A Short History of Nearly Everything. Bill Bryson. Doubleday, Transworld Publishers, London, 2003. 515 pp. £ 20.00.

As the author states in his preface, 'A short history of nearly everything' crystallized in his mind while looking out of an airplane window during a trans-Pacific journey and he was seized by a sudden realization that 'he didn't know a thing about the only planet he was ever going to live on'. From that defining moment of self-realization, Bill Bryson, who had no scientific background, was driven to ask questions and find answers. What made all of those amazing things happen, like the birth of our universe? How does Nature condition itself to a universe that we see around us, including 'us'? He finds out that science provides reasonable answers to some of the fundamental questions and also leads to further questions. The author spent about three years reading and also used considerable amount of time interviewing learned people and practising scientists themselves, asking some 'dumb' questions. The result of the toil is this book, which winds through major scientific breakthroughs in geology, biology, chemistry and physics and also tells the stories of key scientists who made us see the wondrous workings of nature, coated in the most stupendous similes, colourful anecdotes and hilarious analogies. The author is able to bring out the amazing underlying unity of all and the self-regulation that we see in nature.

The book starts with the 'Big Bang' origin of the universe and how scientists Arno Penzcias and Robert Wilson discovered 'cosmic background radiation' from the static they detected in a Bell Lab antenna. Bryson caps the chapter with a comment that next time your TV screen shows up the static, remember that you are watching the birth of the universe, without paying a penny. His sumptuous discussions take us onto supernova and how they are being detected, an area to which amateur astronomers contribute a lot. On the supernova explosion and its detection, Bryson explains: 'Looking for a supernova, therefore, was a little like standing in the observation platform of the Empire State Building with a telescope and searching windows around Manhattan in the hope of finding, let us say, someone lighting a twenty-first birthday cake'; such enjoyable analogies are galore in this book, which help us to a few chuckles as we read on.

The subjects discussed later on in this book are how the size and mass of the earth were measured (the ill-fated Peruvian expedition of 1735, sponsored by the French Academy to triangulate distances through the Andes, gets a special mention); how the distances between the planets and the sun were measured; and how finally Newton ended up writing his *Principia* (Edmund Halley, eponymous with Halley's comet, had to pay for its publication, that is another story). Bryson has a way of telling the story; perhaps he is most comfortable while dealing with geology. There was a time when geology gripped the intellectual world, in a way no science ever had before. It is hard to believe that a sell-out audience of about 3000 waited at every venue, when Charles Lyell gave a series of lectures in Boston in 1834. Those were the days when men of learning would also do a 'little stone-breaking', as they called it. The Huttonian principles had revolutionized our geologic outlook by then. Palaeontology was blooming with new discoveries on a daily basis. Charles Darwin's singular insight was in fact a culmination and a logical conclusion of all these developments in geology and palaeontology. To a large extent, his *Beagle* expedition provided verification for his insights. The flip side of the story is that FitzRoy, captain of the naval survey ship *HMS Beagle*, and a deeply religious man, chose Darwin as his travel mate primarily because he liked the shape of Darwin's nose! 'It betokened depth of character', he thought. Unfortunately, they were a mismatch from day one, and there was not a single day they did not quarrel during their five-year expedition. FitzRoy continued to sail without Darwin and later killed himself during another cruise. Such stories and anecdotes add to the readability of this book.

The part on chemistry presents an entertaining history of its development, with portraits of early key players like Robert Boyle, Karl Scheele, Joseph Priestly, Cavendish, Lavoisier, Avogadro, Mendeleyev, John Dalton, Humphrey Davy and many others. Some of them discovered new elements or compounds and others helped to bring rigour and clarity to chemistry and transformed it to a branch of science from being a voodoo science to which even Newton was a great devotee. All of them are interesting and colourful people; the story of Lavoisier is particularly moving. He was arrested and beheaded during the 'reign of terror', one of the chapters of the French Revolution, in which the perpetrators themselves became victims at the end. Another remarkable personality that Bryson introduces is Cavendish, a recluse and a genius who contributed to both chemistry and physics. The book also unfolds the momentous developments in physics with the advent of Einstein and Niels Bohr. The story of modern physics is told by unravelling the life and work of chief protagonists like Rutherford (the real villain of the piece is Rutherford, and not Einstein, so says Eddington), Max Planck, Michelson, Morley, Marie Curie, Heisenberg, Wolfgang Pauli, Enrico Fermi, S. N. Bose and many others (somehow Paul Dirac does not find a mention). The last part of the book deals with human cell and its constituents, discovery of DNA structure and also lingers on the rise of humans. While discussing the lives of scientists, the book also highlights the unsung heroes in all these branches of science, who got sidelined due to various social and personal factors, in spite of their accomplishments. I am sure most of us have not heard about Clair Patterson – arguably one of the greatest geologists of the twentieth century; thanks to his efforts, America now has the Safe-air Act in place.

Bryson seems to imply that it is extremely lucky for us to evolve into intelligent species, especially when too many odds were stacked against such an outcome. The tiniest deviation from any of those evolutionary imperatives and we might now be 'disgorging air through a blowhole in the top of your head before diving sixty feet for a mouthful of delicious sandworms', a la walrus on a stormy coast. This viewpoint somewhat mimics Stephen Jay Gould's metaphor of winding back the tape of life, although Richard Dawkins and others would contest this idea, to which this book devotes some space. Add to this is the possible fact that we may be the only supreme achievement of the living universe and the sole custodian (until it is proved otherwise, of course). The sum total of this book is a celebration of the idea, that how lucky we are to have been chosen against all odds in an unfriendly universe to monitor and look after it. Are we doing justice as a race to this weighty responsibility? The melting Greenland ice and the widening ozone hole perhaps tell a sordid story of our careless or somewhat casual approach to nature. Bryson

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.

C. P. RAJENDRAN

Centre for Earth Science Studies,
Akkulam,
Thiruvananthapuram 695 031, India
e-mail: cp_r@vsnl.com

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