brings to our attention that the human activities are reported to be causing about two extinctions a week, according to an estimate made in 1979. If this is not alarming enough, he says that by 1990s the number of extinctions reportedly rose to six hundred per week. Some think this is grossly exaggerated. The United Nations report put the extinction figure most conservatively at about five hundred for animals and about six hundred for plants for the last four hundred years. Whatever be the real figure, this news is not reassuring for a race that has graced the face of the earth less than about 0.0001% of the history of the earth. We are just at the beginning of our existence.

Few research scientists are consummate popular science writers (a few well-known exceptions are Arthur Eddington, Richard Feynman, Carl Sagan, Stephen Hawkins and S. Chandrasekhar). Professional writers who may not have deeper understanding of the technicalities of science, usually fill this void because of their ability to communicate with the public. Bryson is a much-loved travel writer and had never dabbled in science journalism before. He has now come out with a tremendously engaging and readable book on science, proving that it requires only unquenchable curiosity and an engaging writing style to become a successful science writer. Such books have a big role in contemporary society, a major part of it still steeped in middle-age mode of mentality and thoughts. However, in spite of the supreme efforts of many scientists and popular writers, most of the public still think that science is extremely dull and scientists are unworthy of attention. But I like to think there has been a change in attitude recently, thanks to some devoted TV channels. (I recently met a young boy hunting for dinosaur eggs in a provincial town in Kerala, probably motivated by TV shows, and I had to spend some time to reason out with him, why it would be a futile exercise to do that in the backdrop of Kerala geology). Nowadays, popular science books retain a relatively high lucrative market and a captive audience and Bryson's book might even give others in this genre a run for their money. His is a brave effort not only to show how exciting science is but also to reveal how scientists work things out, with their human side laid bare, although you might find some forgivable inaccuracies and an occasional tendency to wander. This book is all the more welcome because it comes from an outsider, and he is a new recruit. So read this book. Not to accept this invitation is more than a lack of curiosity; it is to miss a golden opportunity for we shall have trodden peaks and seen distant landscapes previously excluded from our view, to paraphrase E. F. Bozman, in his introductory note for Arthur Eddington's popular science book of 1930s, *The Nature of the Physical World*, a rather serious professorial treatise for present-day popular taste. Bryson also explains the nature of the physical world, but goes much further than that by embracing the whole of science with sparkling wit and humaneness.

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Artificial Intelligence and the Study of Agentive Behaviour. R. Narasimhan. Tata McGraw-Hill, 7, West Patel Nagar, New Delhi 110 008. 2004. 251 pp.

What are the fundamental operating principles of intelligence? The field of artificial intelligence (AI) takes the view that we can express such principles as algorithms, or sequences of instructions, and that understanding these algorithms is the key to understanding intelligence itself. The fundamental principles should be the same whether the algorithm operates as a barrage of neural impulses in your brain, or as a computer program running in silicon.

One of the key goals of neurobiology is also to understand the operating principles of intelligence, as manifested in the brain. The difference between the disciplines is that AI takes the top-down view, while neurobiology works from the bottom up. In other words, AI, in its search for fundamental principles, begins with abstractions and high-level descriptions of interesting aspects of intelligent behaviour, whereas neurobiology starts off at the most basic level of neurons and their activity, and works its way up. In an ideal world, these two approaches should someday intersect and then, hopefully, we will understand intelligence.

In the book under review, the author Narasimhan is particularly interested in using AI to study intelligent 'agents'. An agent is an object that is able to interact with the environment to achieve some goals. Biological organisms are agents, and survival is one of the fundamental goals of such agents. The author feels that AI has the same role to play in the study of behaviour, as mathematics has in the physical sciences.

I should state at this point, that I think of most of the issues raised in this book from the viewpoint of a practising neurobiologist. However, the author has chosen not to emphasize this approach to the subject: 'Recent work in neurobiology concerns itself primarily with Type II explanations [pertaining to physiological aspects of brain function]. In this book we avoid the study of behaviour at this level since it should take us too far outside the intended scope of this book.'

Narasimhan first considers how different scientific disciplines, notably psychology and ethology, have approached the study of behaviour, and suggests how behaviour might be modelled with an AI perspective. This section of the book is based closely on some reports written by the author during a Jawaharlal Nehru Fellowship some 30 years ago. With this context in mind, the section is an interesting insight into viewpoints from this period, with flashes of prescience. For example, the subject of strategies for analysing sensory inputs, which the author identifies as being an important one, has become a fruitful source of understanding of sensory mechanisms. With the benefit of hindsight, it is clear that many of the issues raised in this section have in fact been addressed. As it turns out, the major player in our increased understanding has been experiment-based neurobiology rather than AI.

The author then discusses architectural issues in intelligence. He speculates on approaches to study human intelligence and, in contrast, presents the well-understood but limited 'intelligence' of expert systems. It is interesting that he compares sensorimotor processing to connectionist (neural-network)-like processing, because rather detailed understanding is now available for many aspects of sensorimotor function at the neuronal level. A general, problem-solving framework from AI is compared to cognitive processing, but the author acknowledges that we are far from bridging this gap. The same would have

to be said for modern neurobiological approaches. It is in this section, particularly, that the author's reticence regarding illustrations from his own and related research leads to a feeling of incompleteness. Although the stated aim of the book is to formulate problems in behavioural modelling, it would be nice to see these problems expressed through descriptions of actual research studies.

The remainder of the book is a bit uneven. There is a briefly foray into sociology, and a couple of transcripts of interviews and discussions, and then a summary chapter. A recurring theme in all of these is interdisciplinarity. Indeed, the discussion on interdisciplinarity (from 1971) could well have been a transcript of similar discussions held down the years till today.

If there were a core message I were to abstract from the book, that too would be the importance of interdisciplinary research in understanding intelligence. The message is implicit throughout the text. While the author perceives AI as being the theoretical counterpart to an array of experimental methods, I would suggest that the mix is richer still. AI is one among several theoretical strands that come together with many experimental approaches in modern neurobiology.

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Eight Preposterous Propositions. Robert Ehrlich. Princeton University Press, 41 William Street, Princeton, New Jersey 08540, USA. 2003. 342 pp. Price: US$ 27.95.

In the 1930s, Theobold Lang, a German geneticist, claimed that male homosexuality could be an inherited trait. His conjecture was based on his observation that sisters of homosexual men displayed masculine characters. This startling assertion generated two drastically opposing views; Nazis declared that homosexuals 'are not poor, sick people to be treated; they are enemies of the state to be eliminated'. A contrary and definitely a humane view – that this trait being inborn, such people have no 'control' over their behaviour and hence laws against homosexuality should be abolished, was advanced by the Socialist medical association (then in exile)[1]. More than half-a-century later, the question of homosexuality remains as strongly an emotive issue as it was in the 30s. Thus, when in the last decade of the last century, Dean Hamer, a prominent researcher at the National Institutes of Health, USA proposed to study this problem, a number of eminent biologists like Evan Balaban, Richard Lewontin and Ruth Hubbard, 'ganged up' to stop his study, claiming that 'behaviour was very, very far from genes'[2]. But is really 'homosexuality primarily innate'? In the book under review, Robert Ehrlich, a physicist at the George Mason University in Washington D. C., USA has examined in detail the evidence for and against this in a dispassionate and objective manner and has placed it all before the reader to let him draw his own conclusions.

In this highly readable and wonderful book (the subliminal aim of which, I suspect, is to teach lay public and perhaps some scientists also, how to examine an 'evidence' with an open mind and then draw appropriate conclusions), Ehrlich has taken up eight 'preposterous' ideas like 'Is homosexuality primarily innate?', 'Are people getting smarter or dumber?', 'Should you worry about your cholesterol?' and so on. He has examined the evidence in support of or against each of these ideas and then proceeded to rate them on a 'flakiness' scale devised by him. Zero flakiness means that there is a reasonable degree of confidence that the idea is based on good evidence. A rating of 'four' in this scale means that there exists no credible evidence to support the idea. Having done that, Ehrlich then calls upon his readers to score each of the eight ideas presented in the book, based on the reader's own analysis of the evidence presented. The eight ideas he has chosen are controversial ones and as the example on homosexuality shows, some have public policy implications. The book also contains an interesting 'epilogue', which examines, though briefly, how conventional wisdom (particularly in the field of medicine), often gets reversed based on factors which ultimately relate to the commercial stakes involved in such studies. Ehrlich advises the reader not to score the ideas presented in this book on his 'flakiness' scale, immediately after reading a chapter. Rather, he suggests that the reader should ponder over the contents and then see if he agrees with Ehrlich's evaluation. I tried this over the past couple of weeks, but in the end found it hard to disagree with him. As I have already stated above, this is a superb book which could be made compulsory reading in college-level science courses in India to help students learn to think. This could perhaps be an effective antidote to the 'teaching shop' approach to science education (the hardbound edition is quite expensive for an average Indian student's pocket – a paperback edition, may be by the Universities Press, would be most welcome). Finally, after reading the chapter entitled 'Can we influence matter by thought alone?', which attracted a 'four' from Ehrlich in his flakiness scale (remember a score of four means that there exists no credible evidence for this idea), I could not but help wondering how, many scientists who firmly believe that their gurus can make things appear out of nowhere or levitate at will, would react to Ehrlich's evaluation.

1. Jones, S., *The Language of the Genes*, Flamingo, London, 2000.
2. Wright, W., *Born that Way*, Routledge, New York, 1999.

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