BOOK REVIEWS

Chandrasekhar with his uncle C. V. Raman, 1951.

D. Ashok, son of Chandra's sister, compares Chandra and C. V. Raman, the nephew and the uncle. He recalls Raman as a dominating personality, while on the other hand, Chandra was soft-spoken, with a mischievous smile while cracking a joke. V. S. Ramesh describes Chandra's reading tips; read the entire book, from cover to cover, almost as if reading a book of fiction.

Chandra believed that discovery was not the finding of an unknown phenomenon, but only bringing to prominence what others have dimly recognized. He had a deep sense of self-motivation. He thought motivation was like brush fire, rather than a raging forest fire; one had to constantly keep lighting the fire. Ramnath also writes about her close association with Chandra and his wife and her last meeting with her uncle.

This book can be read by anyone, be it a pupil of science or a layman who knows nothing about physics. It provides an insight into the man behind the legend.

1. Subramanyan Chandrasekhar – Banquet Speech. The Nobel Foundation; http://www.nobelprize.org/nobel_prizes/physics/laureates/1983/chandrasekhar-speech.html
2. Chandrashekhar, S., *Nature*, **344**, 1990, 285–286.
3. Chandrashekhar, L., In *S. Chandrashekhar: Man Behind the Legend* (ed. Wali, K.), Imperial College Press, London, 1997, pp. 9–16.

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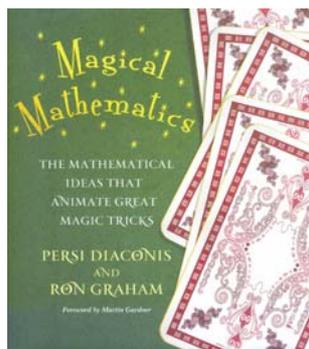
Magical Mathematics: The Mathematical Ideas that Animate Great Magic Tricks. Persi Diaconis and Ron Graham. Princeton University Press, 41 William Street, Princeton, New Jersey 08540, USA. 2012. xii + 244 pp. Price: US$ 29.95.

How many times while watching a magic trick did you feel a logical explanation existed but could not quite put your finger on it? If the answer is more than once, then this is the book for you. Here you have two mathematicians, Ron Graham and Persi Diaconis, each famous in his own field, combinatorial mathematics and statistics respectively, both pursuing magic with a passion and endowed with the gift of words as well. The product of their collaboration therefore is this book which has all the ingredients needed to make a success of popular scientific writing.

The book explains the mathematics that goes into many card tricks, and it does not stop there. It tackles various scientific aspects underlying tricks of different sorts, for instance, paper-folding and juggling. A concept for a book such as this, exposing the mathematical principles behind magic tricks could suffer from many drawbacks. It could become pedantic if not careful; it could be heavily loaded towards mathematics; when discussing sophisticated mathematics the authors could frighten away those having a fear of mathematics, and so on.

The authors deal with all the above aspects skillfully, both by means of structuring the book as well as leading the reader gently into the subject and concealing the structure in their conversational style, magicians that they are! The book gives equal importance to card tricks as it does to the mathematics behind them. When some of the aspects are not clear on reading, the reader is induced to pick up a pack of cards and try out the tricks, and this leads him/her to figure out the math of the sequences. Starting from simple tricks such as the 'baby Hummer', the authors lead us on to more complex tricks and concepts. Woven into the dialogue are leads to further reading and suggested exercises, some of which, as they point out, are open problems in mathematics.

The de Bruijn sequence, introduced in chapter 2, has many ramifications, as we learn in chapter 3, 'Is this stuff actually good for anything?' – from applications in robotic vision to constructing codes to revealing patterns hidden in DNA strings, the de Bruijn sequence is ubiquitous. Along with learning about established and some speculative mathematical truths in these fields, we also hear some amusing stories. For instance, the authors narrate their experience of working on crypto chips. 'We did our best, designing a complex scheme of sixteen S-boxes with linear de Bruijn sequences in each. To get an export license we had to let a division of the government's spy service test our chip. We passed the test, which means our scheme wasn't really good…' – a wry comment on the times before truly secure cryptic systems were allowed to be used in products sold overseas.

In chapter 4, 'Universal cycles', we are introduced to variations on the methods and tricks explained in chapters 2 and 3. Some of them lead to new tricks and others to new math problems. The concept of Bell cycles is introduced here and tricks that use them: 'For years we have been intrigued by the numerical coincidence $B(5) = 52$…. After brooding about this for years, we finally saw a trick.' And they explain the new trick and how it works. In what follows, they take up k-subsets of n-sets and describe the mysteries in them, for instance, involving the prime factors of $^{2n}C_n$, and the
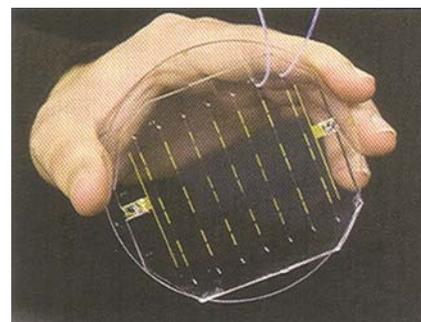
DNA sequencing chip (courtesy of Berkeley Lab, www.lbl.gov).

patterns in these that lead to card tricks for $k = 3$. As they narrate the way they unravelled these patterns, the audience is also led into the working of mathematics in practice, 'The problem became a part of an academic talk we went around giving and… Brad Jackson became intrigued.' And the story continues of how Jackson developed the proofs for $k = 4$ and 6, and later, they themselves evolved the proof for $k = 5$.

Chapter 5 explores the connection between the Gilbreath Principle and the Mandelbrot set, whereas chapter 6 describes neat shuffles, the unavoidable tool for professional magicians. In chapter 7 we are taken back in time into the working of the three-object miracle divination trick and then the history of mathematical magic. We learn that Reginald Scot's 1584 magic book was written, 'to protest the growing mistreatment of the old and frail as witches', and that the first theorems of mathematical magic were found in Gaspard Bachet's 1612 book. To quote once again, 'It is interesting to note that he had come up with an early example of a generalized de Bruijn sequence.'

'What goes up must come down', is the intriguing title of chapter 9. It is easy to guess that this chapter is about juggling, but not so easy to figure out the connection between juggling and mathematics; so that is what is tackled in this chapter. We learn of the long history of juggling, and that the sort of throws a juggler makes are not random but are restricted to definite sequences of numbers that specify the amount of time the thrown objects spend in air. With remarkable simplicity and directness, the authors explain why some sequences of throws would not result in a stable juggling pattern – the site-swap juggling sequence as they call it. The chapter concludes with a pictorial explanation of how to master the simplest juggling trick, the three-ball cascade and how to continue it indefinitely. The reader is by now used to the ease of the explanations and is not surprised when they reveal, 'One of your authors served as president of the international jugglers association, a group of nearly three-thousand jugglers around the world (with quite a few having day jobs in Computing, Mathematics and the Sciences generally).'

A story of magic would be incomplete without a chapter on famous magicians, and the authors have taken care that this charge shall not be levelled at their book. The longest chapter in the book, 'Stars of mathematical magic' tells the reader about famous magicians and their most popular magical tricks. This section includes origami and tricks using loops and, of course, card tricks. Every reader will have a favourite among this spread of magic tricks on the offer. According to me the lines carrying the most infectious message is their tribute to Martin Gardner, 'Warning: Martin Gardner has turned dozens of innocent youngsters into math professors and thousands of math professors into innocent youngsters. We are living proof;…'.

The book moves on to a short chapter on further reading and learning more math and magic. The last chapter is tantalizingly named 'On secrets', where the authors discuss the mathematics of secrets and the importance of secrets in keeping magic and mathematics effective and how this can be achieved in the era of the Internet.

While turning the last pages, the reader is bound to feel touched and charged up and would definitely be moving in an altered direction, for this is a book that will not just leave an impression, but will also suggest which path to take next.

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This volume offers an excellent selection of review articles by authors – mostly luminary of their fields. This series of the *Annual Reviews* has maintained its reputation as a valuable publication for all those interested in drugs. The need for the good review article is undeniable, since the ever-increasing volume of pharmacological research makes it difficult even for the expert to separate forest from trees. The chapters in this volume are presented as review articles and cover a heterogeneous selection of subjects ranging from microRNAs – the master regulators of cellular responses to the strategies to target HIV-1 latency. Appropriately, the opening chapter is an inspiring and intriguing saga of Erik De Clercq during the 40 years of his circuitous journey in antiviral chemotherapy field.

I am sure several of us who are craving for better drugs will gratefully acknowledge the generosity of editors for giving special consideration to GPCRs, since five out of the 18 reviews in this volume have been devoted to GPCRs – the most druggable target in the human genome. Special reference must be made to the chapter by Allen and Roth, entitled 'Strategies to discover unexpected targets for drugs acting GPCRs', and a chapter by Ibrahim and Taminga, entitled 'Schizophrenia: treatment strategies beyond monoamine system'. In his review, Bryan Roth stupendously argues 'magic shotguns verses magic bullets' for psychiatric conditions, while Carol Taminga emphasizes the rationale to move beyond the monoamine targets for treating cognitive deficits in schizophrenia. Although the review by Li *et al.* entitled 'Hydrogen sulphide and cell signaling' is somewhat out of place, in the company of otherwise serious subjects, the editors have done justice to include it. It provides a detailed overview and mechanistic insights into the way to regulate several physiological phenomena by the newly discovered gasotransmitter-H2S.

It is great to see a fitting review by Rawland *et al.*, on 'Physiologically based pharmacokinetics in drug development and regulatory science', reflecting significant advances over the past decade in the predictability of key PK parameters. Inflammation seems to be at the beginning of the majority of chronic diseases, and major efforts are dedicated to the development of anti-inflammatory drugs. Recent evidence suggests that even metabolic diseases, such as type-2 diabetes, and certain cardiovascular diseases, could be considered to have an inflammatory origin. In this context, the two chapters in this series on inflammation – one by Debra Laskin on 'Macrophages and tissue injury: agents of defense or destruction' and the other by Feldman on 'Mechanism of anticancer and anti-inflammatory actions of vitamin D' are of great interest.