Moscow, where he is serving as advisor to Secretary Gorbachev in the latter's attempt to rejuvenate the economy. Ironically, the move of Aganbegyan to the centre of things in Moscow means that he has inevitably lost his cachet with the more free-wheeling reformers of Novosibirsk, and is now increasingly seen as one more member of the "techno-managerial intelligentsia" serving the establishment.

Marsh is understandably much more knowledgeable about literature than she is about science. Her statement that under Stalin "...certain important subjects, such as classical genetics, the theory of relativity, quantum mechanics, resonance theory in chemistry, the 'big bang' theory in cosmology and the whole new field of cybernetics were banned altogether" is far too simple. Relativity theory and quantum mechanics never were banned in the Soviet Union, despite some philosophical in-fighting over them, and, in fact, only genetics was entirely proscribed. Soviet scientists in structural chemistry, cosmology and cybernetics were not seriously hindered, since they rather easily found ways to evade ideological restrictions by adopting different terminology.

Marsh also has a tendency to cast most issues in political terms, thereby sometimes obscuring subtle intellectual nuances, especially when they concern science. She frequently evaluates Soviet scientists on the basis of whether they support official ideology and therefore overlooks the fact that eager defenders of the regime's policies have on occasion advanced important scientific ideas (an example is the physicist Nikolai Basov, who won a Nobel Prize), or that a critic of Stalinism can still be devoted to the principle of uniting Marxism and science (an example was the outstanding physicist Vladimir Fock).

Viewed against the background of her impressive achievement, however, these flaws are minor. Rosalind Marsh has given us a map to a little-explored area of the Soviet mind, the relationship of science and literature, and all who wish to enter that area will benefit from her cartographic skill. □

Loren Graham is a Professor of the History of Science in the Program on Science, Technology and Society, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA.

Circuits in colour

L.W. Swanson

Chemoarchitecture of the Brain. By Rudolf Nieuwenhuys. *Springer-Verlag: 1985. Pp.246. Pbk DM 99.*

THE nervous system is a biological computer that orchestrates metabolism, as well as behaviour and its psychological counterparts. While great strides are now being made in understanding the cellular and molecular biology of chemical synaptic transmission between individual elements within the circuitry of this computer, complementary knowledge of the organization of its functional subsystems will ultimately be necessary to explain the biological foundations of behaviour. Neuroanatomy has a long and rich tradition of interest in this problem, and Professor Nieuwenhuys has provided a thoughtful, even-handed evaluation of many of the issues involved.

The seeds of the revolution dealt with here were sown in the early 1960s with the introduction of the Falck–Hillarp method for the cellular localization of monoamines in the central nervous system (CNS), and its early exploitation and refinement by the Swedish school of histochemists. The power of this method was threefold: it formed a bridge between anatomy and biochemistry by providing information about possible neurotransmitters within specific pathways; it revealed three new neural systems; and it suggested that these systems were unlike anything previously known, as they consist of small, discrete groups of neurones that innervate most of the CNS in a seemingly rather diffuse way. A decade later came the introduction of immunohistochemical methods. Not only did these methods provide independent support for the conclusions drawn from the histofluorescence approach, but, more significantly, in principle they allowed the cellular localization of any neurotransmitter, receptor or other antigen.

The application of histochemical techniques has generated massive amounts of information about the organization of neural circuitry, and has led to a certain hybrid vigour that has rekindled interest in neural circuit organization. This has occurred for two reasons. First, much of the early work was carried out by histochemists who worked outside the tradition of classical neuroanatomy. Second, many of the neurones that were found to contain monoamines and neuropeptides lie outside the relatively well-known systems subserving the transmission of sensory information and the production of motor responses; instead, they predominate in the least-understood parts of the brain, particularly the so-called limbic system and reticular formation.

Chemoarchitecture of the Brain is an attempt to bring together the fruit of classical research with what has been learned from a somewhat different vantage point. In this it is largely successful. To date, the topic has been approached with varying success in multi-author books and limited review articles, but this volume is a critical review of the literature which covers most of the CNS from a uniform perspective.

The book is divided into three parts. The first consists of a series of maps showing the distribution of neurotransmitters as projected onto a schematic view of the human brain. These maps are based largely on work on animals (primarily rats), and specialists will not agree with all of the details and will raise the obvious question of possible species differences. The second part sets down a number of generalizations that may seem obvious to some, but which are documented systematically here for the first time. Some of the more intriguing points raised are that no obvious structural or functional rules have emerged to explain the pattern of neurotransmitter expression in various sites; that most regions of the brain are heterogeneous with respect to neurotransmitter content; that neurotransmitter-specific cell types often do not respect traditional neuroanatomical boundaries; and that at least some neurones contain more than one neuroactive substance.

It is the third part of the book that is the most interesting, however, because here the author speculates about the possible existence and identity of a neural system whose organization is said to emerge from the histochemical data. In brief, Nieuwenhuys suggests that regions containing a large number of the currently identified transmitters constitute a readily identifiable entity (the "[paracrine?] core of the neuraxis"), which is surrounded in the brainstem by "median and lateral paracore" adjuncts. This core stretches the length of the CNS, from the olfactory bulb through the spinal cord. Structurally it corresponds largely to the dorsal horn, reticular formation and limbic system, while functionally it is postulated to subserve mechanisms that assure survival of the individual and of the species.

It is difficult not to agree with this conclusion, which follows traditional lines of thought. The novel suggestion is that this "system" may rely heavily on "paracrine neurotransmission", that is, on the non-synaptic release of transmitters from varicose, unmyelinated axons, as has long been known to occur in sympathetic fibres. It will be extremely difficult to prove this hypothesis, however, unless a histochemical marker for transmitter release sites can be developed.

On the whole the book provides an excellent summary of contemporary views in chemical neuroanatomy and of their impact on what has often been a very conservative discipline. It should be required reading for students of neuroanatomy, while workers in other fields will find it a helpful introduction to a most complex field of research. □

L.W. Swanson is at the Salk Institute, PO Box 85800, San Diego, California 92138, USA.