cava connecting with the liver of a healthy animal were rapidly cannulated, the hepatic artery was tied and the organ was removed. It was submerged at once in a bath of paraffin oil at 40° C., and connected with the circulation of the liverless animal by means of the cannulae already present in the carotid artery and jugular vein of the latter. In this way the circulating blood of the liverless animal was passed for as long as an hour through the freshly removed liver of the healthy rabbit.

Of 14 experiments 4 were carried to completion without lapses of technique which might render the findings questionable. In none of the 14 did clinical improvement of the liverless animals take place though the "transfused" liver was actively functioning as shown by a copious formation of bile.

Cross transfusions. The effect was next studied of cross transfusions between normal rabbits and liverless ones showing the signs of advanced hepatic insufficiency. Of 15 such experiments 5 were completed without technical lapses. In 2 of these latter the blood, leaving by cannula in the proximal end of a carotid artery of each animal, entered the circulation of the other one through a cannula placed in the distal end of its carotid. In the 3 remaining instances, cross transfusion was performed from the carotid artery of the one animal to the jugular vein of the other. The rabbits receiving the blood from hepatectomized individuals in these ways over periods up to an hour and a half showed no ill effects; but, on the other hand, the symptoms of liver deprivation were not ameliorated nor death in consequence of it deferred. This held true in all 15 cases.

From the findings here reported, the late changes after liver deprivation, those leading to death, would appear to be irreversible.

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Glucose Requirement of Hepatectomized Rabbits and Its Relation to Lactic Acid Production.

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We have previously reported[1] on the minimal glucose requirements of the hepatectomized rabbit during the first 6 to 8 hours after operation. During that period, a constant intravenous injec-

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[1] Drury, D. R., and McMaster, P. D., *J. Exp. Med.*, 1929, xlix, 765.

tion at the rate of 125 mg. of glucose per kilo per hour will maintain a normal blood sugar level. The oxygen consumption of these animals indicated that they would have required 500 mg. glucose per kilo per hour if their energy requirements had been entirely supplied by glucose. The difference between these two figures represents mainly the amount of fat oxidized, expressed as its glucose equivalent. The respiration quotients of approximately 0.77, in these animals, bears out this assumption.

The blood sugar level can be maintained in liverless animals for periods up to 15 hours after operation by the injection of glucose at the rate above mentioned. Eventually, however, the blood sugar begins to decrease and the amount of glucose must be increased to bring it back to normal. Thereafter added increases must be made at least every hour to maintain the blood sugar level. Finally, a rate of about 500 mg. glucose per kilo per hour is arrived at, which is the maximum amount ever required and one on which the normal sugar level can be maintained until the animals die.

It is at the time when the first increase in the quantity of glucose is required that the symptoms of the so-called second stage after hepatectomy develop. At its beginning there is restlessness and irascibility, then blindness and ataxia, followed by extreme weakness, and coma. We noticed that the lactic acid content of the blood became higher as the second stage progressed and it seemed pertinent to ascertain whether the increase in the glucose requirement of the liverless animal is due to an incomplete utilization of glucose by the organism, with the production of lactic acid.

It has been found that when both the liver and kidneys of a rabbit are removed the blood lactic acid drops slowly during the first 8 to 15 hours from the rather high level consequent on etherization. Then, as the second stage develops, the lactic acid begins to mount again and rises about 70 mg. per 100 cc. on the average during this period, the maximum rise noted being 150 mg. The intravenous injection of 100 mg. per kilo of dextro-lactic acid (injected as calcium lactate) into the hepatectomized, nephrectomized rabbit raises the blood lactic acid about 50 mg. per 100 cc. This suggests that the rise of 70 mg. in the blood lactic acid during the second stage after hepatectomy would be caused by production of about 150 mg. lactic acid. This increase takes place over a period of from 5 to 8 hours, giving an average lactic acid production in the animal of some 30 mg. per kilo per hour. Since one mg. lactic acid results from the breakdown of one mg. glucose, the production of this small amount of lactic acid cannot be held to account for the large increase of glucose consumption, which amounts during the last hours of life to 375 mg. per kilo per hour. The explanation of the increase must be sought in other directions, either in the incomplete breakdown of glucose to form other products than lactic acid, or in an inability of the animal to utilize fat as at first. There is no evidence of an increased metabolic rate during this period.

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The Relation of pH Value of Medium to Selective Bacteriostatic Action of Dyes.*

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Several years ago experiments were carried out in this laboratory to determine whether changes in pH value of the medium with which the experiments were conducted would alter the character of the selective bacteriostatic activity of gentian violet. In these experiments, the results of which were never published, a series of divided plates with the following pH values were planted with *B. coli, B. anthracis, Staphylococcus* and *B. prodigiosus:* 5.4, 6.4, 6.6, 7.4, 7.6, 7.8, 8.8 and 9.3. The upper halves of the plates contained gentian violet in a strength of 1 to 200,000. On all the plates from pH 6.4 to pH 9.3 selective action of the dye took place exactly as on media of pH 7.2; growth of the Gram positives was inhibited, growth of Gram negatives was unaffected. At pH 5.4 no growth of any organism occurred even on the plain agar. Means were not then at hand for buffering the media in the alkaline range beyond 9.3 but in plates made of media to which large amounts of alkali had been added, certainly sufficient to give a pH well beyond 10, no growth occurred even on the plain agar. The conclusion was reached that, within the range of growth, pH of media was not a factor in determining the character of selective action of gentian violet.

The recent publication of Dubos[1] in which the suggestion is made that some of the inhibitory dyes owe their power of inhibition to the fact that they poise the media at an oxidation potential outside the range in which the inhibited organisms can grow, made it seem wise to repeat our earlier experiments. Divided agar plates, the

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[1] Dubos, Réné, *J. Exp. Med.*, 1929, xlix, 575.