Ivory Bridges. Gerhard Sonnert – With the assistance of Gerald Holton. MIT Press, Cambridge, Massachusetts 02142, USA. 2002. 227 pp. Price: US $ 30.

A romantic title catches your imagination and you pick up the book in your leisure hour. But no sooner that you see the background of the authors and the contents of the book, you sit up and struggle to grasp the complex subject of their concern – connecting science and society. It is refreshing to see two sociologist professors belonging to the Physics Department of the Harvard University giving such a detailed and analytical account of the last 50 years of social phenomenon taking place in a country like the United States, where science reigns supreme today. The book is about American science and its connection to the American society, but on looking at the topics covered, one is surprised to see the parallelism with the developments in Indian science as seen over the last few decades. I wish someday, Indian sociologists find a place in our scientific institutions and agencies to write about our ivory towers and the 'bridges' our scientists are trying to build with our society.

Right in the beginning, the author talks about how the metaphor of 'ivory tower' originated in the nineteenth century – 1837 to be more specific, when Charles Augustin Sainte-Beuve was the first to record the term, which since then has denoted the self-absorbed lifestyle of those who dedicate themselves single-mindedly to ethereal pursuits, while ignoring the realities of life and society. Colleges and universities have been known as the primary building grounds of ivory towers and many academic scientists have been the prominent occupants of these structures.

Over the last 50 years or so, particularly after the World War II, when science got into the hands of the governments, several developed nations (and also few developing countries like India and China after they became sovereign nations) realized the immense importance of fostering science and applying scientific knowledge to the problems of development of their societies. It is at this stage that the question of connecting the science emanating from the ivory towers to the problems of the society became important. The isolation of the scientists from the real-life problems of the society on the one hand, and the technical ignorance of the members of the society on the other, proved a great challenge, if not an obstacle to the scientists and to those who were responsible for the governance of the society. The book under review is an analysis of the various social, political and economic factors that have been involved in connecting science and society in a large democratic country like USA.

The entire book is based on an assumption that there are two 'ivory bridges' – both constructed and traversed by the members of the 'ivory' community, viz. the American scientists. We will question this assumption in the Indian context later. The two bridges that are assumed to connect science with society are the following:

(1) The Federal Government Science Policy, formulated with the active involvement of the scientists having stints of assignment or permanent positions in the government. These scientists are called as the 'insiders'.
(2) Scientists' Voluntary Public-interest Organizations, where scientists prefer to be outside the government and make independent and objective studies about the development of science and its impact on society, often criticizing government's misuse of science for the determinate of the good of the society. Nearly 90 such active bodies in the US are listed in the book, giving a fairly detailed account of the role played by each. This community of scientists is called the 'outsiders'.

The book introduces this very interesting concept of 'insiders' and 'outsiders' belonging to the scientific community. Quoting from the work of an Oxford University Press publication of 1962 by Don Price, the insiders are called the *scientist-administrators* who work within the official structure of government as science advisers, as officials at the Office of Science and Technology Policy or at the National Science Foundation, or as employees of a multitude of other government agencies. The outsiders are the *citizen-scientists* belonging to voluntary associations. They express views, on science and science policy, which are often opposed to specific or fundamental aspects of the government's stance. In India, we have increasing numbers of 'insiders' in our numerous scientific agencies; and our 'outsiders' are not organized and do not seem to have a strong voice.

In describing the activities of the 'insiders' in the government, we are given a detailed account of the structures that existed in the government under different presidents of the US. As scientists, some of the advisers in the government showed their dissent regarding the government views, and during the Nixon regime, this resulted in the abolishment of the top-level presidential science advisory system. Some scientists in the US, true to their profession, considered their duty to dissent, not caring to remain as insiders in the system. Science and politics did not always see eye to eye even within the government framework. On the contrary, in the US the organizations of scientists seemed to be more effective, and their voice was very strong soon after the World War II, giving rise to several peace movements during the cold war period, followed by the environment movement of Rachel Carson's 'Silent Spring' work in 1962. Today, the organized citizen scientists are playing an important role in programmes relating to global warming, impact of information technology and the ethics of genetic research. The government policies are often influenced and directed in a way so as to take these independent voices into account. In India we do not see such a strong voice from the outsiders. The various science academies that could play this role effectively are themselves dependent on the government for funds, thus preventing them from raising their voices. One would have liked to see debates in India on important issues, e.g. the use of 'atomic energy as a safe option for power', 'role of astrology in science education', 'scientists as politicians' and several others that seem to be murmured in the canteens but not openly debated and analysed objectively.

A positive aspect of the book is the detailed discussion on the so-called Jeffersonian model of science policy that is recommended for the country during

the 1977 Carter regime, when Frank Press was the President's Science Adviser. In order to protect the role of basic research in science and at the same time meet the societal needs through the use of science, a unique initiative now called the Press–Carter initiative was taken by preparing a master list of research questions, involving the various scientific agencies in the government. This list was submitted to the cabinet to justify support for basic research in some of the science programmes that could fulfil the major societal needs. Appendices B and C of the book give this list in detail. Research groups and scientific agencies in India must look at these lists to frame their research agenda. It is tempting to quote one such research-oriented question that justifies the need for basic research to satisfy societal needs:

'What are the physical processes that govern climate? Greater understanding of climate could aid in the prediction of climate changes and allow time for measures to offset their impact.'

The book has devoted several pages to the large number of scientists' voluntary public-interest associations. It has highlighted the pioneering role played by individuals and groups of scientists, such as Einstein–Russell in the Pugwash group, Linus Pauling for the peace movement, Rachel Carson for the environmental movement and several other not-so-effective but serious movements that have influenced the functioning of the two ivory bridges in the US.

The book ends with a short but thoughtful chapter on the autonomy and responsibility of the scientists and the scientific community. It concludes by saying . . . 'they have been doing an important service to our society – one that has not been sufficiently noted and appreciated by society at large. They have prevented science from becoming either too subservient to the demands of government or, at the other extreme, a new establishment in itself, and have preserved the image and reality of the scientist as beneficent dissenter'.

The analysis in the book becomes relevant to a country like India and it is for this reason that the book needs to be taken seriously by the members of the scientific community and by the government agencies in India. In fact, it almost becomes necessary that one of the scientific agencies or science academies commission a study by social scientists who have some familiarity and understanding of how science has been pursued in India, and how the scientific community has responded, if at all, to the call of the society.

The Indian scientific community should introspect its role in the context of creating ivory bridges in India. The book, though not of interest to students of science, should certainly prove an eye-opener to the 'scientist-administrators' and 'citizen-scientists' in India.

P. J. LAVAKARE

B48, Diamond District,
Airport Road, Kodihally,
Bangalore 560 008, India
e-mail: lavakare@vsnl.com

Microarrays for the Neurosciences – An Essential Guide. Daniel H. Geschwind and Jeffery P. Gregg (eds). The MIT Press, Cambridge, Massachusetts 02142, USA. 2002. Price: US $ 55.

A lot has been written, during the last few years, about microarray technology, definitely one of the most revolutionary techniques to have been invented to address problems relating not only to various diseases, but also to address basic biological questions. However, one aspect of modern biology, neuroscience, has probably not been subjected to a microarray-based analysis to the extent it deserves. In this context, the book under review comes as a refreshing change to all that has been written about microarrays so far. The book describes in an easy-to-understand language, the achievements of this amazing technology to understand the nuances of the central nervous system and also explains how it could be used for future research in the field of neuroscience.

The preface begins with a short description of the microarray technology and its important applications. It highlights the difference between using the technology in simpler systems such as cancer biology, yeast, bacteria, etc. and the more complex central nervous system. It then gives a wonderfully succinct, concise and wholesome overview of the various topics covered in the book. The first chapter by Gregg is of great help to neuroscientists to learn the basics of this technology. It gives a good introduction of the microarray technology by way of a general description, which is so simple that it will help any laboratory interested in establishing a microarray facility. Each step of the technique, starting from slide preparation to data analysis, is explained. The chapter also provides information on laboratories where pioneering research has been done in this field. The second chapter by D. Wells and his colleagues deals with microarray scanning and data acquisition. Axon is the world leader in this field, and Wells *et al*. have expectedly given a good account of this important component of the microarray technology. Details of background subtraction and normalization have been explained. While all aspects of background fluorescence have been covered, starting from array creation, choice of dyes, etc. this chapter also deals with all the other important technical aspects of microarray scanning and data extraction. Such details are usually not easily available, which makes it an important aspect of this book. The third chapter by S. Shah and S. Shams specifically deals with various aspects of informatics involved in the whole process. Although this is the most important aspect of microarray technology, several researchers limit the use of informatics to the final step of data analyses. This chapter lucidly describes usefulness of informatics in the initial stages of array fabrication as well, besides dealing at length with the intricacies of image generation and analysis, quantitation, principal component analysis and data analyses. P. Ramm and colleagues describe the widely discussed subject of data mining. Even though so much has been written about statistical approaches for microarray data analysis, this chapter presents a refreshingly new look. The use of original data figures in the form of plates makes it easy to understand this slightly complicated aspect of microarrays, and makes interesting reading.

L. W. Whitney and colleagues discuss specific use of microarrays in neuroscience and focus on radioactive probes. Both glass as well as membrane- and filter-based arrays are discussed. The important difference between using homogeneous cell lines and heterogeneous