

CORRESPONDENCE

Future reference

SIR — The recent letter from Andrew Brooks (*Nature* 7 May, p.7) suggesting that research students should take a course in information sciences recalls Dr Johnson's comment "Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information about it". The combination of a continued growth in scientific literature and the worldwide cutback in library budgets is making it more difficult for us to "know where we can find information about it".

The long-term solution appears to be electronic publishing; a range of databases giving bibliographic and abstract information backed up by huge databanks where the original text is stored in machine-readable form for full retrieval. It has been estimated that in 1979 there were in the United States 93 databases in agriculture, life sciences, pure and applied science, producing 26 million records, while in Europe there are 92 databases in the same subject area producing 19 million records.

Commentators predict that these databases will grow rapidly over the next five years. Users will no longer expect to find the article they require in their library but with the aid of on-line access to the databases will be able rapidly to identify the literature relevant to their needs and to call it up from the databanks. Time spent on training should be more than compensated for by savings in time spent on the customary literature search.

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Badger strain

SIR — In your correspondence about the Zuckerman Report, little has been said about the more medical aspects of the problem.

The report opens by confusing the issue. In the first paragraph the disease "tuberculosis" is referred to and figures given for its incidence in the United Kingdom. However, tuberculosis is a term covering the disease state produced by infections with more than one strain (some would argue more than one species) of bacterium. Man can be infected with *humanis*, *bovis* and *avium* strains. It is only strain *bovis* that concerns us in badgers. Paragraph 82 does rather belatedly clarify this, and implies that the figures on the first page overestimate the human risk by sixty-fold.

There is an even more dubious presentation of data in paragraph 58, where it is stated that the "bovine strain was four times more responsible for abdominal tuberculosis" in children (my emphasis). These figures are from a survey between the wars, when abdominal tuberculosis was commonly contracted by ingesting infected milk, while other forms (especially pulmonary) were transmitted more by human contact. Hence, *bovis* predominated in abdominal cases (before most milk was pasteurized), and *Humanis* in many others. (Abdominal tuberculosis used also to be common in cats, another group, besides children, that ingested large quantities of raw milk!) I fail to see why data were selected for cases in children, and

for this particular anatomical site, without some explanation.

The report goes to great lengths to destroy various falsehoods that have been in circulation. The above two examples refer to the cases respectively that there is a real threat to man, and that *bovis* does infect man. The fact that they in my opinion overstate the case in the support of what is in basis a sound argument does much to undermine the authority and objective position of the report.

It is also disappointing that the chapter dealing with the measures that have been taken is so small a part of the report. Here again I think a full picture is not presented.

The report also states (paragraph 107) that vaccination is not allowed for livestock. What it does not state is that in no way can this affect the question of badger vaccination — vaccination of cattle would interfere with the tuberculin test, but the test is of no use in badgers. (Curiously, the fact that the test does not work in badgers is then used as a reason against vaccination.) No explanation is given as to why infected badgers should not be vaccinated (as would happen unwittingly if blanket vaccination were practised). There are possible objections to vaccinating infected animals, but whether these would be outweighed by the advantages of blanket vaccination is an open question.

The report does not raise the question of the effectiveness of BCG in badgers. If it is not known, I would have thought it a prime research aim. If some of the badgers could be protected for some time, this would reduce the susceptible population.

Further, long-term policy is not well explored. The report supports the ministry's policy, but does not state what effect is expected. Is the policy to eradicate the disease or just to control it? Present measures seem to be only controlling it — is not that in itself a justification for a rethink on policy?

I am convinced of the sincerity of the ministry's actions, but I am also convinced of the sincerity of many zoologists who doubt the basis of those policies. Unless those doubts are considered I do not see how there can be public confidence in the ministry's policies. The association between state veterinary medicine and wildlife epidemiology is young, but of utmost importance as long as rabies lingers on the other side of the English Channel. I for one would welcome a widely based inquiry into ministry policy on both the current problem and those plans we hope we will never need.

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Paradigm change

SIR — It is now well understood that the abandonment of one time-honoured theory or paradigm in favour of another by scientists does not solely depend on proof¹. It also takes a substantial time for the whole scientific community to accomplish such a paradigm change². But for individual scientists the time taken can be much shorter. I have personally experienced several changes in my commitment to theories and paradigms, which

were prompted either by external motives or self-induced discovery independent of the extant information. These changes occurred either over a period of a year or so, or, more than once, within a matter of an hour — almost like lightning.

So *one day* may be long enough for a scientist to abandon one particular theory in favour of another. In this context and in opposition to Hesketh³, I support the scientists in the British Museum (Natural History) when they write⁴: "the theory of evolution would be abandoned tomorrow if a better theory appeared", although I admit that people would vary in the speed at which they might come to find a novel theory "better" than the present one.

In this connection, I wish to point out that the current trouble with the evolutionary theory does not reside in science itself but in the attitude of some religiously committed people. If so, science will be able to remedy the situation only when it appears trustworthy in the eye of the public. Science is *not* a religion. In contrast to followers of a religion, scientists should admit that the currently held (scientific) theory may very well be wrong⁵, whatever consequences that may have for a civilization based on science and technology.

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1. Kuhn, T.S. *The Structure of Scientific Revolution* (University of Chicago Press, 1962).
2. Kuhn, T.S. *The Essential Tension*, 320–339 (University of Chicago Press, 1977).
3. Hesketh, R.V. *Nature* 290, 286 (1981).
4. Ball, H.W. *et al. Nature* 290, 82 (1981).
5. Sibatani, A. *Trends biochem. Sci.* 6 (in the press).

Protecting the work

SIR — Many scientists need to handle biological material in a containment facility that provides sterile conditions for the work as well as protection to the operator. This requirement highlights one aspect of the current debate concerning performance and use of microbiological safety cabinets where an increasingly held belief (based mainly on misconceptions as to the properties of particles in moving airstreams) suggests that Class I cabinets can provide considerable product protection in addition to the operator protection for which they were designed, and that consequently there is no need for the sophistication of Class II types.

We have recently carried out a series of experiments, in ordinary laboratory conditions, which clearly demonstrate that protection is not obtained in Class I cabinets whereas in Class II types, built to the requirements of BS 5726 and working correctly, there is a consistently high degree of product protection that is independent of the particulate contamination in the laboratory air.

Although the idea of using a Class I cabinet for some degree of product protection is attractive, it is evident that this is intrinsically unsound and should be abandoned.

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