that this fraction is able to neutralize biotin *in vitro* and that this action is due to the formation of a fairly stable compound. Thus egg-white injury is explained by the unavailability of biotin because of its fixation to the avidalbumin. It can be assumed that in the presence of avidalbumin biotin is not even absorbed from the intestinal tract and is excreted with the feces. This would then also throw light on the question why biotin should exert a potency three to five times higher in parenteral administration than in oral.[9]

From one point of view egg-white injury is a secondary deficiency disease and belongs in the same group as deficiency manifestations in sprue, for instance, or in other chronic diarrheic conditions. It also bears some similarity to the possible effect of long-continued medication of mineral oil on the vitamin A (carotene)[10] and vitamin D[11] reserves of the body, with the important distinction, among others, that in contrast to avidalbumin mineral oil is not a regular food constituent.

The mechanism of egg-white injury appears to represent a hitherto unknown principle in the production of disease.[12]

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THE EXCRETION OF INJECTED HEPARIN IN THE URINE OF MICE AND DOGS

THERE is some controversy in the literature as to whether heparin is excreted in the urine following its intravenous injection. Howell and McDonald[1] and Wilander[2] reported that heparin is excreted by the kidney. Jaques[3] on the contrary recently reported that heparin does not appear in the urine. We, therefore, tested the urine of heparinized mice and dogs for the presence of heparin.

METHOD

According to Lison[4] the purple color obtained with toluidine blue is specific only for sulfuric acid esters of high molecular weight. Jorpes and Bergström[5] considered heparin to be a mucoitin polysulfuric ester and Jorpes[6] tested this metachromatic reaction on heparin solution. He found that the color with heparin is about one hundred times more intense than with chondroitin sulfuric acid.[7] We confirmed his observations and moreover found that the heparin of the Connaught Laboratories (110 units per mgm) was about 1,100 times more intense than chondroitin (Wilson and Company). The method is very simple: 0.5 cc of toluidine blue in distilled water 1:5000 is added to 0.5 cc of diluted or undiluted urine. If heparin is present a purple color results. A precipitate is gradually formed and after 30 minutes its density is compared with a series of standard solutions containing 1 to 6 units of heparin to the same amount of normal urine. Two hundred to 1,000 units of heparin per 20 grams weight were injected subcutaneously into 11 mice. Three to 6 hours after the injection the urine showed a purple color with toluidine blue. One hundred and 200 units of heparin per kgm of body weight were injected intravenously into 12 dogs. Samples of urine were obtained before heparinization and one hour after the heparin was injected.

RESULTS

Normal urine never showed the purple reaction whereas the urine of the heparinized animals always developed a purple color. The estimated number of units of heparin could be computed to the volume of urine obtained by catheterization. It was thus possible to measure in a certain time interval the approximate amount of heparin excreted by the kidneys. As further proof, the urine was also tested for its anticoagulant action upon blood. It was found that urine from heparinized dogs prolonged the coagulation time of blood whereas urine from the same dogs before heparinization did not.

We conclude that heparin injected subcutaneously in

[9] P. György and C. S. Rose, *Proc. Soc. Exp. Biol. and Med.*, 43: 73, 1940.

[10] A. C. Curtis and P. B. Horton, *Am. Jour. Med. Sci.*, 200: 102, 1940; M. T. Burrows and W. K. Farr, *Proc. Soc. Exp. Biol. and Med.*, 24: 719, 1926–27; R. A. Dutcher, J. O. Ely and H. E. Honeywell, *Proc. Soc. Exp. Biol. and Med.*, 24: 953, 1926–27; R. A. Dutcher, P. L. Harris, E. R. Hartzler and N. B. Guerrant, *Jour. Nutrition*, 8: 269, 1934.

[11] M. C. Smith and H. Spector, *Jour. Nutrition*, 20: 19, 1940.

[12] Aqueous solution of tobacco mosaic virus (containing 25 mg per cubic centimeter), kindly furnished by Dr. W. M. Stanley, Rockefeller Institute, Princeton, N. J., has been tested for its biotin-binding capacity. The test showed (1) that the virus did not inactivate biotin in so far as the yeast is concerned and (2) that no appreciable amount of biotin is freed by heating the virus in solution.

[1] W. H. Howell and C. H. McDonald, *Bull. Johns Hopkins Hosp.*, 46: 365, 1930.

[2] O. Wilander, *Skandinav. Arch. f. Physiol.*, 81: Suppl. xv, 1939.

[3] L. B. Jaques, *Am. Jour. Physiol.*, 125: 98, 1939.

[4] L. Lison, *Compt. rend. Soc. de biol.*, 118: 821, 1935; *Arch. de Biol.*, 46: 599, 1935; *Bull. Soc. chim. biol.*, 18: 225, 1936.

[5] E. Jorpes and S. Bergström, *Jour. Biol. Chem.*, 118: 447, 1937.

[6] E. Jorpes, *Acta med. Scandinav.*, 88: 427, 1936.

[7] E. Jorpes, *Acta med. Scandinav. Suppl.*, LXXXIX: 139, 1938.

very large quantities or intravenously in moderate quantities is partly excreted by the kidneys.

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THE ARTIFICIAL SYNTHESIS OF A 42-CHROMOSOME WHEAT

COMMON wheat, *Triticum vulgare,* and the related species, *T. Spelta* and *T. compactum,* form a natural group (usually called the *vulgare* group) which is believed to have originated by crossing between a wheat of the emmer type and a species of the related genus *Aegilops*. This origin was first suggested by Percival on purely taxonomic grounds. Later it received strong support from genetical and cytological evidence.

The different species of both *Triticum* and *Aegilops* have their chromosome numbers in multiples of seven. The emmer wheats are tetraploid (2n = 28) and the *vulgare* group hexaploid (2n = 42). Cytogenetic studies show that all the fourteen haploid chromosomes of emmers have homologues among the twenty-one of *vulgare* and spelt. The remaining seven in the latter must, if our hypothesis of the origin of *vulgares* is correct, have come from *Aegilops*. And cytological evidence is not lacking that some species of *Aegilops* contain a set of chromosomes which are homologous with these seven.

Crossing a species of wheat which has fourteen haploid chromosomes (emmer) with one of *Aegilops* which has seven, produces a completely sterile hybrid which has twenty-one. If doubling of the chromosomes were to occur in the sterile hybrid, the somatic number (42) of the *vulgare* group would be produced, fertility should be restored, and, if the hypothetical origin of *vulgares* is correct, the characters might be expected to resemble those of *vulgares*.

Accordingly, *T. turgidum* (n = 14) was crossed with *A. speltoides* (n = 7). The seedlings were treated with colchicine to induce chromosome doubling. A special colchicine technique involving repeated daily injections with a hypodermic needle proved successful. A considerable number of heads on two different plants were found to have the doubled number. These heads with forty-two chromosomes showed nearly normal chromosome behavior (twenty-one pairs). They were fully fertile.

Several offspring from these heads have been raised to maturity. Their chromosome number is that of the *vulgare* group of wheats; their chromosome behavior is nearly regular; their fertility is reasonably good. They also have some of the characters of the *vulgare* group; this is true with respect to laxity of head, pubescence of leaves, shape of glume, shoulder and tip of glume and development of keel. In certain respects spelt resembles some of the 28-chromosome wheats more than it does *vulgare,* and in some of these points the synthetic type resembles spelt, notably in form and fragility of head and adherence of glumes. In certain other characters, such as the diameter and solidity of the stem, the new type resembles the emmers rather than either *vulgare* or spelt.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN ANTIMONY ELECTRODE FOR THE CONTINUOUS RECORDING OF THE ACIDITY OF HUMAN GASTRIC CONTENTS*

THE pH of gastric contents has been determined *in situ* by Eyerly and Brenhaus[1] for human beings and by Flexner and Kniazuk[2] for dogs. In both investigations the glass electrode was used. The disadvantages of using this electrode lie in the serious difficulty of adequately insulating the leads from the electrode, since the resistance of this insulation must exceed that of the glass electrode and the large size and inflexibility of the tubes that must be passed into the stomach.

The method for measuring the pH of gastric juice described here overcomes these difficulties by substituting for the glass electrode an especially prepared antimony electrode. No elaborate precautions are required for insulation. The electrode is 5 mm in length and 1 mm in diameter and the rubber tube containing the leads, which are 3 strands of No. 43 copper wire, is only 1 mm in diameter and entirely flexible. The electrode is swallowed without any difficulty and can be retained in the stomach for a long period of time without the slightest discomfort to the subject.

The potential of the antimony electrode is measured against a calomel half cell connected to saline in a basin into which the subject places a foot. The pH is recorded with any convenient type of measuring apparatus; for the record given here, a Leeds and Northrup continuous recording potentiometer was used.

[8] Aided by a grant from the Dazian Foundation for Medical Research.

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[1] J. B. Eyerly and H. C. Brenhaus, *Am. Jour. Digest. Dis.*, 6: 187, 1939.

[2] I. Flexner and M. Kniazuk, SCIENCE, 90: 239, 1939.