Or consider the following. You have the opportunity to play a betting game repeatedly; the game is fair – the chances of win and loss are equal. If you bet X on the game, you stand to lose it all or to make a net gain of X with equal probability. You start with $ 100 in cash and make a total of 5000 bets; each time you bet 3/4 of whatever capital you still possess. What is the probability that you will have $ 100 or more left after the game? The answer is surprising – it is less than 10^{-44}!

The world of investment planning and financial decisions is full of truths that are counter-intuitive. The counter-intuitiveness probably owes to the poor understanding that most of us have of conditional probability, interest rates and discounting. (Here is a quick query with regard to interest rates. It is known that Manhattan Island was bought for $ 24 in 1626. Suppose that it is sold in 2026 for $ 30,000,000,000,000. Quick now, what annual rate of interest does this imply? Estimate the answer before reaching for your calculator!) A study of Davis's book would go a long way towards strengthening one's intuition in these matters.

It is not immediately clear who will use *Math of Money*. Those who are none-too-comfortable with quantitative reasoning – perhaps those for whom the book is meant! – are not likely to take the trouble to read the book and work through the analysis, which is dense and non-trivial in parts and requires a certain commitment on the part of the reader. But for those with an interest in financial analysis and its mathematical basis, the book is a pleasure to read. It is finely produced, written with an elegant wit and illustrated with illuminating examples. At the start of each chapter are included instructive and entertaining puzzles (titled 'Test your intuition'), with solutions given in full at the end of the book.

The author has (fortunately or unfortunately, depending on one's point of view!) taken pains to 'hide' much of the mathematics involved; though several formulae are to be seen, one does not get to see any derivations. There are likewise no references to Bayes's theorem or to conditional probability as such. (Those who are mathematically sophisticated may wish that less pains had been taken in this regard!)

Can we look forward now – having studied the book – to making a killing on the stock market? That may be too optimistic – but we can be at least a bit more rational now in our financial thinking.

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Where Do We Come From? The Molecular Evidence for Human Descent. Jan Klein and Naoyuki Takahata. Springer-Verlag, D-69121 Heidelberg, Germany. 2002. 462 pp. Price: US $ 49.95.

This book provides a grand view of human evolution. Although the subtitle of the book is 'The Molecular Evidence for Human Descent', the book provides not only molecular evidence, but also a feast of morphological, archaeological and palaeontological evidence.

The preface states, rightly so, that science writers who strive to popularize science are often non-experts in the relevant area of science and tend to sensationalize scientific findings. This is detrimental to both science and development of scientific temper. The authors, both of whom are renowned biologists and evolutionists, have, therefore, attempted 'to provide a picture of human evolution for those who want to be informed rather than be entertained'. Indeed, the book is no bedtime reading. The style of writing is attractive in parts, but may often distract the attention of the reader. The authors intersperse scientific facts with facts and anecdotes from art, mythology and history, and with extensive quotes from literary writings. Many sections of the book have headings, several not self-explanatory, such as 'The floppy discs of heredity', 'Taking a dip in a gene pool', 'Have transposon, will travel', 'Thy sister, the mushroom', 'A rock concert', 'The oracle of the Holy bottle', etc. My initial impression of the style of writing was quite favourable, but as I read more of the book and thought about the pages I had read, I became convinced that I would rather have had the authors devote to science, the pages that they have devoted to art, mythology, etc. I say this not to state that I have not learnt anything or have hated reading these 'other' pages, but because I found these distracting in many parts and also because I think that the authors should have said a whole lot more about recent molecular studies on tracing prehistorical and historical human movements.

The title of this book is drawn from the title of a painting by Paul Gauguin, now kept in Boston Museum of Fine Arts. The first chapter explains, using historical and mythological aspects of Gauguin's work as the backdrop, the purpose of the book. Although molecular evolution is a young scientific discipline, the authors state that 'the information revealed by molecules has already changed current views of human past so radically that it should be of interest to anybody who has ever asked: Where do we come from? (title of Gauguin's painting) What are we? Where are we going'?

To the human inquiring mind, the resemblance among relatives, in particular between parents and offspring, has always been a source of wonder. Much theorizing was done by philosophers of various hues, until Mendel and his rediscovery in 1900. Subsequently, biology and genetics have witnessed major leaps, which have laid the foundations of ancestor–descendant relationships. Although the continuity of genes over generations is guaranteed by Mendelian transmission, it is not immediately evident how well the genealogical record is preserved in the DNA molecule. Therefore, a framework for human evolutionary inference using information contained in the DNA was developed. Although this framework is intuitively straightforward, for an in-depth understanding of the framework, probabilistic arguments are required. Further, various biological processes, e.g. recombination, can scramble such genealogical information, make evolutionary inferences difficult. While the behaviour of allele frequencies in idealized population may be regular and predictable, real populations are often far from 'ideal'. The original foundations of population genetics were laid under the assumptions of an idealized population. Subsequently, it was discovered that when ideal conditions are not met, actions of various stochastic forces play dominant roles in determining the behaviour of allele frequencies in populations. Further, from analyses of empirical data it was proposed that most newly arising mutations at the molecular level are selec-

tively neutral and their fates are largely determined by stochastic factors. This proposition led to major controversies. During the subsequent period (1970s and 1980s), a feast of many interesting theoretical results in population genetics was provided. The applications of these results to empirical data led to many important discoveries in molecular evolution. Often such molecular evolutionary inferences did not agree with the ones drawn on the basis of palaeontological or morphological data. Further, different molecular data sets led to different inferences, particularly in respect of the famous human–chimp–gorilla trichotomy problem. These discrepant inferences resulted in further insights on difficulties in inferring species relationships from data on genes drawn from these species. In the presence of ancestral polymorphisms, it was discovered that gene trees may not coincide with species trees. Further, there are differences in perceptions of time by palaeontologists and molecular evolutionists, which have important implications on evolutionary inferences.

The reconstruction of evolution from hominids to modern humans has also witnessed bitter controversies. This book provides a good overview of competing paradigms, data and interpretations. The authors have discussed fossil evidence, geographical distribution of fossil finds of various *Homo* species and competing paradigms of evolution of *Homo sapiens*. They have then evaluated the relative merits and demerits of the two major competing models of evolution of modern humans – the multiregional and uniregional models – in the light of palaeontological and genetic data. Although the authors have finally supported the uniregional model, I have found their treatment and evaluation of these two models to be balanced. The authors have not hesitated to criticize the 'mother Eve' inference which was originally based on data of a single non-recombining molecule – mitochondrial DNA. There is a clear and critical discussion of the data that have been generated and interpreted in the past few years to refute the expectation, under the multiregional model, that Neanderthals were the ancestors of modern Europeans.

In recent years, molecular evolutionary inferences are increasingly based on gene genealogies – genealogical relationships among a sample DNA sequences drawn from a set of populations or species. Reconstruction of gene genealogies, and the theoretical framework underlying gene genealogies, is mathematically somewhat heavy. However, this theoretical framework – coalescent process – can be effectively used to look backward in time and to ask questions pertaining to past demographic processes that may have shaped the genetic profiles of contemporary populations. This framework has been widely used in the recent past and has led to many important insights, including the fact that modern humans migrated out of Africa subsequent to a major population expansion, which perhaps led to pressures on natural resources forcing them to migrate to new areas. Alas, there is no direct way to verify this!

In addition to providing eleven chapters on technical details of human evolution, in the final chapter the authors have speculated about the future of humankind. They have discussed the current and continuing destruction of the biosphere and have concluded that we have to make 'substantial changes in our thinking and in our lifestyles', if we are 'to have a future'. They have also addressed the difficult issue of patriotism, nationalism and racism that is leading to the evolution of an intolerant *Homo* species, which they have termed 'intolerant'. They have identified three pressing problems currently facing the human species: (i) finding a non-destructive relationship to the biosphere, (ii) eliminating intolerance, and (iii) finding a just social system. I suppose everyone will agree with the authors' views.

Overall, I greatly enjoyed reading the book and learnt a lot from it. I can unhesitatingly recommend the book to anyone seriously interested in human evolution. The authors have used a style of writing, drawing heavily from the arts and literature, which personally I have often found to be distracting. Having said this, in parts the book reads like poetry – wonderful poetry. The authors have explained algebraic details of population genetics almost from first principles, and have provided a useful set of appendices, which will make the life of a mathematically uninitiated reader fairly easy. It is tempting to compare this book with other available books on molecular evolution. What makes this book stand out are its clarity, focus on human evolution, logical arrangement, high content of comparative non-molecular and molecular data, emphasis on concepts of molecular evolutionary inference and a relatively non-partisan view of human evolution. One cannot learn the nitty-gritty details of methodologies for molecular evolutionary inference from this book, but can certainly learn how molecular evidence be used to learn about human descent.

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Science and Engineering Indicators 2002. National Science Board. National Science Foundation, Arlington, VA, USA. 2002 (NSB-02-01). Vol. 1. xii + 475 and Vol. 2, xi + 621. Unpriced publication.

Fifteenth in the series of biennial *Science Indicators* report submitted by the US National Science Board to the President of the United States, this two-volume report provides a broad base of quantitative information about US science, engineering, and technology. As the report also presents considerable amount of material about scientific and technological capabilities around the world, it would be useful for policy-makers not only in the US but also elsewhere.

The report presents huge volumes of carefully collected data and insightful analysis on science, mathematics and engineering education from the elementary level through graduate school and beyond; the scientific and engineering workforce; US and international R&D performers, activities and outcomes; US competitiveness in high technology; public attitudes and understanding of science and technology; and the role of information technologies in science and in the daily lives of people in schools, homes and the workplace. The report is particularly concerned about the decline in the US share of world science, low science literacy and diminishing standards of science and mathematics education in American schools.

Despite the fact that the US investment in R&D equals that of the combined total investment in R&D by the other six G7