Two 100 cc samples of ordinary distilled water were then given a similar treatment, except for the final refluxing, which was omitted. The results are shown in Table II. The high values first obtained with

TABLE II

BECKMANN READINGS AT WHICH THE FLOAT BALANCED IN PURIFIED ORDINARY WATER

	Sample 1	Sample 2
Direct from still	3.289 ± 0.001°	3.282 ± 0.002°
After boiling out	3.289 ± 0.002	3.279 ± 0.002
Following one more distillation without $KMnO_4$	3.280 ± 0.001	3.280 ± 0.001
Value chosen	3.280 ± 0.002	

Sample 1 were apparently due to a little contamination by spray carried over in the first distillations, as evidenced by the result obtained after a fourth distillation. Accordingly, the first two readings on this sample were disregarded in obtaining the final average.

From these results we take Δ T, for the butane sample as compared with ordinary water, as 0.032 (± 0.003° C.) which is equivalent to 8.3 (± 0.7) ppm. excess in density. It is probable that a portion of this density increment is due to O^{18} enrichment in the tank oxygen which was used.[6, 7] If the heavy oxygen enrichment in our tank oxygen corresponded to that of Smith,[6] the density increase due to deuterium would then be 6.1 ppm. It is improbable that our oxygen would differ from this enough to be significant in the conclusions which we may draw.

On the basis of Bleakney and Gould's[8] work which fixes the deuterium/hydrogen ratio in ordinary water at 1 to 5,000, corresponding to a 21 ppm. influence on the density of ordinary water as compared with pure protium water, the 6 ppm. density increase in the water of combustion from butane corresponds to a 30 per cent. increase in deuterium.

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THE RESPONSE OF THE NORMAL GUINEA PIG TO THE ADMINISTRATION OF LIVER EXTRACTS[1]

NUMEROUS attempts have been made in the past to obtain a valid biological indicator of the hematopoietic activity of liver extracts which are therapeutically potent in pernicious anemia. As far as the writer is aware, this has not been accomplished. The phenomenon which is briefly described in the present communication consists in a rise in the percentage and in the absolute number of reticulocytes in the peripheral blood of a majority of normal guinea pigs, following the oral or parenteral administration to them of any therapeutically active liver extract. The capacity to react in this fashion to subsequent injections of such an extract is apparently maintained indefinitely. This reaction is exceedingly sensitive, for the minimum amount of fresh porcine liver, from which the extract is derived and which will evoke a response, is in the neighborhood of .6 mg per kilogram of guinea pig. This amount of liver is equivalent to one Guinea Pig Unit (G.P.U.) of hematopoietic activity; conversely, one hundred grams of fresh porcine liver may be said to contain approximately 164,000 G.P.U. That the reticulocyte response of the reactive guinea pig is intimately related to the true hematopoietic action of liver in pernicious anemia is rendered highly probable by numerous control experiments. The best evidence that the response is concerned solely with the hematopoietic materials in liver is furnished by the facts that the extract of the liver of a patient dying in a relapse of pernicious anemia, when assayed on guinea pigs, effected no demonstrable response, yielding an activity of less than 12 G.P.U. per 100 gm of fresh liver, whereas the liver of a non-anemic patient, when extracted and assayed in an identical fashion, showed an activity of approximately 164,000 G.P.U. per 100 gm of liver.

The response of the normal guinea pig to liver extracts may well be conditioned by the fact that such animals, both reactive as well as non-reactive ones, possess a richly megaloblastic bone marrow. Two sets of experimental results further offer evidence that the reactive guinea pig is endowed with a deficiency state that simulates the condition in pernicious anemia. In the first place, an extract of a reactive guinea pig's liver, when assayed on reactive animals, exhibited a hematopoietic activity of only 31,000 G.P.U., while the extract of a non-reactive animal's liver showed an activity of 164,000 G.P.U. Secondly, a mixture of Castle's intrinsic and extrinsic factors, when administered orally to guinea pigs in the form of normal human gastric juice and beef muscle, elicited a reticulocyte response differing in no way from that following the administration of therapeutically active liver extracts; while the extrinsic factor alone, or extrinsic

[6] Smith, *Jour. Chem. Physics*, 2: 298, 1934; SCIENCE, 79: 454, 1934.
[7] Klar and Krauss, *Naturwiss.*, 22: 119, 1934.
[8] Bleakney and Gould, *Phys. Rev.*, 44: 265, 1933.

[1] This investigation has been aided by grants from the Council on Pharmacy and Chemistry of the American Medical Association, and from the William W. Wellington Memorial Research Fund of the Harvard Medical School.

factor together with gastric juice inactivated by heat, provoked no response.

The foregoing facts partially explain why certain normal guinea pigs exhibit a hematopoietic reaction to the administration of liver extracts. This response is a tool which may prove its usefulness in the quantitative assay of the therapeutic potency of commercial liver extracts, and in various studies concerning the physiology of hematopoiesis and the pathogenesis of pernicious anemia.

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THE ANAEROBIC CONDITION OF SOILS IN POROUS PORCELAIN CONTAINERS

IT has generally been assumed that one of the virtues of porous clay pots for plant containers is that the material provides for the aeration of the soil through the walls of the pot. Jones[1] has demonstrated the fallacy of this assumption and his conclusions are strikingly supported by data obtained in some soil potential studies.

In an attempt to measure the potentials of soils in pots in the presence of growing plants it was thought advisable to protect one series of buried electrodes from contact with plant roots. The device used was to place ordinary bright platinum foil electrodes on glass stems into the same soil as that contained in the pot in porous porcelain capsules sealed at the top with picein.

These and the same type of electrodes without protection were imbedded in soil in one-gallon pots at a depth of about four inches. The soil in the pots was kept at a uniform moisture content of about 50 per cent. saturation. Potential measurements were made after the electrodes had been in place about a month. A saturated KCl-calomel electrode was placed in contact with the soil at the surface.

Considerable work with soil potentials has shown that aerated soils will give Eh values ranging from +.4 to +.7 volts, depending on the hydrogen ion concentration and the technique employed. Potentials below +.1 volts indicate an extreme anaerobic condition.

In the work under discussion the potentials listed in Table 1 were taken from a number of pots with different treatments.

It was anticipated that the electrodes exposed to plant roots would be negative to those enclosed in the porous porcelain capsules. The reverse was found to be true and the magnitude of the difference indicates an extreme anaerobic condition in the latter.

TABLE 1

POTENTIALS OF SOILS AT BARE AND PROTECTED ELECTRODES

Soil acidity	Potential (Eh) of electrode		Potential difference
	Bare	Protected	
pH	Volts	Volts	Volts
6.9	+.56	−.26	.82
6.8	+.60	−.14	.74
6.75	+.58	−.08	.66
4.6	+.72	−.11	.83
4.6	+.96	−.19	1.15
4.6	+.73	−.04	.77

The results indicate that oxygen does not dissolve and diffuse through the moisture in the walls of the capsule rapidly enough to supply the microorganisms in the soil within the capsule. They should be applicable to any static moisture film. The thickness of the film, the activity of microorganisms and the movement of the film either by convection or flow would govern the difference.

This evidence is a by-product of an investigation that was originally planned with another objective. It is one of many instances of the utility and versatility of the potentiometric method of studying soil properties.

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[1] Linus H. Jones, "Aeration of Soil in Plant Containers," *Florists Exchange and Horticultural Trade World*, 79: 11–39, 1932.

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