Mathematics and its History. J. Stillwell. Springer-Verlag, Berlin, Germany. 2002. Second edition. 542 pp. EUR 59.95.

As the very title of this book makes it clear, the book is about mathematics and its history and not merely the history of mathematics. History plays a supporting role in this book. Thus the book fills a gap in the existing mathematics literature by providing an overview of mathematics peppered with its history and biographical accounts of famous mathematicians. Clearly the book is not meant for laymen. The reader is assumed to be familiar with topics like calculus, algebra and geometry.

Given its aim in presenting a unified view of mathematics, the book starts appropriately enough with a description of Pythagoras theorem. This theorem is a prime example of a result which connects different areas of mathematics – in this case, arithmetic and geometry. The author clearly brings out this connection; and such interconnections and their origin form a recurring theme in this book. Another useful feature is the presence of a large number of exercises throughout the book. This will be appreciated by those readers who wish to delve deeper into specific areas.

The second chapter deals with Greek geometry. Euclid and his *Elements* play a stellar role in this chapter. Towards the end of this chapter, the author laments the present low cultural status of mathematics and links it to the absence of a book comparable to the *Elements*. While the latter part is certainly true, the first part is no longer true as the vast potential of mathematics and its applications are widely appreciated today. Of course, mathematics and its practitioners were not always held in high esteem even in the past as the following quotation from St. Augustine (354–430) shows: *The good Christian should beware of mathematicians, and all those who make empty prophecies. The danger already exists that the mathematicians have made a covenant with the devil to darken the spirit and to confine man in the bonds of Hell.*

The next three chapters deal with number theory. In the Indian context, a commendable feature of this book is that it does not ignore the contributions of Indian mathematicians as do many books on the history of mathematics. There is a chapter on number theory in Asia which describes Indian contributions in some detail. Even though it is not as substantial as the material in the controversial book by G. Ifrah, it at least fills a lacuna present in the first edition of the book.

The author next describes polynomial equations, analytical and projective geometry. The last topic is not often dealt with at this level and is therefore a welcome addition. The next two chapters deal with calculus and infinite series. In particular, several results related to the infinite series expansions and infinite product formulas for π are listed. The author desists from exploring some of the hilarious sidelights connected with this. The reviewer cannot resist mentioning one: In 1897 a bill was introduced in the Indiana State (USA) House stating that one Mr Goodwin had solved the problem of squaring the circle and further copyrighted the solution. If the legislature endorses his solution, the state would be allowed to use it in its textbooks free of charge while charging royalty from other states. The bill implicitly would have legislated the value of π to be equal to 3.2. The bill was passed by the House 67-0. In the meantime, this came to the attention of a mathematician, Prof. C. A. Waldo, who ensured that the bill was shot down in the Indiana Senate. More accurately, the bill was indefinitely postponed and more than 105 years later, the bill still remains indefinitely postponed!

Modern books on mathematics often omit mechanics even though it played a crucial role in the development of mathematics and continues to do so in the area of dynamical systems. Fortunately, the present book does not belong to the above class. There is a chapter devoted to mechanics and hydrodynamics. However, this chapter could have made a connection to the modern theory of dynamical systems. Since this is another area where different streams of mathematics come together, an opportunity to further highlight the unity of mathematics is lost.

The author also briefly explores Fermat's last theorem and its connection with elliptic curves. The author next delves into complex numbers, curves and functions. This is followed by differential geometry and noneuclidean geometry. A simple and intuitive description of these difficult topics is given. The topics dealt with subsequently become progressively more difficult starting with group theory and hypercomplex numbers and ending with advanced topics like algebraic number theory. The author makes a largely successful effort in presenting this material in an understandable manner. The book ends with a brief description of set theory, measures and Godel's theorem.

In summary, the book covers an amazing range of mathematical topics in some depth, aided by a generous collection of exercises. However, important topics like probability and stochastic processes, dynamical systems, partial differential equations, numerical analysis, etc. are not covered adequately. But such omissions are to be expected in a book with such a vast scope and are therefore excusable. The exposition is clear throughout the book and provides a unified view of mathematics. The book should be required reading for all undergraduates majoring in mathematics.

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Ancient Indian Astronomy: Planetary Positions and Eclipses. S. Balachandra Rao. B. R. Publishing Corporation, Delhi. 2000. Rs 1200. pp. 288 + xv.

Our ancient texts in science suffer from being remote from the modern reader. Written in Sanskrit and using old notation, they are hardly suited for easy communication to a student of science. It is therefore laudable that Balachandra Rao has carried out the difficult job of explaining what our ancient astronomical texts were about, using the modern mathematical framework. The author has other books to his credit, dealing with our astronomical heritage as well as scientifically debunking astrology.

This one deals with how the ancients plotted stellar and planetary positions, could predict their future locations as well as positions on any past date, and more usefully tell the timings of solar and lunar eclipses.

The opening chapter has a brief historical survey of how the Indian contributions to mathematics and astronomy evolved from the Vedic times to about a millennium ago. It is a quick run through *Vedang Jyothisha*, *Siddhantas* and later astronomical traditions, coupled with accounts of the works of some major players like Aryabhata I. The next chapter describes the zodiac and the major constellations, and how they were mapped on the sky. Here the author uses modern notation, but tells us what the older contents were. The same applies to the various astronomical coordinate systems in vogue today. Thus one learns what is the difference between the sayana and nirayana systems, what are dakshinayana and uttarayana, and so on.

A major aspect of astronomical observations is linked with timekeeping over long timescales. What do the *Mahayuga*, *Manvantara*, *Kalpa*, etc. mean? How does one link the present Julian calendar to these systems? Chapter 4 deals with this aspect. The real meat of the work begins in Chapter 5 where calculations are carried out for Ahargana, that is, counting the number of days lapsed since a chosen past epoch. There are several examples worked out to illustrate the method.

The next three chapters deal with the angular motions of the Sun and the Moon across the sky, and the determination of the exact positions of these objects on specified instants. The problem would have been simple, had these objects moved on circles with uniform angular speeds. This not being the case, the Greeks had to invoke the epicyclic theory, which was also used by the Indian astronomers who refer to the calculation as Mandaphala. Here the author explains the calculation including the technical words used by the ancients, such as *Bhujantara*, *Udayantara*, *Mandakendrajya*, etc.

All this is useful for determining the occurrence of eclipses which require special alignments of the Earth, the Moon and the Sun. Chapters 9 and 10 are devoted to carrying out these calculations. One needs several details and looking back one admires the attention to detail given by Aryabhata and other astronomers who followed him. The author also points out that these astronomers knew that the eclipses were shadow-plays and did not encourage the myths of Rahu and Ketu. Yet social forces seem to have been stronger than scientific ones and the myths gained ground. What can we say today, when more than 50% of the population prefer believing in myths than in facts, judging by their responses on such eclipses?

Chapters 11 and 12 extend the calculations to the planets known in those days, viz. Mercury, Venus, Mars, Jupiter and Saturn, which had their own Indian names. Again, epicyclic corrections are needed to achieve precision.

Nevertheless, the late T. S. Kuppanna Sastry suggested improvements on the old eclipse calculations to make them more accurate. The enthusiast may follow them in Chapter 13. In Chapter 14 the author calculates corrections to the earlier planetary positions to make them more in conformity with the modern values. He points out that the earlier astronomers were aware that their computations need to be revised from time to time as the corrections (*bijas*) get larger.

As if anticipating that the modern student would be too impatient with and may lack competence with carrying out a series of tedious trigonometric calculations, the author has given computer programs in dBASE to compute most of these quantities. Around seventy pages of the book contain computer programs.

A few minor blemishes intrude from time to time. The celestial meridian is not defined where it is needed most. A uniform labelling of the celestial equator, the ecliptic, etc. would have helped in comparing different figures. A historic discussion of the epicyclic theory would have added to the understanding of why one has to do these intricate calculations. The index could have been more exhaustive.

These intrusions are, however, of a transient nature and do not in any way detract from the usefulness of this work. The author should be congratulated for undertaking it and taking it to a satisfactory level of exhaustiveness. Any student of mathematical astronomy would appreciate the effort.

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Method for Affinity-based Separations of Enzymes and Proteins. Gupta, M. N. (ed.). Birkhäuser Verlag, P.O. Box 133, CH-4010, Basel, Switzerland. 2002. 225 pp. Price not indicated.

Affinity chromatography is like the queen among the various methods used for the purification of proteins and other biomacromolecules. Protein purification had generally been an arduous task until the advent of affinity chromatography. Most protein purification protocols of the earlier days involved a series of chromatographic and precipitation steps, each resulting in a diminished recovery of the active ingredient, usually with only a moderate improvement in the specific activity, ultimately yielding a small fraction of the activity in a nearly pure fraction. Papers reporting partial purification of enzymes and other proteins were not uncommon. The procedures normally took several days and often weeks. Fortunately, affinity chromatography has brought in a revolution in the approach to protein purification and made the purification of proteins a rather pleasant and rewarding task.

The book edited by Gupta gives an excellent update on the state-of-the-art separation methods that employ an 'affinity' step in the overall scheme; quite often it is the only step! For most practising biochemists affinity chromatography is a well-known technique. But the variety of improvements and modifications made to the basic affinity chromatographic technique, leading to a variety of affinity-based purification methods, which are covered in this book, is simply beyond imagination. If you have a protein purification problem, see if this book can help you solve it and most probably, it will. Even if there is a working method, it is likely that you will benefit by trying to modify the method by incorporating an affinity-based step in the protocol.

The book contains eleven well-written chapters. The introductory chapter by Gupta and Roy provides a brief historical background for affinity-based separation methods followed by an excellent overview of the variety of different separation methods that employ an 'affinity' step. The next chapter on 'Affinity Chromatography' by Labrou describes general methods for the selection of a suitable affinity ligand, its immobiliza-