owe to the R.A.V.C., which bought, conditioned, trained and issued these invaluable animals. This work called for high administrative and business skill. Mules had to be sought out in many countries, and the right types had to be selected and transported across land and sea. Many veterinarians were required for the pack transport companies and more for the remount depots, animal hospitals, mobile sections and laboratory services. Evacuation of animal casualties from the line and the supply of reinforcements was one of the most eagerly sought jobs in the veterinary service. The Corps is now considering the extensive use of dogs.

It is certainly true that, as Major Franklin says, the story of all this work, when it can be told in full, will bring great honour to the veterinary profession. Much of the veterinarian's work, in peace-time as well as in war, is unspectacular and done with a quiet efficiency which does not get into the news. It deserves the admiration and gratitude of all who care for animals. G. LAPAGE.

RELATIVITY OF TEMPERATURE RADIATION

IN his Halley Lecture[1], Prof. H. Dingle gave an outline of an entirely new application of relativity principles to thermal radiation. He has now published a more detailed account[2] which shows how far the theory has been worked out. The fundamental idea is that "our theories should not imply the possibility of observing what is, in fact, unobservable". Thus in Einstein's theory of two bodies moving with uniform relative velocity, it is only this relative velocity and its limiting value which are of importance. Moreover, the equality of the inertial and gravitational mass is regarded not as a remarkable coincidence, but as establishing that these two masses are two aspects of the same property.

Guided by this analogy, Prof. Dingle deals with the radiation of a black body, of constant temperature, in terms of its effect upon a second black body. He regards the equality of the emissive and absorptive powers as establishing that these are two aspects of the same property. It should have been pointed out that this equality exists only when the powers are defined in a general way[3]. The conventional definitions[4], which give absorptive power as a pure number, but emissive power as a quantity with dimensions, obscure this equality.

The most important part of Prof. Dingle's theory seems to be the analogy between the three kinematical variables, displacement, time and velocity, and three thermal variables, entropy received by a certain instrument, 'thermal time', and what I will venture to call 'radiocity', though he calls it 'radiation temperature', or simply 'temperature'. It is certainly not the usual absolute temperature, as it is approximately proportional to its fourth power. The 'thermal time' is measured by a 'thermal clock', which records what in ordinary terms would be called the total amount of radiant energy received from a black body radiating at a constant rate. In terms of these variables, Stefan's law of radiation takes the form 'radiocity is rate of change of entropy', exactly analogous to 'velocity is rate of change of displacement'. Moreover, if the zero of 'radiocity' is changed, the three thermal variables are transformed by formulæ that correspond roughly (but not in detail) with the Lorentz transformation formulæ of Einstein's theory. Finally, there is an invariant thermal interval; but this involves an expression of the fourth degree in the differentials, whereas the kinematical interval of space-time involves only one of the second order.

Two applications of the theory are to the maximum efficiency of a heat engine working between fixed temperatures, and to the general equations of the thermo-electric circuit. It is difficult to find other applications, as there are few phenomena which depend only on temperature differences, do not appreciably alter the temperature, and are independent of the properties of particular substances. It is emphasized that the theory, at any rate in its present form, deals only with radiation; no claim is made that all thermal phenomena are independent of the zero of temperature.

Prof. Dingle concludes by indicating how the limitation of constant temperature might be removed. As in the extension of the special theory of relativity to the general theory, it would be necessary to deal with tensors, but in the thermal case the work would be much more difficult. Perhaps some enterprising young mathematician may care to tackle this. If Prof. Dingle's arguments are sound, they open up a new line of approach to the theoretical study of radiation and a new opportunity for the use of the tensor calculus. H. T. H. PIAGGIO.

[1] *Nature*, **153**, 731 (1944).
[2] *Phil. Mag.*, **35**, 499 (1944).
[3] Preston, "Theory of Heat" (4th ed.), 494.
[4] Preston, "Theory of Heat" (4th ed.), 541–42.

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

THE annual report of the Indian Association for the Cultivation of Science for the year 1943 includes the presidential address, the report of the committee of management, including lists of papers published in the *Indian Journal of Physics*, vols. 16 and 17 and in the *Proceedings* of the Association, and appendixes on the scientific work of the Association. The membership increased from 157 to 213 during the year, and of the latter figure 133 are life-members.

The report on the scientific work of the Association refers to a study of primary extra reflexions in Laue photographs, in which the exact location of the absolute maximum of each extra spot at different orientations of a crystal, the spread of the intensities of the spots along different directions, the change of maximum intensity with variation in the angle of incidence, and the deviation of the direction of maximum intensity from the planes of incidence are being studied. A closer study of the extra reflexions in Laue photographs of phloroglucinol crystals indicated that these reflexions are also of the secondary type and originate from the lattice degradations along the trigonal and the diagonal axes, and further investigations of this effect in benzil are in progress. Attempts are also being made to obtain accurate values of the atomic parameters in benzil crystals by a two-dimensional Fourier analysis.

Investigation of the magnetic behaviour of rare earth ions in crystals at low temperatures led to the conclusion that the paramagnetic units do not change with temperature, but the angle between the various paramagnetic units and the unit cells in these crystals