the amounts which Seibert and Mendel injected[7] to produce characteristic fevers.

The results give additional support to the conclusion of Seibert[4] that bacteria are responsible directly or indirectly for the production of fever upon the introduction into the circulation of substances foreign to it. Her conclusions came as the result of an exhaustive study of the fever-producing substances in distilled waters. The work of Rademaker[8] likewise confirms her hypothesis. Barkan and Nelson[9] studied the cause of the febrile reactions following injections of milk and concluded that bacteria or products of bacterial action and not the proteins of the milk were pyrogenic. The work reported here indicates that the proteins of the navy bean are not pyrogenic *per se* but that they are easily contaminated. Injected extracts prepared from navy beans produce a slight or a strong fever reaction, depending upon the degree of bacterial contamination.

Summary. A method is presented for preparing a strongly hemagglutinating, non-pyrogenic extract from navy beans. This extract is high in protein content. The method demonstrates that the proteins of the bean which may be extracted by water are not fever-producing unless contaminated by bacteria or products of bacterial action.

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Oxygen Consumption by Acidified Tissues.

JOSEPH NEEDHAM. (Introduced by William R. Amberson.)

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Amberson, Armstrong and Root[1] have described a curious phenomenon; the persistence of oxygen consumption without carbon dioxide production in acidified tissues. *Fundulus* eggs, for instance, continued to take up some 7 to 14% of the oxygen which they had previously been consuming in normal respiration. This residual oxygen-uptake persisted after neutralization of the acid, and was not affected by KCN or by high temperatures.

In recent experiments[2] on the respiration and respiratory quotient

[7] Seibert and Mendel, *Am. J. Phiysiol.*, 1923, **67**, 105.

[8] Rademaker, *Ann. Surg.*, 1930, **92**, 195.

[9] Barkan and Nelson, *J. Am. Med. Assn.*, 1924, **82**, 190.

[1] Amberson, Armstrong and Root, PROC. SOC. EXP. BIOL. AND MED., 1931, **29**, 31.

[2] Needham, *Proc. Roy. Soc. London*, B, 1932.

of the embryo and the extra-embryonic membranes of the hen's egg, a similar phenomenon has been observed. These experiments were carried out in Warburg manometers fitted with the cups designed by Dickens and Simer,[3] and the procedure in determining a respiratory quotient was essentially that laid down by the latter investigators. Three manometers are used, 2 of which contain similar pieces of tissue, while the third contains the solutions alone. The cups have an annular trough containing baryta, and a side-bulb containing 2.5N HCl. Manometer 1 gives the oxygen-uptake of its tissue by a steadily increasing negative pressure, and when the acid is tipped at the end of the experiment, the carbon dioxide due to respiration, that bound in the tissue at the beginning, and that contained in the solutions, give together a large positive pressure. The 2 non-respiratory quotas of carbon dioxide are given by manometers 2 and 3 respectively, which are tipped at the beginning of the experiment and show, in one case, the carbon dioxide of tissue and solutions together, in the other case, the carbon dioxide of solutions alone.

The phenomena here reported were often seen in manometer 2, for although respiration was expected to cease on acidification, it was common, though by no means invariable, to note a continuous small development of negative pressure. Thus, to take a typical instance (Exp. 357, 5-day chick embryo in Ringer-phosphate-glucose medium, atmosphere of pure oxygen, bath at 36°), the bound CO_2 in tissue and solutions gave at the beginning of the experiment, a positive pressure of +2.15 cm. Brodie fluid. But during the succeeding period of 4 hr. 35 minutes, during which the manometer 1 was developing a negative pressure of —6.95 cm. the acidified cup also developed a negative pressure amounting to —0.55 cm. As the weights of the embryos were almost identical, the "respiration" of the acidified embryo was about 7% of the normal one, *i. e.*, a residual oxygen consumption of exactly the same order as that reported by Amberson, Armstrong and Root.

The effect has been observed not only with avian tissues (embryo up to the 6th day of incubation, yolk-sac, blastoderm), but also with the eggs and embryos of the shore-crab, *Carcinus moenas*. Amberson, Armstrong and Root do not offer any explanation for it, but the following possibilities should probably be kept in mind. Oxygen-consumption without carbon dioxide production may theoretically arise from (a) the oxidation of organic sulphur to sulphate, (b) the transformation of lactic to pyruvic acid, and of glucose to

[3] Dickens and Simer, *Biochem. J.*, 1930, **24**, 905.

glycuronic acid, (c) the formation of acetoacetic acid from fat, (d) the oxidation of reduced glutathione, (e) the oxidation of lipoids (*c. f.* their spontaneous decomposition in air). No doubt the effect is due to a combination of these factors.

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Resistance of Glucose Urea to Urease and Other Enzyme Action; Non-Absorbability of Glucose Urea from the Jejunum.

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In studying the mechanism of urease action, it would be of interest to find a derivative of urea that would be hydrolyzed in the presence of urease. Urease is very specific in its action and urea appears to be its only substrate. Closely related compounds such as amides or purines as well as simple derivatives of urea are not attacked by this enzyme. Armstrong and Horton[1] found that substitution in the urea molecule with methyl or ethyl groups invariably rendered the substituted urea inaccessible to urease. Schoorl[2] synthesized glucose-urea, in which one molecule of urea was united with one molecule of the sugar. This compound is very soluble in water and is stable in solution. When heated with acid it undergoes hydrolysis with the formation of δ-glucose and urea. Johnson and Bergmann,[3] in their recent researches on nitrogenous glucosides have prepared glucose urea, and Dr. Johnson generously placed at our disposal a very pure sample of glucose urea for investigation. We have studied the action of urease on this urea derivative.

Jack bean urease was found to have no ability to decompose glucose urea. There was no ammonia production in 10 minutes when urease was added to 0.2 M solutions of this compound. However, if glucose-urea was hydrolyzed by acid prior to the addition of urease, ammonia production occurred at a rate comparable to that observed when a 0.2 M solution of urea and glucose was exposed to urease. The results (Table I) clearly demonstrate that the inability of urease to split glucose urea must be ascribed to the chemical

[1] Armstrong, E. F., and Horton, E., *Proc. Roy. Soc.*, Series B, 1912, **85**, 109.

[2] Schoorl, M. N., *Rec. Trav. chim. Pays-Bas*, 1903, **22**, 1.

[3] Johnson, T. B., and Bergmann, W., *J. Am. Chem. Soc.*, 1932, **54**, 3360.