and an attempt to identify the lacunae in existing approaches are revealed in most of the chapters, especially those on the government's response, the role of non-governmental organizations, community responses in Mumbai City, and interventions with gay men. These chapters demonstrate the complexity of the issues involved, and contrast with the superficial analysis presented by *Combating AIDS*. The negative impact of the information, education and communication strategy in terms of increasing fear and stigma is recognized. *Living with the AIDS Virus* also highlights the limitations of 'targeted interventions' as the target groups tend to be stigmatized. Instead, it is better to address communities at large; for example, rather than target truckers, it is better to reach societies along transport corridors.

Both books acknowledge that AIDS-control strategies have generated stigma, ignored the creation of capacities for care and support, and been gender insensitive. But despite this, both books propose managerial and technocratic solutions that do not question the existing perspective. If we do not want to prescribe without a diagnosis, we need to ask why such measures were adopted in the first place.

Alternative perspectives with a societal rather than a programme-oriented approach have also been articulated since the 1980s. They integrate the biomedical and social dimensions rather than dichotomizing them, and view preventive and curative measures as an integral whole, and means and ends as complementary. However, neither book cites the people's movement groups and academics who espouse such perspectives, and who warned early on of the limitations that are now being widely realized. Instead, the books attribute the positive influence to international funding agencies or to local non-governmental organizations, which have been influential in shaping the response in the first place. AIDS control has been led more by emotion, instinct and international politics than by scientific evidence or contextual needs. Denying this 'politics of knowledge' can only allow the suffering caused by AIDS to continue unabated.

Combating AIDS is slickly written using communicators' theories, taking the reader step-by-step through various arguments, and using repetition to ingrain them in the reader's mind. It is likely to interest local programme managers, as it provides examples of a wide range of interventions that comply with the homilies of current AIDS-control thinking. *Living with the AIDS Virus*, although less elegantly written, provides more food for thought for policy-makers, researchers and programme managers. Both books should interest the general reader. ■

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Designer darwinism

Darwin and Design: Does Evolution Have a Purpose?
by Michael Ruse
Harvard University Press: 2003. 384 pp. $29.95, £19.95

Mark Ridley

Design — what biologists call 'adaptation' — is an obvious feature of life. People have probably been thinking about it for as long as they have been thinking about anything. Classically, it provided the basis of the 'argument from design', one of five arguments put forward for the existence of God. Darwin undermined that argument, but it has enjoyed something of a revival in the latest version of creationism, known as 'intelligent design creationism'.

Michael Ruse is a philosopher of biology, and his broad-ranging book covers several themes. He distinguishes the 'argument to complexity' — the factual observation that complex adaptations, such as eyes and wings, exist in nature — from the 'argument from design', the theological inference from that fact that God exists. Ruse traces the history of these two arguments from their earliest forms in the hands of Plato and Aristotle, through Galen and Thomas Aquinas, on to David Hume, Immanuel Kant and William Paley, followed by Georges Cuvier and Richard Owen, and then Darwin and his followers in the modern synthesis.

After the history, Ruse takes a look at modern research on adaptation, and at its 'formalist' critics, who think that organisms are shaped by non-adaptive laws of form, rather than by adaptation to the environment. He ends with two chapters on modern theologians, including the intelligent-design creationists.

There is no central argument to unify the book, but Ruse holds a consistently darwinian position against all its critics. Adaptation exists, he says; it matters; it is not explained by God; it is explained, and with exemplary scientific propriety, by natural selection; and it is a legitimate topic for scientific research. The various people who have argued otherwise are making various kinds of mistake.

The book is written for philosophers and theologians as well as scientists. Indeed, the book will help to broaden the minds of most scientific readers. I doubt whether anyone else has read up on quite the range of authors that Ruse has, and he writes about them clearly and non-technically.

Ruse also advances certain theses along the way that will particularly interest *Nature* readers, and I'll concentrate on them. One question concerns adaptationist research. The biologists who do this research often argue not only that they find adaptation interesting, but that it is peculiarly important in biology. Successful adaptationist research is explanatory in a way that makes most mechanistic research look descriptive. And any big theory about life has to be able to explain adaptation.

On this topic, Ruse gives a sympathetic hearing to the critics who, he says, "would raise the objection that adaptation and the associated design metaphor have their roots in British natural theology of the pre-Darwinian era, and they would ask again why, in the secular world of the twenty-first century, we should be bound by this retro-thinking." This seems to be close to confusing the contexts of discovery and of justification. Adaptationism may have its roots in predarwinian anglican theology, but that does not make it false. German textual scholarship may have its roots in lutheran theology, but that does not reduce the value of the texts.

I think the strongest argument that the critics can make is not that adaptation is unimportant, just one problem among many, but that it has been solved. This may level the playing field for adaptationist and non-adaptationist research now, but it does not reduce the conceptual importance of adaptation for understanding life.

Research into adaptation often uses optimality models, or something like them. It might aim to understand the form of an eye, for instance, on the assumption that eye shape is optimized for forming images. One common interpretation of this research is that it aims to understand how, and not whether, organisms are adapted. Ruse disagrees. "It is fairer to say that a two-way process is at work here. We adopt a background assumption of adaptationism and then

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An eye for design? The complexity of a chameleon's eyes doesn't imply a role for God.

we test specific models. Inasmuch as things do not work, then we worry more about our adaptationist background as well as our model."

I do not agree with Ruse on this point, but his position is undoubtedly defensible. The only place I had a deep disagreement was in the history of ideas, with what Ruse has to say about Motoo Kimura and the neutral theory of molecular evolution — the idea that most molecular evolution proceeds by random genetic drift. Kimura's ideas receive only a brief mention before being dismissed.

I favour the view that Kimura's idea led to something of a paradigm shift in the late 1980s. Most biologists who work on molecular evolution nowadays assume that they are mainly studying the effects of random drift. This contrasts with earlier biologists who worked with non-molecular characters. Kimura's ideas seriously challenged, or at least restricted the scope of, adaptationism. If adaptationism could carry on much as before, it was for reasons that needed further attention. So Kimura deserves more than a passing gesture in a survey as admirably thorough and sensible as *Darwin and Design*. ■

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István Hargittai has interviewed many of the most influential chemists of the past sixty years, including Glenn Seaborg (top left), Ad Bax (second row, right) and Jean-Marie Lehn (third row, second left).

Chemical conversations

Candid Science III: More Conversations with Famous Chemists
by István Hargittai, edited by Magdolna Hargittai
World Scientific/Imperial College Press: 2003. 520 pp. £48, $78 (hbk); £21, $34 (pbk)

Arthur Greenberg

This book is the latest in a continuing series of interviews with prominent scientists by István and Magdolna Hargittai. The Hargittais are highly regarded structural chemists, located in Budapest, Hungary, whose wide-ranging interests and energy have produced a 'cottage industry' of books.

Candid Science III provides snapshots of the culture and progress of chemistry over the final 60 years of the twentieth century. Its oldest interviewee, Glenn Seaborg (1912–1999), was a nuclear chemist who added a new row — the actinides — to the periodic table. Seaborg was one of the team that discovered plutonium, and worked on the extraction of this metal for the Manhattan Project. His frustration with the naming of the trans-uranium elements is apparent in this interview from 1995. But in a postscript that was first published in 1998, Seaborg happily describes the history of the discovery of element 106, which was named in his honour in 1997.

The youngest interviewee, born in 1956, is Ad Bax, who runs the US National Institutes of Health's section of NMR (nuclear magnetic resonance) spectroscopy. From 1981 to 1997, the ISI logged 21,655 citations of his work, 50% more than the second-most-cited chemist, Nobel laureate John A. Pople. This emphasizes the amazing evolution over the past half-century of NMR spectroscopy from a physics experiment to a routine technique for structural proof, and finally to a method for solving protein structures in solution and for magnetic imaging. Bax, who is at the cutting edge of this work, briefly describes the integration of NMR experiment and computation that took off during this 50-year period, due, in part, to unimaginable advances in computer technology. These applications of NMR, along with advances in X-ray crystallography (also referred to in the interviews with Johann Deisenhofer and Robert Huber), contributed mightily to the emerging field of structural biology, which arguably began with the discovery of the structure of DNA in 1953.

Reading this book reveals the growing sophistication with time of the interviewer's technique. For example, Hargittai began his 1996 interview with Nobel laureate Jean-Marie Lehn as follows: "You started as an organic chemist", to which Lehn replied: "Yes, an organic chemist and, in fact, a natural products chemist." The interviewer's follow-up was: "Now you are also a very conceptual chemist. Not every organic chemist develops general concepts the way you do." Well, *bien sur*. Not many chemists of any stripe develop concepts like Lehn does.

In contrast, an interview two years later with another Nobel laureate, Bruce Merrifield, is more thoughtful and leads to some interesting insights. In discussing his early life in California during the Depression, Merrifield, who was seven years old when the stock market crashed, describes his family's economic condition: "So we scraped along, and that affected me all my life. I can't bear to waste things, I'm not extravagant, never buy anything on credit, and that came directly from the Depression." Two decades later, Merrifield developed solid-phase protein synthesis, a technique that essentially wastes none of the synthetic amino acids and peptides.

Most of the interviews are fairly straightforward affairs, but once in a while some sparks fly. For example, Hargittai starts the interview with Paul von Ragué Schleyer with a provocative implied question: "I recently heard you say that experiments are no longer necessary in chemistry. We can compute everything." Schleyer's response is forceful and there is a fascinating thrust and parry during the interview. The Schleyer interview tracks the career of this experimental chemist, whose early computations