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.

PARTHA P. MAJUMDER

Anthropology and Human Genetics Unit,
Indian Statistical Institute,
Kolkata 700 035, India
e-mail: ppm@isical.ac.in

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

countries, viz. UK, Germany, France, Italy, Canada and Japan, there is a concern that US dominance may be on the decline. The total number of papers published by USA-based authors in all fields of science and engineering has decreased by about 8% between 1986 and 1999, from 38.5% to 30.9%. The share of citations received by US papers has reduced from 52.1% in 1990 to 45.45% in 1999. Other countries and regions are building up their indigenous S&T capabilities. For example, Taiwan and South Korea have made phenomenal progress in technical inventions. Before 1986, Taiwan received 742 US patents, and South Korea 213, but since then they have received nearly 19,000 and more than 14,000 US patents respectively. USA continues to be strong in patenting. In 1999, over 83,900 of a total of 153,487 US patents were granted to US residents, compared to 3562 to South Korea and 3693 to Taiwan. Unlike in the past, many foreign students, especially Asians, return to their home countries within a few years of finishing their doctoral research, making it difficult for US universities and industry to get trained personnel. Furthermore, the number of retirements of persons with degrees in science and engineering will increase substantially in the next two decades. The United States should gear itself to reduce its reliance on foreign-born scientists and engineers. But the current trend is not encouraging. The share of doctoral degrees awarded in science and engineering fields to US citizens, including naturalized citizens, has fallen from over 79% in 1977 to about 62% in 1999. Commencing 1990, Europe awards a larger number of doctoral degrees in science and engineering than the US. But the United States is better prepared than all other countries to take maximum advantage of the Internet and its role in facilitating scientific communication, contact, and collaboration. International scientific collaboration is growing rapidly. Between 1986 and 1999 the number of scientific articles with international coauthors worldwide tripled and the proportion of such articles rose from 7% to 17%. During the same period, the proportion of US papers resulting from international collaboration rose from 9% to 22%.

Industrial R&D in the US is getting increasingly globalized. US companies overseas R&D spending increased considerably in the 1990s from about $ 5.2 billion in 1989 to $ 12.5 billion. However, R&D spending in the US by foreign-owned companies grew even more rapidly, yielding a net inflow into the US of $ 7 billion in R&D spending in 1998.

There is great concern in the USA about declining public interest in science. Few characters on prime time television shows are scientists. Only 2% of occupations portrayed on TV between 1994 and 1997 included science. Education fared just as poorly. Business garnered the largest share with 19%, followed by entertainment at 18% and law enforcement at 14%. Only 17% of 12th grade students scored at the proficient level on the National Assessment of Educational Progress mathematics assessment in 2000. The score in science was no better. And science literacy in the US is fairly low. No wonder the National Research Council has initiated the rather ambitious and innovative programme 'Every Child a Scientist'. This reviewer is happy that a whole chapter has been devoted to education with special emphasis on elementary and high school level education.

On the whole this report is a treasure trove of valuable data. There are a few errors and a few numbers that do not tally, but that does not diminish the value of the report in any way. I wish Indian scientists, science policy-makers and the Minister for Science and Technology took note of statements such as 'China has registered a three-fold gain in its publication output' as against 'a 7 per cent decrease in India's output' and the very low number of patents granted to Indian institutions.

SUBBIAH ARUNACHALAM

M.S. Swaminathan Research Foundation,
Third Cross Street,
Taramani Institutional Area,
Chennai 600 113, India
e-mail: arun@mssrf.res.in

MEETINGS/SYMPOSIA/SEMINARS

International Conference on Health Care and Food: Challenges of Intellectual Property Rights, Biosafety and Bioethics

Date: 1–5 December 2002
Place: New Delhi, India

Topics include: Benefits vs risks of new technology, Integration into globalization process vs protecting national resources and markets, Food and health security for all vs privatization of knowledge and resources.

Contact: Dr S. Visalakshi
Conference Secretariat
National Institute of Science,
Technology and Development Studies
Pusa Gate
K.S. Krishnan Marg
New Delhi 110 012, India
Website: http//www.nistads.res.in

An International Conference Commemorating the Discovery of Discotic Liquid Crystals

Date: 25–29 November 2002
Place: Trieste, Italy

The principal aim of the conference is to review the overall growth and advances in this field of discotics since their discovery 25 years ago and to forecast new areas of investigation in both the basic and applied aspects of the subject.

Contact: Prof. S. Chandrasekhar
Centre for Liquid Crystal Research
P.B. No. 1329, Jalahalli
Bangalore 560 013, India
Tel: 91-80-8382924
Fax: 91-80-8382044
E-mail: clcr@vsnl.com