ten times as efficient as gamma-ray energy in its lethal effect on bean roots.

We gratefully acknowledge the financial assistance of the British Empire Cancer Campaign, and the loan of radium by the Medical Research Council.

Note added in proof. We are advised by a statistician, "It is not correct to say there is a 50 per cent chance that the true value of *p* corresponding to the dose lies in the range found in the manner described above. This cannot be done without the use of 'inverse probability', which is not justifiable in such cases as this". However, we have treated the data in the manner described on p. 243 of "Biological Effects of Radiation", Vol. 1, Duggar, with the same conclusion regarding the 50 per cent mortality dose.

L. H. GRAY.
J. READ.
J. C. MOTTRAM.

The Mount Vernon Hospital
and the Radium Institute,
Northwood, Middlesex.
July 29.

[1] Mottram, J. C., *Brit. J. Radiol.*, 8, 32 (1935).
[2] Spear, Gray and Read, NATURE, 142, 1074 (1938).
[3] Gray and Read, NATURE, 144, 439 (1939).

Formula for the Change of Velocity of Sound with Temperature

THERE appears to be no simple expression which satisfactorily represents the velocity of sound in air over normal ranges of temperature.

The formula

$$v = 331 \cdot 5 + 0 \cdot 56\, t,$$

in which v is the velocity in metres per second at a temperature $t°$ C., is accurate to three significant figures between $-40°$ and $100°$ C. Thus, at $100°$ C., the expression gives $387 \cdot 5$, which is correct to $0 \cdot 1$ per cent, and at $-40°$, 309, which is the value obtained from the Greely and Parry Antarctic measurements.

A. E. BATE.

Northern Polytechnic,
London, N.7.

Action of Copper Salts on Emulsions Stabilized by Sodium Oleate

DURING experiments on the effect of addition of electrolytes on emulsions of xylene in water stabilized by sodium oleate, we noticed that the xylene thrown out by copper salts was a clear, bright green or blue colour. The same colour was obtained if benzene, even the purest benzene, was used instead of xylene. On adding a quantity of copper salt equivalent to the sodium oleate present in the emulsion, benzene began to separate immediately and a certain amount of inverted emulsion was also formed, which, however, broke after some time. The separated water contained copper. On evaporation of the benzene a dark green, waxy solid was obtained, which on analysis gave a ratio of copper to oleate of 1 : 3·4 and contained some sodium. Dilute solutions of this solid in benzene were blue, more concentrated ones a bright emerald green.

Copper oleate prepared by the interaction of equivalent quantities of copper sulphate and sodium oleate in aqueous solution was, when first precipitated, insoluble in benzene. After allowing it to stand for some time it could be filtered off and obtained as a much paler green, waxy solid, which on analysis gave a ratio of copper to oleate of 1 : 2·05. After it had been kept for some time this solid would dissolve in benzene, presumably because it had lost some water, to give a solution identical in appearance with that obtained when breaking emulsions. Freezing point measurements, however, showed that these solutions were not identical. Copper oleate prepared in aqueous solution caused no depression of the freezing point of benzene (compare the work of Bhatnagar, Kapur and Hussain[1] on magnesium and zinc oleates) whilst the substance obtained on breaking an emulsion did depress the freezing point. Freshly precipitated copper oleate can be made immediately soluble in benzene by the addition of sodium oleate or oleic acid.

Now when our emulsion was completely broken, all the oleate was dissolved in the benzene, but not all of it as ordinary copper oleate, the ratio of copper to oleate being 1 : 3·4. Therefore one might expect that it would not be necessary to add a quantity of copper salt fully equivalent to the sodium oleate present in order to break the emulsion, but only 2/3·4 or 59 per cent of this amount. This expectation was not fulfilled—addition of this quantity of copper salt threw out only about one third of the benzene. We therefore conclude that the copper ion experiences some resistance to penetration to the oleate at the benzene-water interface, perhaps due to strongly attached sodium ions of the inner portion of the diffuse section of the double layer forming a practically continuous protective sheath of bound water around the benzene droplet.

The power of cations to overcome this resistance should be greater the less they are held back by their affinity for the aqueous phase, which affinity is indicated by their position in the lyotropic series. In our experiments on the partial breaking of emulsions by a number of electrolytes, we have found that the order of effectiveness of a number of cations did follow this series; for example, calcium chloride was less effective than strontium chloride, which was less effective than barium chloride, and zinc sulphate was less effective than magnesium sulphate.

A. R. MARTIN.
R. N. HERMANN.

Sir John Cass Institute,
Jewry Street, Aldgate,
London, E.C.3.
August 1.

[1] Bhatnagar, Kapur, and Hussain, *Proc. Ind. Acad. Sci.*, 9, A, 143 (1939).

Cholinesterase and Electrolytes

WE have found some effects of electrolytes on the activity of cholinesterase, which may explain the well-known effects of these electrolytes on irritability.

A purified preparation of cholinesterase from horse serum free from electrolytes was used in these experiments. 1 mgm. of the dry enzyme preparation hydrolysed about 100 mgm. of acetylcholine per hour. The esterase activity was measured manometrically.

Calcium and magnesium ions act as activators and potassium ions as inhibitors of cholinesterase. The effects of added calcium, magnesium and potassium depend on the concentration of the substrate; they are more pronounced at low concentrations of acetylcholine. At a concentration of 0·5 per cent of acetylcholine, the activity of the esterase is increased about 30 per cent by calcium or magnesium and decreased about 15 per cent by potassium. At