ascertain correct dose and frequency of both fluphenazine enanthate and orphenadrine. When the outpatient attends regularly there is the sure knowledge that he is taking the drug. He is motivated to take anti-Parkinsonian drugs by the presence of the side-effects.

Hicks and Ovenstone stress the side-effects, which we find are controllable. We feel that the value of the drug outweighs its disadvantages.—We are, etc.,

N. CAPSTICK.
J. E. OLIVER.

Graylingwell Hospital, Chichester.

SIR,—I feel I must comment on the letter of Drs. R. Hicks and Irene M. K. Ovenstone regarding the use of fluphenazine enanthate (29 October, p. 1071). I would have thought that they had really missed the point about this drug, which is not that it is more effective than other phenothiazines but that it can be given in a long-acting preparation. We have been studying it now for about a year at the Royal Edinburgh Hospital, and although we have only treated 10 patients we are convinced that it has some part to play in the management of some schizophrenic patients.

I think treating 13 chronic schizophrenic patients, as Drs. Hicks and Ovenstone did, was probably of little relevance to the appropriate use of this drug. As most workers in this field have found,[1] the problem of management after the acute episode is to persuade certain patients to go on with medication. There are many other patients who do so without trouble, but there are some patients who seem inevitably and repeatedly to discontinue their drugs. It is in this group that I would have thought fluphenazine offers a real possibility. We have not used a routine dosage of 15 mg. per day of the oral drug as this is too high for some patients. Like Drs. Hicks and Ovenstone we have used anti-Parkinsonian drugs routinely and have started with the half dose of the fluphenazine enanthate—that is, 12.5 mg. by intramuscular injection—and I would judge that half of the patients had responded well to this regimen, the other 50% showing excessive side-effects or not benefiting from the fluphenazine.

It should be remembered, however, that these patients were only put on the enanthate because they had failed to take their earlier phenothiazine drugs regularly.—I am, etc.,

A. D. FORREST.

Royal Edinburgh Hospital, Edinburgh.

REFERENCE

1 Renton, C. A., Affleck, J. W., Carstairs, G. M., and Forrest, A. D., *Acta psychiat. scand.*, 1963, **39**, 548.

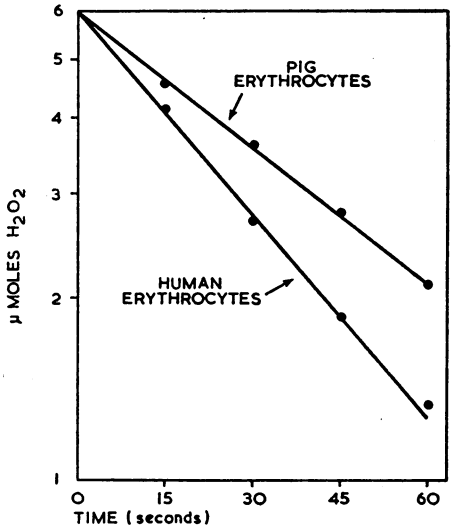
Hydrogen Peroxide for Oxygenation

SIR,—We have read with much interest the preliminary communication "Oxygenation of Cats by Hydrogen Peroxide During Temporary Ventilatory Arrest," by S. A. Feldman, J. R. Hoyle, and J. P. Blackburn (2 July, p. 28). It would seem to be worth while to briefly report our findings in a series of similar experiments on pigs.

In anatomy and physiology the pig is remarkably like man.[1] Pig's blood, like cat's blood, has a relatively high catalase activity, be it less than that of human blood (see Fig.). The pig would thus appear to be a suitable experimental animal to test the feasibility of body oxygenation by means of intravascular hydrogen peroxide infusion.

A solution of 3% H_2O_2 in 0.9% NaCl was infused directly into the right ventricle to ensure optimal mixing with the entire venous return. It was anticipated that gaseous oxygen evolving from catalase-decomposed hydrogen peroxide would rapidly combine with desaturated haemoglobin so that no intravascular bubbles would form as long as not all haemoglobin had been converted into oxyhaemoglobin. As an additional precaution, the experiments were initially performed in a hyperbaric chamber at ambient pressures of up to 4 atmospheres absolute. Since one volume of a 3% H_2O_2 solution liberates approximately 10 volumes of oxygen upon complete breakdown, approximately 0.4 ml./kg./min. (a volume equal to one-tenth of the estimated oxygen consumption[2]) was infused into the right ventricle of Dial (allobarbitone)-anaesthetized pigs which were rebreathing through a soda-lime cannister from a nitrogen-filled anaesthesia bag.

We have succeeded in keeping three out of the eight pigs, whose sole oxygen supply consisted of infused hydrogen peroxide, alive for 18 to 28 minutes, but all animals developed severe methaemoglobinaemia and none survived. In another series of eight experiments, this time performed at normal ambient pressure, oxygen uptake through the lungs was measured before and during infusion of relatively small volumes of 3% hydrogen peroxide in saline. To our surprise, the oxygen consumption of our anaesthetized pigs was from 10 to 12 ml./kg./min., or approximately three times as high as previously reported.[2] Oxygen uptake through the lungs of the oxygen-breathing pigs diminished by the calculated amount of oxygen liberated per minute by 100% decomposition of infused hydrogen peroxide. It was possible to supply approximately 20% of the oxygen consumed by means of intravenous hydrogen peroxide for periods up to one hour, with subsequent survival of three out of eight pigs. All pigs, however, developed methaemoglobinaemia, despite the fact that, in vitro, excessive amounts of hydrogen peroxide added to control samples failed to convert haemoglobin into methaemoglobin.



Decomposition of hydrogen peroxide by erythrocyte catalase from pigs and humans. Lysates containing equivalent amounts of haemoglobin were prepared from thrice-washed erythrocytes. Freshly drawn blood, collected in heparin, was used. Assays for catalase were carried out at 4° C. in 10 mM phosphate buffer, pH 6.8. Hydrogen peroxide was determined at the indicated time intervals by titration with permanganate. Each line represents the average rate obtained in erythrocytes from several different individuals.

This discrepancy between the effect on blood of hydrogen peroxide in vivo and in vitro is puzzling, and we cannot yet offer an explanation for this phenomenon. Feldman and his colleagues have attributed similar findings in their cat experiments to catalase depletion as a result of frequent blood sampling, but such an explanation seems inadequate in pigs with a relatively large blood volume, as compared with the total volume of blood withdrawn for sampling. In conclusion, we feel that intravascular hydrogen peroxide infusions temporarily to improve deficient arterial oxygenation in man may be possible to a limited extent, but for the time being would be a hazardous undertaking.—We are, etc.,

JOHANNES A. KYLSTRA.
ROBERT L. FUSON.
PAUL HOCHSTEIN.

Duke University Medical Centre, North Carolina, U.S.A.

REFERENCES

1 Bustad L. K., *Scientific American*, 1966, **6**, 94.
2 Dittmer, D. S., and Grebe, R. M., eds., *Handbook of Respiration*, 1958. Natl Acad. Sci.-Natl Res. Council. Saunders, Philadelphia.

Infectious Hepatitis

SIR,—Regarding the recent Clinico-pathological Conference on a case of infectious hepatitis (29 October, p. 1057), I would think that the moral is "Don't have your subclinical attack of hepatitis just prior to Christmas." You are very likely, as this lady may well have done, to consume more alcohol than all the year round. The timing of the patient's illness is highly suggestive.—I am, etc.,

G. R. CLARKE.

Kettering, Northants.

SIR,—In a letter of 29 October (p. 1072) Dr. B. Arora raises the question of the immediate mortality in epidemic infectious hepatitis. Her figure of eight deaths among 2,507 cases in the Bristol epidemic of 1960–3 gives a mortality of 0.3%, corresponding with the figures quoted by Lucke[1] of 0.12–0.4%. This level of mortality probably represents that found in the past 50 years in this country.[2] The disease had also been of great military importance in both world wars, and it is of interest that my late father, who was consulting physician to the Army in Mesopotamia in the first world war, quoted the mortality among troops in that campaign in 1917 and 1918 as 0.73% among 6,300 cases.[3] Details were as follows:

Troops	Cases 1917	Mortality %	Cases 1918	Mortality %
British ..	1,538	0·6	865	1
Indian ..	2,633	0·3	1,264	1·5

It is remarkable that the mortality among troops in 1917 was so low considering that they were living under most arduous conditions on hard rations in active warfare in one of the hottest climates in the world. The mortality in the Delhi epidemic of 1955–6 must have been difficult to estimate, as in such a city many of the fatal cases probably