Strange Curves, Counting Rabbits and Other Mathematical Explorations. Keith Ball. Princeton University Press, 41 William Street, Princeton, NJ 08540, USA. 2004. 251 pp. Price: US $ 29.95.

One problem that I have with the old proverb 'all work and no play makes Jack a dull boy', is that it takes for granted clarity of distinction between work and play. Things are often quite otherwise. Young ones of wild animals hone their life skills through playful behaviour. Romping and gambolling of kittens or tiger cubs involves practice of all the actions needed for hunting. In traditional human societies, children learn the arts and crafts of their parents, at least in part, while mimicking them in play. In general, fun things related to serious matters seem to have a lot of merit in terms of motivating and training minds. In the Indian educational system there seems to be room for lots of such stuff.

One has to consider puzzles of any kind, in this light. Puzzles stimulate thinking, promote interest in the particular topic and generally offer creative and active entertainment. Puzzles in contract bridge and chess are a daily fare in many newspapers. In mathematics, Martin Gardner's name stands out for voluminous first-rate writing that combines play and work. The work under review belongs to that genre.

Keith Ball tells that the book emerged out of lectures given to school pupils in England, as a co-curricular activity. It would be wonderful if Indian students of classes 11 and 12 can enjoy the material herein. If you face the task of addressing such a group, this book can help. It is meant to be recreational, but at the same time it hopes to convey some serious ideas. It touches many topics such as probability, coding theory, number theory, etc. Technical details generally do not overwhelm the narrative and are reader-friendly. There are problems to be tried and recommendations for further reading for those who get hooked.

Chapter 1 explains what is meant by a mathematical code and how coding is useful not only for encryption and secrecy, but also for communication efficiency. We learn what is an error correcting code and how one can set up a code that is accurate as well as economic. Concepts of entropy and Shannon's theorem about existence of an efficient code are added bonuses.

'Strange curves' in the title make their appearance in chapter 4. Here the author discusses fractals. Explanation of self-similarity is lucid and constructive. It certainly helped me understand the idea better.

The chapter on probability (chapter 5) invites readers to guess the value of probability for some innocuous events and then shows how intuition can go astray. Next it discusses the 'normal distribution' and the reasons for its ubiquity. As an extra benefit, the author explains how to show that the area under a normal curve is unity. This discussion should catch the attention of good students.

It is easy to be convinced that value of $n!$ (n factorial) explodes quickly and that it is difficult to manage. In chapter 6, the author gives a succinct account of Stirling's approximation to the value. His comments on historical background are perceptive as well as informative.

Chapter 7 begins with the following problem posed before the author by a researcher in biology: He has a new test to check the presence or absence of a particular abnormality in blood. He wants to apply it to a large group of blood samples. Can he do it? one by one or by pooling some samples. His query concerns the best way of doing this. The problem is similar to that of identifying one counterfeit coin in a lot by weighing coins (since the fake one is expected to be heavier). We can pool all samples into one and test it. If the result is negative, we have managed with just one test. If it is positive, we can split the lot into two groups and test each group separately. If one of them gives a negative result, that lot is taken care of, etc. Fortunately, the author recognizes the limitation of the analogy, in that biochemical tests tend to be somewhat less deterministic than weighing of coins. Even at the best of times, there is some chance of false positive or false negative. All this matter is well known in statistics under the title 'group testing'. I was surprised (perhaps unreasonably) that it should be news to a research biologist in England.

Books like this have no logical end. You never run out of fascinating stuff. This one ends with a nice discussion of irrational numbers. Inevitably, for this book 'how' is at least as important as 'what'. The friendliness of its narrative is perhaps best illustrated by a footnote on p. 230: 'If you work in this branch of mathematics, you very quickly get the feeling that good approximations do not sit around waiting to be found, they make every effort to hide'. The author does a good job of bringing out of hiding many interesting features of select topics in mathematics.

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Alzheimer Disease: Neuropsychology and Pharmacology. Gérard Emilien *et al*. Birkhauser Verlag, P.O. Box-133, CH-4010, Basel, Switzerland. 2004. 288 pp. Price not stated.

The introductory chapter sets the tone of the book. 'In November of 1901, the Bavarian neuropsychiatrist, Alois Alzheimer began observing a 51-year-old mentally ill patient whom he referred to as Auguste D . . . He described the behavioural changes in the years leading to her death five years later. The neuropsychological changes included deteriorating memory, disorientation and occasional hallucinations. He also described the "miliary foci" accumulating extracellularly which are known as senile plaques and the "dense bundles of fibrils" occurring intracellularly which are now known as neurofibrillary tangles. These two pathological lesions that he observed upon postmortem examination remain the key diagnostic features of Alzheimer's disease today . . . The disease officially got its name in 1910 when Emil Kraepelin named the disorder after Alzheimer because of his thorough description of the two lesions.'

Interest in this disease continues, as it is the cause in 60–70% of patients with degenerative dementia. The exact inci-

dence in India is not documented, but an estimate suggests that 1% of persons over the age of 65 living in some of our villages are afflicted thus[1]. (The BBC report, dated 21 November 2001, also focused on the UCLA study suggesting that curcumin in turmeric may play a role in slowing the progression of this disease). Chandra *et al.*[2] reported a two-year prospective study. It compared persons aged 55 years and above in a rural community in Ballabgarh district to similarly aged persons in the Monongahela valley of Pennsylvania. The authors concluded that the overall incidence in India was 4.7 per 1000 person-years, substantially lower than the corresponding rate of 17.5 per 1000 person-years in the Monongahela Valley.

As noted by Alzheimer, this disease causes progressive loss of concentration, memory, learning, abstract thinking, judging and forming of concepts. The patient also loses the ability to solve problems and use language. The affected cells in the brain, which are responsible for producing neurotransmitter substances necessary for signal transmission between nerve cells, fail progressively. Communication between nerve cells is impaired. Since life-long memories and the personality of the person depend on neuronal circuits, these decay. Patients are no longer able to process sensory impressions correctly and to associate these with their existing knowledge. They become socially, mentally and psychologically dependent. Eventually, the person is unable to walk, talk, control the flow of urine and faeces, swallow fluids or food and is bedridden. Death is a merciful release.

Examination of the brains of such patients post-mortem shows deposits of beta-amyloid plaques. These trigger a cascade of events that end in dramatic loss of neurones and their connections (synapses) in many areas, especially the basal forebrain, amygdala, hippocampus and cerebral cortex. Mutations in genes for beta-amyloid precursor proteins, presenilin 1 and presenilin 2 have been implicated in the development of this disease.

Emilien and his colleagues provide a wealth of information in this book. The first five chapters (part 1) review neurological, diagnostic, pharmacological and pathological studies. Part 2 (chapters 6–11) deals with memory and cognition. A review of normal processes is followed by a description of the clinical features of early and progressive damage by disease and methods for assessment. Emphasis is on early diagnosis and detection of individuals likely to develop the disease. Part 3 outlines the strategies for prevention, treatment and rehabilitation.

Each chapter has sections dealing with subheads, the final section providing a discussion of concepts and facts with practically useful statements. Thus chapter 1 (Alzheimer's disease) deals with such topics as diagnosis, factors that help differentiate it from fronto-temporal dementia and dementia with Lewy bodies; epidemiology; risk factors; psychiatric manifestations; genetic susceptibility and the assessment of outcomes. The discussion in this chapter notes that the risk of developing this disease is lower in people who have been intellectually active and that cognitive functions are better preserved in those with higher mental function when in their twenties. It also points out that there are great variations from one patient to another, with the result that it is not possible to tell an individual caregiver how long each stage of the disease will last in her own ill relative.

A detailed consideration of cholinergic and monoaminergic receptors and mechanisms and their disruption by disease is followed by a review of the abnormalities in molecular genetics observed in patients. These studies have, in turn, led to experiments on a variety of strains of mice. Whilst animals can never be fully equivalent to humans, they do permit experiments such as immunization using monoclonal and polyclonal amyloid. In one experiment immunization prevented the deposition of amyloid or display of neuropathological abnormalities in transgenic mice over thirteen months, whilst non-immunized mice showed the typical plaques. Such observations have led to attempts at screening and testing compounds of eventual use in man. Thus genetic studies and the more recent proteomics are likely to help in customizing medicines for individual patients, stimulating drug research by developing new molecular targets for screening potential chemicals, developing new and simpler diagnostic tests for different conditions and finally in gene therapy to modify abnormal genes to correct diseased or susceptible conditions[3].

An analysis of normal memory (short-term, working and long-term) and the anatomical and physiological mechanisms underlying it, is followed by an account of derangement and its evaluation, clinically and using tests such as conventional imaging and positron emission tomography. The mechanisms for cognition, its impairment and assessment are dealt with similarly.

Those caring for patients will find chapters 12–14 especially useful. These review drugs currently in use and those that are under study. These include agents to modulate the cholinergic system, modulation of other neurotransmitter systems, drugs to reduce oxidative stress that destroys nerve cells and synapses, hormones and drugs to suppress inflammation and ion chelators. A section in chapter 12 briefly discusses the emerging field of pharmacogenetics, pointing out that developments may help choose the class of drug (e.g. statin vs amyloid-modifying) that may help an individual patient early in the course of the disease. As awareness of worsening capability dawns within the patient, it inevitably leads to depression and anxiety. The patient withdraws into a shell. If coaxed to voice her innermost thoughts, she may reveal her worry of becoming dependent on loved ones and express her desire to die. Chapter 13 is devoted to the treatment of such states. Depression, psychosis and anxiety are dealt with in separate sections, with a discussion of the pros and cons of drugs in use. The authors sound cautionary notes. The elderly are often sensitive to the effects and the unwelcome side effects of drugs. Some of the chemicals used to treat agitation also lead to instability and must be used carefully to avoid catastrophes such as fracture of the femoral neck. Chapter 14 discusses the means by which patients can be supported psychologically, making their lives meaningful. It also dscribes a variety of aids that may restore some measure of cognition.

References to the literature quoted by the authors are provided (pp. 209–282). The glossary of acronyms (pp. xiii–xvii) and index (pp. 283–288) aid the student of this volume.

[Readers keen to learn more about what is being done for patients in India would do well to contact the national office of Alzheimer's and Related Disorders Society of India at P.O. Box 53, Kunnamkulam 680 503, Kerala, India. Tel. 0091-488-2522939/2523801. Fax: 0091-488-2523801/2522347. e-mail: alzheimr@md2.vsnl.net.in]

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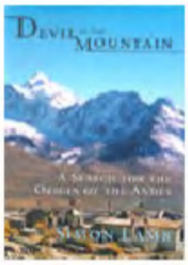

Devil in the Mountain – A Search for the Origin of the Andes. Simon Lamb. Princeton University Press, 41, William Street, Princeton, New Jersey 08540, USA. 2004. 335 pp. Price: US $ 29.95.

Devil in the Mountain is a story of the Andes – the greatest mountain chain of the world, after the Himalaya, which defines the western margin of the South American continent. The author of the book, Simon Lamb, who belongs to the Oxford earth sciences faculty, had spent several years in the Bolivian Andes, piloting a project that probed the origin and evolution of this mountain chain. Reading Lamb's book, I was reminded of an astonishing analogy made by K. V. Hodges of MIT, while reviewing the tectonic processes that shaped the Himalaya. With regard to the study of orogenesis (mountain building), he makes an allusion to two schools of paintings – impressionism and neo-impressionism. While the impressionist depicts the flow of time, as the artist perceives it, the neo-impressionist, in a minimalist way depicts only some 'specks' of reality, leaving viewers to built on their imagination. Part of Lamb's book that describes the historical progression of the Andes' evolution, coloured with his own perspective, may represent the best in the heuristic traditions of classical geology, and may be likened to an impressionistic approach. Occasionally, the author dons the hat of a neo-impressionist, and nudges the reader to appreciate the role of individual components like thermal and magnetic properties of the crust, climatic factors, erosional processes and ocean currents in carving out the sum total of the present architecture of the Andes. To paint a big picture, Lamb exorcises all these 'devils' –a metaphor borrowed from the Bolivian miners who believe in propitiating the spirit whom they think resides in the mountain.

Lamb begins his narration by unfolding the intellectual pleasure of geological fieldwork. To put it in his idiom – how to learn the language of rocks and start 'conversing' with them, a tradition inaugurated by early naturalists like James Hutton, Charles Darwin and Charles Lyell. Throughout the book, the author exudes this excitement for reading the language of the rocks. Lamb essentially describes how he went about searching for the 'root' causes of the Andean evolution – the question of what supports and maintains the mountain ranges. The author discusses in detail two different theories of the 19th century – one by George Biddell Airy, Astronomer Royal of England and the other by Archdeacon of Calcutta, John Henry Pratt. According to Airy, a deep root at the base of the crust supports the high-standing land mass at the surface (thus the mountain floats like an iceberg). The Pratt hypothesis, however, visualizes variation in density within the earth and he says that high topography is supported by low-density material beneath the mountain (similar to risen dough). In the end, Lamb concludes that one may require elements from both these theories to explain the high mountain topography. The other question of why mountains are localized only in certain areas of the globe, is answered with the help of plate tectonic theory – sine qua non of any modern geology book. In the case of the Andes with its high-rising twin ranges called eastern and western cordilleras, separated by plains of Altiplano, even the variation in the geometry of the subduction plate and the availability of sediments in the trenches seem to have a bearing on the development of this remarkable landscape. Lamb finally takes the reader to modelling of geodynamic processes and finds out the genetic parallels between the Bolivian Altiplano and the Tibetan Plateau, two intriguing high plains that appear in the middle of the mountains. Lamb deals with all these complicated scientific topics with ease and aplomb.

This book may also be taken as an open defence of the author's own research in the Andes, admittedly, most eloquent and on the whole very convincing. I must, however, add here that the jury is still out on many issues related to the evolution of large mountain chains and their eventual demise. Many speculative theories float around and this field continues to be a fertile ground for fresh insights; new imaging techniques help us reach the unreachable under the surface, thus giving us further fodder for thought. Although the author gives a comprehensive review of the work and results of not only his, but also of others, I think he has omitted or only glossed over some of the factors like seismic pattern and productivity along the Andean front, which may have a bearing on the mechanics of deformation of the Andes mountain. Another aspect that requires more elaboration, I think, is the role of the Atacama fault bordering the western foot of the Andes. What is the fault doing there? How does it fit in the overall deformation of the Andes? I think this aspect is the least explained (Lamb's nerve-racking and whimsical solo drive through the shimmering Atacama Desert in a rented car to reach the fault, notwithstanding). Yet another interesting problem that deserves greater attention from the point of view of mantle dynamics is the generation of deep earthquakes under the Bolivian Andes; for example, the focal depth of the 1994 Bolivian earthquake was 600 km, the deepest ever known.

Another function that this book does well is its projection of the Bolivian society and the daily grind of its vast majority of poor but gritty people. Whether they are miners, farmers or even drivers, these people bravely fight many odds on a daily basis to live their lives. The author