and especially at the end, to keep a firm distinction between her personal and scientific life. But in this she failed, and a woman of greater understanding of the world would have realized that she was bound to fail.

She was awarded the Nobel prize for chemistry at the height of the open scandal over her affair with Langevin. A member of the Swedish Academy wrote to her indicating that she would not be welcome in Sweden and should refuse the prize until she had cleared her name. But, she replied, the prize was given for her discovery of polonium and radium, and nothing else. Was she right to insist — is any scientist right to insist — that there is "no connection between scientific work and private life"? Given the facts, and that she had written an incredibly indiscreet letter to her lover, with detailed recommendations as to how he could withhold sexual favours from his wife and thus make a break inevitable, there was probably no way that Marie Curie could be treated fairly by contemporary French society.

There is something very Janus-faced about the situation and, for an English reviewer, the furore and scandal that surrounded Marie Curie's affair in France is very hard to understand. For I am writing at a time when the president of France not only has an illegitimate daughter but is also applauded for his paternal devotion. This contrasts sharply with the speed with which a number of English politicians have resigned for extramarital affairs. Some have an illegitimate daughter as well, in one case two of them. As Quinn points out, in France certainly, bourgeois men could keep — and still can keep — a mistress so long as she stayed in the background, as did President François Mitterrand's. That enforcer of male privilege, the Napoleonic Code, was indulgent towards the husband. But Marie Curie was in no way anonymous; she could not fade into the background. She had a career, an independent income and ambitions, and was therefore completely vulnerable to public exposure. Her letters to her lover were stolen and published, letters fuelled by passion as fiery as the passion that, as Einstein pointed out, she demonstrated at scientific conferences.

Marie Curie's impotence in the face of the 'outrageous press' was total, as apparently is that of adulterous British politicians and all the rest. A touch of farce attended the affair when Langevin challenged Gustav Téry to a duel for insulting him in an article that accompanied the publication of the letters. Neither of them ever intended to fire the pistols, nor did they, but the duel was the talk of Paris and of Sweden too. It was shortly after this event that Marie Curie was recommended not to go to Stockholm to receive the Nobel prize.

The episode affected her profoundly, of course, both personally and scientifically. It ruined her chances both of becoming a member of the French Academy of Sciences and of starting a new life with her lover. He was reconciled with his wife and took another mistress (an anonymous secretary) while Marie Curie was left to go on alone.

Whether about this scandal, or the details of her scientific discoveries, or her theories or her childhood, the material in this volume is impeccably researched and splendidly presented. This is not a book that one devours at a sitting as one did *The Double Helix*. It is far too profound and thought-provoking for that. Yet I also found it, and its subject, devoid of humour, as is Eve Curie's biography. True, there are lighter touches. As is usual with all good discoveries, quacks and opportunists raced to exploit them, trading on "the assumption that water's radioactivity had health giving powers and the Curies' good name". This lasted for a long time. I remember, again from my earlier years, drinking mineral water in France and seeing the label on the bottle list the quantities of magnesium, zinc and all the other goodies therein, and the radioactivity too. How quickly radioactivity disappeared from the list. So it is not surprising that there was a "Curie hair tonic" that was claimed to stop the loss of hair as well as restoring its colour and a "*creme activa*" that held out the promise of eternal youth with the statement that "Madame Curie... promises miracles".

All this was in deplorably bad taste of course. But the puzzle of Marie Curie persists. While she may have had her lighter moments, irreverent humour was never one of her strong characteristics; and perhaps it doesn't matter for scientists, other than that those without a sense of humour will have a hard time. If, on looking back, I realize I didn't have what it takes to be a scientific nun, it's quite clear from reading this book that Madame Curie didn't have it either. As a role model, the injection of Eve Curie's book provoked an immunity to dedicated laboratory work in me, although it had the opposite effect on my admirable sister.

So how, in 1995, would the Madame Curie portrayed in this biography shape up as a role model for today's aspiring women scientists? Although I don't really know, I suspect the young women of today will find more inspiration in the deliciously eccentric and formidable Barbara McClintock, who brilliantly and comprehensively gave those Young Turks of molecular biology their come-uppance. For we are all creatures of our times. □

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My families and other animals

W. C. McGrew

Reflections of Eden: My Life with the Orangutans of Borneo. By Biruté M. F. Galdikas. *Little, Brown/Gollancz: 1995. Pp. 408. $24.95, £16.99.*

Now comes the long-awaited volume to complete primatology's most famous 'trilogy': Biruté Galdikas's account of her long-term field study of the orangutans of Kalimantan in Indonesia. She joins Jane Goodall (*In the Shadow of Man*, 1971; *Through a Window*, 1990) and the late Dian Fossey (*Gorillas in the Mist*, 1983) in giving a personal report of behavioural research on great apes in nature. Goodall has studied the eastern chimpanzees of the Gombe National Park in Tanzania since 1960; Fossey looked at the mountain gorillas of the Virunga volcanoes in Rwanda from 1967 until her death in 1985; and Galdikas has focused on the Bornean orangutans of Tanjung Puting National Park since 1971.

From *Reflections of Eden*

Galdikas: self-reflection of reflected self?

What makes the project part of a trilogy is the common source: the Anglo-Kenyan palaeoanthropologist Louis

Leakey, who assigned to each of these women a species of great ape. (Actually, we are told, Leakey gave Galdikas a choice: she could have had the pygmy chimpanzee or bonobo, but she stuck to the Asian ape.) Leakey's influence as the 'spiritual father' of these scientific siblings is immense and pervasive: much of the final, summing-up chapter is a synthesis of Galdikas's feelings about her 'sisters'. As the youngest offspring, Galdikas seems to be the most keen to uphold Leakey's memory, perhaps because he died before she achieved success.

Unlike the books by her fellow trimates, *Reflections of Eden* is highly egocentric, sometimes frustratingly so. Of the 64 photographs, 37 feature Galdikas, whereas only 36 portray orangutans. (Oddly enough, there is no photograph of the forest itself, despite the book's title.) No references are given should the reader want to pursue Galdikas's scientific writing or the alternative views of others. There is no index, and most of the 22 chapters have enigmatic one-word titles, usually proper names. Chronologically, the book concentrates on the first four years of the project — as late as Chapter 16, we have reached only 1975.

The substance of the book is a memoir of what it is like to study wild orangutans and to live with ex-captive orangutans who have been confiscated and then released back into the wild. Following Goodall's and Fossey's lead, Galdikas concentrates on individual apes, about half from each category. Here Galdikas is at her best. She is a master storyteller: vivid, evocative, moving. In delving into the hearts and minds of her subjects, she is intuitively persuasive. (Interestingly, unlike most field primatologists, her undergraduate major was in psychology.)

Underlying the account is a spiritual theme that goes beyond the recurring imagery of Eden. God features prominently, most startlingly as a super-hominoid player of cat's cradle. A walk into the rainforest is likened to a walk into the mind of God. Angels keep popping up, either as wealthy donors in Los Angeles or as self-descriptors for the trio, with, for example, Fossey's anti-poaching efforts making her an avenging angel. Galdikas tells us that her revelationary calling came in the form of a crystal-clear chime during a lecture at the University of California, Los Angeles. So it is not surprising that the book's final sentence reads: "We are allowed to see the eyes of God [when we look into the eyes of an orangutan]".

Happily, the scientific findings after decades of research are notable. Orangutans really are loners: Galdikas has never seen two adult females groom one another — and they are reckoned to be the more sociable of the two sexes! Males disperse from their natal ranges, whereas females stay at home, making the Asian ape different from its African cousins. The typical birth interval is eight years, the longest of any species of primate. Despite the remarkable ingenuity and imitational skills of released captive orangutans, such as their attempts to kindle cooking fires, their wild counterparts show no subsistence technology whatsoever. They regularly mate face to face and engage in forcible copulation, which Galdikas likens to "date-rape".

Unfortunately, knowledge from her impressive research is rarely integrated with that of others. Of her contemporaries, only John MacKinnon is credited. Pioneers such as Peter Rodman and David Horr are mentioned only to be dismissed, and decades of research by Dutch workers such as Hermann Rijksen on the other subspecies of orangutan in Sumatra are simply ignored. Japanese researchers (Akira Suzuki, for example) and Indonesian researchers (such as Jito Sugardjito) suffer a similar fate. Galdikas may well have spent more time near wild orangutans than all other primatologists put together, but science is not a solitary activity, even when its subjects are.

The strengths and weaknesses of the book ultimately boil down to one basic difference between Galdikas and her counterparts, Fossey and Goodall. Unlike them, Galdikas undertook to do both research and conservation from the beginning. Within a week of arriving in Borneo, she instigated the rescue of a pet orangutan and so began a commitment to individual welfare that persists to this day. Her field site, Camp Leakey, is thick with ex-captives, from panhandlers to irregulars. Rehabilitation of infant great apes is a round-the-clock job, exhausting in all ways. To have done it in parallel with full-time study of wild primates is unprecedented, like holding down two jobs, each of which could be all-consuming. This double life has taken a toll along with the rewards: at no point does Galdikas seriously address the key issue of the possible impact of her immigrants on the lives of the wild resident apes. More than a hundred incomers have been released into what was apparently an ecosystem already at carrying capacity, yet she fails to consider the consequences of enhanced competition. At the end of the book, one wishes it were two, one about the natural lives of our close relations and another about the challenges and choices of repairing our human mistreatment of those same cousins. □

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A river runs through it

Christopher Wills

River Out of Eden: A Darwinian View of Life. By Richard Dawkins. *Basic-Books/Weidenfeld and Nicolson. Pp. 166. $20, £9.99.*

THIS short book is the latest in the Science Masters series, a set of brief explorations of their fields of expertise by some of today's most distinguished science writers. Richard Dawkins treats the subject of evolution in his usual limpid style. The book breaks no new ground but, as usual, it abounds with metaphors that make things brilliantly clear. As someone in the metaphor business myself, I must admit that nobody can turn a metaphor better than Dawkins. The central metaphor here is that evolution is like a river, flowing smoothly (more about this later) and made up not of water but of bits of digital information. We are rapidly moving into a digital world, and Dawkins, no laggard, points out that it is lucky that our genetic material is digital rather than analogue.

It is not impossible to imagine an analogue mechanism for passing genetic information from one generation to the next. Suppose a gene were to consist of a protein molecule of a specific shape, which serves as a template for the construction of another protein containing a negative image of it. This in turn would serve as a template for the construction of a molecule of roughly the original shape, and then the process would be repeated. It would not take many generations before the genetic message would fade into indecipherability. And, although Dawkins does not make the point, that is how geneticists tended to think about gene replication before the age of Watson and Crick.

I immediately tried out Dawkins's picture of a flow of digital information on students in my class on molecular evolution. Most of them, it turned out, knew all about digital information, but few had come across the concept of analogue information. (Those who want to use his image had better hurry, before the memory of analogue watches and analogue records fades from the collective consciousness.) Dawkins uses the metaphor of a digital river to link together lucid discussions of several fairly disparate subjects: the provenance of the mitochondrial Eve, the way in which complex organs and behaviours might have evolved and the problem of good and evil. His view of the last will be, for many potential readers, a bone-chilling one: