Microscopic blind spots

No newspaper columnist would expect to claim that 'spiders are insects' or that 'Mars is a star' without attracting a regular deluge of indignant correspondence. Yet even our most respected publications can state that typhoid is caused 'by a virus' and emerge unscathed. Brian Ford comments.

SOCIETY has a blind spot for micro-organisms. Such scientific devices as an automatic transmission system, a programmed washing machine, an electronic calculator or a sophisticated high-fidelity amplifier are familiar features of today's domestic landscape. People are equally familiar with the sights and sounds of science. The craters on Mercury or the boulders on Venus take space of their own in the press, along with integrated circuits, steel-piercing lasers and thermographs. And the hissing whistle of a transmitting satellite is as familiar to our ears as warbling whales and echoing, ghost-like bats.

The microscopic universe, however, remains obscured, and for all the undoubted familiarity of the microscope as a symbol of scientific endeavour there is ample evidence of the esoteric complexity surrounding the subject. Superstitions about infection persist a century after the popularisation of the germ theory, and though they are intimately connected with us, microbes are unfamiliar to the public.

Critics of modern microscopy argue that professional standards of routine technique are inferior too. Certainly one hears far more from research workers who claim to have a love-hate relationship with the instrument than suggestions that microscopy is enjoyable. The blind spot that exists within the discipline is revealed not only by a low average standard of practical microscopy, but also by the paucity of educational opportunities for those who wish to improve. This is vividly reflected in the way we have delayed setting up safety codes for the handling of pathogenic bacteria.

It is perhaps a legacy of nineteenth-century bacteriology that we tend to associate 'microbes' with 'bacteria', and 'bacteria' with 'disease'. It is still accepted that microbiology and bacteriology are virtually synonymous. This tradition of distaste, in might be argued, underlies our microbiological apathy, which has delayed progress in a field rich with potential.

During the debate on energy sources, for example, much was said about waves, windmills and the power of the tide. But little was heard of the solar-powered electron pump systems of algae and the capacity of micro-organisms to act as transducers. The brand of automotive fuel sold as 'Cleveland

Discol' was possibly the last one available containing fermentation alcohol, and it is somehow intriguing that the industrial liberation of metabolic energy from a 'waste' substrate is now—in an energy-seeking world—so rare.

Corynebacterium simplex is familiar as the organism which converts cortisone to prednisone and hydrocortisone to prednisolone, both more potent yet less hazardous to the patient than the parent steroid substrate. An extension of cell technology has for years offered us a range of similarly self-fuelling conversions that demand no energy supplies. Yet microbiological methods seem to be used only when an acceptable chemical-industrial approach cannot be found. Should we not reverse the process, and opt for cell technology wherever we can?

The public health field offers limitless possibilities. The antibiotic era has revealed many of the growth-regulating products of the fungi, but such familiar algae as *Microcystis* and the abundant *Chlorella* secrete bacteriostats. Little is known about the ecological importance of microbial interrelationships, yet since the 1930s it has been known that soil-borne pathogens such as *Helminthosporium* and *Ophiobolus graminis* are controlled in some way by micro-organisms in the rhizosphere. Intracellular bacteria can be found in many species of insects (including *Periplaneta*, the cockroach) which will not mature normally without them.

Some instances of overwhelming skin infections in man may be due not to the removal of commensals and the opening of a niche, but rather to the absence of specific health-promoting species—salogens (from the Greek *salus*—health) as opposed to pathogens.

Becoming microbe-conscious opens many avenues of investigation. For all our exhaustive knowledge of the behaviour of a single cell of *E. coli* or *Paramecium*, we know little about the interactions of five cells, or five hundred. The trend towards bulk *in vitro* methodologies is unlikely to resolve these issues unless it is complemented by that rare art, the microscopy of living cells.

A similar philosophical approach allows one to resolve the conflict of the 'cell-equals-egg' versus 'cell-equals-organism' debate. This involves demonstrating that a concept of func-

tional delegation can relate the specialisation of cells within a multicellular organism to the complexity of such single-celled organisms as the protozoan *Epidinium*, a rumen protein converter which possesses a brain-like motorium and a segmented skeletal plate and has an almost quasi-chordate appearance. Certainly one can argue that the loss of delegative function in malignancy allows the cancer cell to return to a less specialised, microbe-like state (and the world-wide infection of cell cultures with HeLa suggests that, even in the practical sense, that analogy holds true).

The philosophical consequences of becoming microbe-conscious range from the lighthearted concept that man is a free-swimming protozoan called a sperm, and all the complexity of an adult human is nothing more than a refined fruiting-body; to the serious and pragmatic possibility of producing crops, food and drugs from tissue culture rather than from colonies of the entire species.

But whatever the future, there can be little doubt that our orthodoxy has done a disservice to micro-organisms. The dogmatism which followed the Pasteurian view of infection must be replaced with something more realistically positive. For philosopher and technician alike, the benefits of doing so are great.

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Five million volt electron microscope (Photo: Fox photos)