in which he discussed the theory of quanta, special relativity, geodesics, invariants, differential equations, the theory of measurement and of space and time.

Perhaps his most direct influence on the philosophy of science has been in these applications of logical construction and other symbolic techniques which first appeared in the *Principia*. Their effect on modern logic (and mathematics) has been incalculable. The success of this analytic approach moved many other philosophers, including the Vienna Circle group of logical positivists, to attempt similar projects in the physical sciences.

Much later in his career (*Human Knowledge : Its Scope and Limits*, 1948) Russell turned again to a sustained attack on the problems specifically related to science and provided a more modern analysis of a number of basic scientific concepts. In this work he presented his analysis of two problems that have been prominent in the philosophy of science: namely, the difficulty of providing a formally correct and materially adequate definition of the nature of probability statements, and the provision of a theory of non-deductive inferences as they are used in the sciences. In 1950 Russell was a founder member of the British Society for the Philosophy of Science.

Characteristically, Russell had no hesitation in attempting the difficult task of bridging the ever widening gap between philosophy and science. In writing *The ABC of Quanta* (1923) and *The ABC of Relativity* (1924) he presented, perhaps somewhat idiosyncratically, the fruits of modern science predigested for philosophers, and demonstrated the benefits of analytic philosophy in a manner palatable to scientists. A Herculean task !

Beyond his philosophy of science, Russell was an indefatigable popularizer of science and an exponent of the application of scientific method to the solving of social, political, moral and philosophical problems. *Our Knowledge of the External World* was subtitled "As a field for Scientific Method in Philosophy". He was undoubtedly among the pioneers who called for social responsibility on the part of scientists and he acted accordingly, in repeatedly analysing the impact of science and technology on society.

Perhaps some insight into the source of Russell's continuing influence is found in the concluding paragraph of *Human Knowledge*. "In this sense, it must be admitted, empiricism as a theory of knowledge has proved inadequate, though less so than any other previous theory of knowledge. Indeed, such inadequacies as we have seemed to find in empiricism have been discovered by strict adherence to a doctrine by which empiricist philosophy has been inspired: that all human knowledge is uncertain, inexact and partial. To this doctrine we have not found any limitation whatever."

Correspondence

Can a Scientific Article be Libellous?

SIR,—In a case before the Court of Appeal, reported in *The Times* (February 13, 1970), a dental surgeon was given leave to take libel action against the British Medical Association and others. The Court held that "a scientific paper in the *British Medical Journal* which was critical of a technique for dental anaesthesia introduced, used and recommended [previously in the same journal] by a named dental surgeon was held by a majority of the Court to be capable of bearing a meaning defamatory of the surgeon in the way of his profession and that it should not therefore be struck out *in limine* as disclosing no reasonable cause of action". While the judges avoided implications as to the likely outcome of such action in court, they maintained that a suit for libel was justified. As suggested in the dissenting judgment by the Master of the Rolls, Lord Denning, the ramifications of this decision on the scientific world could be serious.

The central issue in the majority judgment was expressed by Lord Pearson, who was reported as saying that "the author's name, practice and reputation have been and were closely associated with the technique in question". Therefore, an attack on the technique held forth the possibility of being an attack on the author and must be entered to jury-decision. In suits claiming libel, the defendant must prove to a jury's satisfaction that his actions did not constitute a personal, subjective defamation of the plaintiff. However, the cost in time and funds to prepare a case to the satisfaction of a lay-jury could be prohibitive to many research efforts and personally ruinous to the defendant.

The Master of the Rolls was reported as expressing that "it would be a sorry day if scientists were to be deterred from publishing their findings for fear of libel actions. So long as they refrained from personal attacks, they should be free to criticize the systems and techniques of others. It was in the interest of truth itself. Were it otherwise, no scientific journal would be safe". On the basis of the judgment in this case, allowing the libel action to proceed, there is clearly cause for concern for all of us. Within the scientific community one accepts that criticism is given and taken. While reputations may be enhanced or damaged in this manner, it rarely becomes a legal issue. However, individual criticism of any research involving commercial interests would appear now to be open to the risk of expensive libel action.

Yours faithfully,

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Should Slides be Seen Blind ?

SIR,—The suggestion is in the wind that, in the safety evaluation of drugs and potential food additives, histopathological material derived from studies on animals should be examined "blind"; that is to say, by a pathologist who is not told which material is derived from treated animals and which from untreated controls. If this suggestion is being seriously put forward, and if it applies to the first time that slides are to be examined, then we believe it to be ill-advised.

The pathologist's appraisal of toxicity should begin with a consideration of the overall design of the experiment and of details of mortality and morbidity in animals subjected to each form of treatment. Next he should acquaint himself with the clinical history of each animal. Central to his appraisal will be observations made by the naked eye at necropsy. Subsequent microscopic examination of material taken for histopathology may or may not add to the information already gained; but it is more likely to do so if detailed clinical and post mortem reports are available to the pathologist at the time he examines the slides. In any case, unless he has these reports before him, he cannot be sure that the microtome knife has found all the lesions seen macroscopically, and he may be in doubt as to the exact location and size of lesions. This description is nothing more than a statement of the general principles of sound pathological practice as they apply to the special problems associated with the safety evaluation of drugs and other agents.

Many variables face the pathologist as he examines histological material from toxicity studies. It would be impracticable for him to consider all of them. Awareness

of the nature of the experiment, the clinical and post mortem findings, and other pharmacological or toxicological information must inevitably direct his attention to relevant features which might otherwise be overlooked.

Once a preliminary survey of the slides from a safety-evaluation experiment has been made, there may be a case for the slides from selected tissues to be re-examined to confirm the presence of a qualitative change in response to treatment, or to measure an apparent quantitative difference between material from treated and control animals. This may be the point at which it would be prudent to ask the same, or a second, pathologist to examine slides "blind". Perhaps the suggestion that is in the wind concerns only such selective re-examination of material. But if primary "blind" examination is proposed, it might as well be done by a blind pathologist!

Yours faithfully,

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Understanding Media

Sir,—On February 15, 1969, *Nature* published a communication from Drs R. G. Edwards, B. D. Bavister and P. C. Steptoe entitled "Early Stages of Fertilization *in vitro* of Human Oocytes matured *in vitro*". To a biologist, the results seemed to be in the nature of a sound record of work in progress, more likely than not to be consistent with a true fertilization *in vitro*, and further communications were awaited with great interest. But there was at that time no evidence of the critical final stages of the fertilization process, and no development to the stage of an embryo. The results could not certainly be distinguished from those to be expected from abortive parthenogenesis, a phenomenon that bedevilled much earlier work on animals before fertilization *in vitro* was conclusively demonstrated in the rabbit by M. C. Chang and others. There was incontrovertible evidence of gross maldistribution of chromosomes in many eggs. All this was made explicit or given due reference in the paper itself.

Shortly after, if my sense of public opinion is correct, large numbers of people came to believe in some or all of the following propositions: (1) that an absolute, unequivocal proof of fertilization of the human egg *in vitro* was available; (2) that this was the first experiment on fertilization *in vitro* in man; (3) that human foetuses had for the first time been cultured *in vitro*; (4) that "life" had been "created".

Since the authors had claimed none of these things, and since all the propositions seemed at that time false, or, at best, arguable, it seems—unless my understanding of public opinion is at fault—that certain misconceptions had spread throughout the world on a large scale. Some still appear to be current. Embarrassment must certainly have been caused to the authors as well as to all others who share with them a regard for the good name of reproductive biology.

The public must necessarily derive its information on technical matters largely from the popular media of mass-communication. It might be opportune for formal enquiry to be instituted into the extent to which these media do actually succeed in giving the public a correct version of scientific material. It would be easy to blame the public itself for its misunderstandings—but perhaps it is the lines of communication that are at fault.

Yours faithfully,

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Capacity for Misunderstanding

Sir,—An important question of terminology arises in the teaching of thermodynamics. In this subject the word "heat" means energy transmitted because of a temperature difference. It very often happens that this is confused with internal energy, as a result of which serious misunderstanding arises. A recent test showed that not one of 148 university entrants in science and engineering knew the scientific meaning of heat. Consequently the first law of thermodynamics and even such an elementary concept as an adiabatic process must be meaningless to them. A contributory factor in this widespread misunderstanding may well be the use of the misleading term "heat capacity". The word capacity conveys the idea of containment, hence this term falsely suggests the containment of heat in matter. Unfortunately the equally misleading term "specific heat capacity" is coming into use.

I suggest that there would be a great educational advantage in discontinuing the use of the word "capacity" in this connexion. It would be better to use some such word as "acceptance". The "heat acceptance" of a body would mean the heat added divided by the consequent temperature rise. Heat is usually partly converted into internal energy in the body and partly into some other form of energy by means of external work. The word acceptance avoids the false implication that heat as such is contained in the body.

Yours faithfully,

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Appointments

V. A. Kotel'nikov, Institute of Radio Engineering and Electronics, Moscow, has been elected to the position of vice-president of the **Academy of Sciences of the USSR.**

Dr Mahlon B. Hoagland, Dartmouth Medical School, has been appointed director of the **Worcester Foundation for Experimental Biology.**

The Secretary of State for Education and Science, **Mr Edward Short,** has appointed four new members of the **Council for Scientific Policy:** Professor G. S. Brindley, London Institute of Psychiatry; Professor A. H. Bunting, University of Reading; Dr H. Morrogh, British Cast Iron Research Association; Dr R. G. West, University of Cambridge.

Announcements

The Grand Prix Technique de la Ville de Paris has been awarded to **Professor Max Serruys.**

Dr Richard D. Deslattes has received an **Arthur S. Flemming award,** for his direction of research which led to the successful design, construction and demonstration of the first device combining an X-ray and optical interferometer.