

## More and more about less and less

V.E. Cosslett

### Transmission Electron Microscopy: Physics of Image Formation and Microanalysis.

By Ludwig Reimer.  
Springer-Verlag: 1984. Pp.521.  
DM 118, \$45.80.

IT IS over 50 years since the electron microscope was invented in Germany and nearly 45 years since the first comprehensive book about it appeared (M. von Ardenne's *Elektronen-Übermikroskopie*, published by Springer-Verlag in 1940). Fortunate though we are to have the founders still with us, they have developed in rather different directions: the originator of the instrument (E. Ruska) towards the attainment of high resolution and von Ardenne into biological problems.

In the interim there has been an increasing number of treatments of the subject, from review articles to multi-authored series. Desirable as a uniform coverage by a single author may be, it is hardly practicable any longer except at an elementary level. The last attempt at a full treatment known to me also came (appropriately enough) from Germany,

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and indeed from the same publishers — *Elektronenmikroskopische Untersuchungs-und Präparations — Methoden* by L. Reimer. The growth of the subject is mirrored in the size (598 pages and 247 illustrations) of the second edition (1967), as compared with the original 300 pages and 135 illustrations in 1959.

The need for an even greater expansion is acknowledged by Professor Reimer in the preface to his new book. To meet such a daunting task he now confines his treatment to the theoretical basis of electron beam imaging and even more narrowly to that in transmission electron microscopy, leaving the large field of scanning almost entirely to one side.

After a short introductory chapter, the physical groundwork is set out: the particle optics and the wave optics of electron beams in two separate chapters, including lens aberrations in the former and diffraction in the latter. The functions of the several parts of a transmission electron microscope are then dealt with in turn, from the electron source to the camera and alternative detecting systems. Beam-specimen interactions, including scattering, energy loss and the origin of phase contrast occupy two chapters (100 pages), with the two following (130 pages) devoted to the details of diffraction theory, the formation of diffraction contrast and crystal structure imaging. These four chapters comprise the heart of the book. Chapter 9 is concerned with various aspects of analytical electron microscopy and the last chapter with the vital problem of specimen damage caused by the electron beam.

The subject of transmission electron microscopy is thus covered by the author in all its basic instrumental aspects, but with only a few incidental asides about practical applications. These were described at length in his 1967 book, half of which was devoted to an account of methods of specimen preparation. More recent developments can be followed up in the many congress proceedings since published.

Reimer's new text ends with a formidable list of references, arranged by the chapters in which they arise and running to over 150 pages in all. As a whole, the book gives an authoritative and up-to-date account of the basic principles of a subject of ever-increasing scientific and technological importance, clearly presented and intelligible to anyone at post-graduate level with a good grounding in mathematics. Some acquaintance with the Schrödinger equation and with diffraction theory would be advantageous but not essential to an understanding of the physical ideas. As stated in the preface, the treatment evolved from a series of university lectures and so it would be a good basis for any similar course. □

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## Rights and wrongs

T.L.S. Sprigge

### The Case for Animal Rights.

By Tom Regan.  
Routledge & Kegan Paul/University of California Press: 1984. Pp.425.  
£17.95, \$24.95.

ANIMAL rights are proving an active subject for philosophers — this work is only the most recent of several books arguing that the ethical principles which govern relations between human beings imply that man does wrong to treat animals as he does, in the kind of animal farming, scientific research and blood sports sanctioned by our current laws and mores. Such writers have helped to change the image of the animal rights (or liberation or welfare) movement. Whereas it was once the habit of animal experimenters or factory farmers to dismiss the opposition as "dear old ladies" and "animal lovers", only the exceptionally blinkered do so now. For these philosophers have insisted that they are not necessarily sentimental about animals; rather they are simply concerned to point out in a cool, rational way that we are behaving wrongly, judged by our own most reasoned standards, and that we are morally obliged to mend our ways.

There have also been those who have defended the principles underlying current practices. Philosophers on each side have typically started with one of the main ethical theories advanced for intra-human relations, and then applied their favoured theory to human behaviour towards animals. Four such theories have figured prominently in the discussion: utilitarianism; contract theories; perfectionist theories; and rights-based theories. This last is the viewpoint defended by Professor Regan.

Utilitarians typically contend that the basic factors to be considered are good experiences promoted and bad experiences prevented, these usually being equated with pleasures and sufferings. The implication is that so far as animals suffer and enjoy life as genuinely as we do, their experiences must be taken into the reckoning on a par with ours. Many utilitarians have concluded that most animal suffering arising from these practices in anything like their present form is not justified, since either the good done (a new drug, say) fails to outweigh the suffering, or equivalent good could be achieved more cheaply in terms of suffering. The main — and very effective — exponent of this view is Peter Singer.

Objections to this line have come not only from non-utilitarians but from other utilitarians, the most usual defences of animal research and modern farming applying a utilitarian ethic. To me they seem ineffective, however, since they rest partly on a failure to take animal sentience

sufficiently seriously, partly on unimaginativeness regarding the possibilities of change in human life-style. With so many under-funded fields in which welfare and knowledge could be increased, why not favour those employing methods not harmful to sentient creatures?

Contract theory sees moral principles as rules of the game of life which morally-conscious agents implicitly do, or if rational would, agree to abide by in their mutual relations. Since animals cannot be party to such a contract, and thus do not belong to the moral community so created, contract theorists give at best a secondary place to human duties towards animals.

A more formidable counter to the utilitarian attack on current practices comes from "perfectionist" ethics; here sentient beings are ranked as different one from another in inherent value. Such a theory is readily used to justify the human exploitation of animals as simply means to the promotion of values only realizable in human life.

Professor Regan contends that each of the first three theories is to be rejected independently of its implications for the animal issue. He is surely right that the contract theory is totally inadequate. But his criticism of perfectionism — a stance of crucial importance — seems rather slight, turning simply on the contention that it implies an intolerable value-ranking of human beings and thus justification for the making of inferior human beings means to the good of superior ones.

Regan's most distinctive line, however, as a proponent of animal rights, lies in the argument (with which I wholly disagree) that utilitarianism cannot provide the basis for the condemnation of current treatment of animals which Singer erects upon it. Simply in terms of the aggregate of pleasure gained and pain prevented, present practices may be largely justifiable, he says. In contrast, they are totally wrong when viewed in the light of an adequate rights-based theory.

According to rights theory, there are valid moral principles such as that every individual possessed of a certain inherent value has the right not to be harmed, to prevent less serious harms to others (however many of them there may be) or even more serious harm, where this is not one they have some special right to be

protected from (as we do not have the right to be protected from sickness at another's cost in life and health). Regan's great challenge to conventional morality is that he argues that this inherent value is shared by every individual with certain mental capacities — such as an ability to plan — and that at least all mammals possess such capacities as truly as we do. No such individual should be regarded as a renewable resource for the purposes of others, nor even merely as one of a set of receptacles for as much aggregate pleasure and as little pain as possible, as we all are for utilitarianism.

Regan's book poses a carefully worked out challenge to all those who warm to an ethic such as his when *only* human beings are being considered. Such people should ponder whether he may not be right that at least all mammals can be denied such value, and consequent rights, only through arbitrary restrictions made in favour of our own species. They will probably find in Regan's book replies to the more obvious objections which occur to them.

Regan's work, however, does have certain limitations. Great emphasis is laid on reflective intuitions on moral matters without its being made clear on what we are to reflect in arriving at them. His discussion of animal consciousness properly opposes extreme views which would deny it altogether, but says little as to how we might improve our knowledge of it. Moreover, he muddies the issue by resting his case for animal consciousness on the need for it to explain behaviour, whereas even if physicalistic explanations which bypass it are possible it is still as much there, as in human beings, as something ethically significant. Finally the rather mystical notion of an inherent value present in every man and mammal, and perhaps beyond, is insufficiently explained, while the claim that it is equal in every case is weakly grounded on the impossibility of measurement and unacceptable elitism of its denial. For all that, this is a telling attack on present human attitudes and behaviour towards animals, one which is based on views implicit in widely professed ideals. □

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## Pieces of science

John Maddox

**Man Suddenly Sees to the Edge of the Universe.**

By Richard Casement.

*The Economist*, London/Open Court Publishing, Box 599, La Salle, Illinois: 1984. Pp.204. £4.95, \$12.95.

*The Economist*, increasingly the thinking man's *Time* magazine but with a British accent, has been so moved by the untimely death two years ago of its science writer, Richard Casement, that it has now issued a collection of his published pieces under a characteristic title. The book is a good read but also splendid illustration of the symbiotic interaction between writers and the papers for which they work.

Casement was not by training a scientist in the strict sense, but one in whom education (philosophy, Oxford) and early experience as a journalist (the *London Times*) had cultivated a vivid curiosity about science and technology in relation to the world at large. Casement's most tangible achievement was to persuade *The Economist* to give him an outlet — a section in each issue of the weekly magazine. But his distinctive style may wear even better.

There is a splendid piece (reprinted here) about the sociology of the Cavendish Laboratory, raising in 1982 the question that now more urgently bothers the people at Cambridge — will this great laboratory manage to stay in the forefront of physics, and how? The anthology shows that Casement also considered that readers of *The Economist* should be told about evolution, neurophysiology and psychiatry — and he was right. But how can one man, without formal training in such subjects, write confidently about all of these matters? Casement's trick was to talk endlessly to people with interesting things to say. Now and again, this anthology shows, he was taken in, but mostly he seems to have emerged with a better judgement than his informants of where their work would lead.

There is one debt that Casement owed to *The Economist*: the belief that journalism practised by the application of intelligent and untrammelled curiosity to complex problems is one of the few remaining honourable professions. Casement's style was plainly also influenced by his fellow journalists on the magazine, with their two-word sentences and three-word epigrams. His strength was that the need for compression forced him into generalizations that were almost always true.

*The Economist* is understandably shocked to have lost this talent, and generous to have collected Casement's pieces together in this way. □

*John Maddox is Editor of Nature.*



The anti-vivisection lobby — moral support from philosophers?