

Cinnabar elixirs to insulin

Science and Civilisation in China. Vol. 5: Chemistry and Chemical Technology. Part 3: Spagyric Discovery and Invention—Historical Survey from Cinnabar Elixirs to Synthetic Insulin. By Joseph Needham. Pp. xxxv+481: plates 462–476. (Cambridge University: Cambridge and London, May 1976.) £16.

PART 3 of Volume 5 of *Science and Civilization in China* completes the survey of alchemy begun in Part 2 (for review, see *Nature*, 254, 539, 1975). It is more difficult to read than the earlier part because it analyses in detail material which is quite unlike anything with which the Western historian of science is likely to be familiar. Before Needham and his collaborators have been able to get down to any kind of criticism they have needed to examine the material written in a language which differs from Western languages in its basic make-up. It would be an impertinence on the part of any reviewer who, like myself, does not know Chinese, to make any remark on this subject were it not for one important fact about the book itself. Needham goes to a great deal of trouble skilfully to expound these linguistic difficulties and so makes it clear how he set to work and how he solved his problems. In the course of explaining some of the most recent chemistry he has some striking things to say about the different ways Western terms have been adapted to Chinese. His exposition of the language problem becomes a contribution to the history of chemistry.

More than in Part 2 he is concerned with individuals and the extensive record of their work. To follow all of these one needs to know a great deal of chemistry. It will not be easy going for those who do not. As in previous volumes one finds light being shed on Western science. For example, in dealing with Ko Hung, a great alchemist, and his contemporaries, Needham says "How did they keep their heads in the midst of so much religious-magical enthusiasm? How did he manage to make so many true observations of chemical behaviour, and carry out so many interpretable experiments even though he himself could never interpret them? . . . Ko Hung had one eye on the magic, the sacrifices, the Taoist temple liturgies but he kept the other firmly fixed on the real changes and transformations which he observed at his bench and his furnaces". We could apply this analysis to much that is puzzling in Western practice not only in the obviously related field of Western



A woman alchemist, possibly Thai Hsüan Nü, compounding elixirs. Taken from the *Lieh Hsien Chhüan Chuan (Complete Collection of the Biographies of the Immortals)*, Ming, about 1580 AD.

alchemy and chemistry, but much other science and proto-science.

The fate of alchemy in China is curiously parallel with its fate in the West. It declined through the Middle Ages and was made the subject of satire. There was even a kind of iatrochemistry as its successor. But instead of a continuous suppression of alchemy by a progressive modern chemistry, there came a gap. Western chemistry was introduced into China bit by bit, to be adapted and assimilated like many other foreign influences, so that in

General relativity for undergraduates

Gravitation and Spacetime. By Hans C. Ohanian. Pp. xiv+461. (Norton: New York, May 1976.) \$18.95.

OVER the past decade there has been an explosion of discoveries, both theoretical and observational, in the subjects of gravity and relativity. Yet curiously there are still very few well written, broadly based and concise introductory books on general relativity which cover these exciting new developments. Perhaps this reflects the tradition of regarding general relativity as primarily a postgraduate and research activity; but increasingly in recent years, universities and colleges are running general relativity courses for undergraduates. This book by Ohanian is ideally suited to such courses as a teaching textbook.

The flavour of the book which emerges, suggests that it is aimed primarily at the physics student. The mathemati-

cal development of the subject matter is competent, and quite adequate for physicists, but perhaps a little sparing for mathematics students primarily interested in the modern techniques of differential geometry and topology, the singularity theorems, and so on.

The book contains much interesting discussion of experimental techniques and results. The later chapters cover modern developments in black hole theory and cosmology. There is little in the way of special relativity.

Many people will find this book useful for reference. Information retrieval is easy, the presentation of the material clear, concise and accurate: students should have little difficulty in finding their way around the subject matter, and exercises are plentiful.

In short, a solid, direct and informative reference and teaching book to be recommended to all students of relativity.

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