Both kidneys were cut in serial sections and the total number of renal corpuscles in each kidney was counted by Kittelson's method. In the right kidney, originally removed by operation, 8453 fully formed corpuscles were counted. There were also many (uncounted) corpuscles observed in various stages of formation in the peripheral, nephrogenic zone of the renal cortex. In the hypertrophied left kidney, removed later at autopsy, 26,779 corpuscles were counted. This is but slightly above the number in the normal rat of this age and body weight as found by Kittelson (25,930) and by Arataki (female, 24,435).

This difference is so small that it probably represents insignificant individual variation, rather than an actual increase in the number of corpuscles. We may, therefore, conclude that there is apparently no hyperplasia of the renal corpuscles in the albino rat, even when unilateral nephrectomy is performed at a very early age, during the period when the new formation of corpuscles is still actively in progress.

Whatever may be the factor or factors which determine the number of renal corpuscles (and tubules) formed in the nephrogenic blastema, it is evident that this phase of the developmental process is not influenced by the functional changes resulting from unilateral nephrectomy.

[1] Arataki, M., *Am. J. Anat.*, 1926, xxxvi, 437.

[2] Kittelson, J. A., *Anat. Rec.*, 1917, xiii, 385.

[3] Donaldson, H. H. The rat. Reference tables and data. 2nd ed. Wistar Institute of Anatomy. Phila. 1924.

3636

Study of Reversible Oxidation of Adrenaline and Its Derivatives.

EDWARD C. KENDALL AND EDGAR J. WITZMANN.

Section of Biochemistry, The Mayo Foundation, Rochester, Minn.

Ephedrine, adrenalone, methylacetopyrocatechol, dimethylacetopyrocatechol, adrenaline, the ethyl and methyl ethers and the anhydride of adrenaline were investigated to see whether (a) they would be oxidized by dibromophenolindophenol, naphtholidichloroindophenol, methylene blue and indigo carmine; (b) whether the oxidized forms would act as oxidizing agents with reduced indigo; (c) whether they formed reversible oxidation-reduction systems; (d)

whether under any conditions they would function as cyclic catalysts.

All of the eight substances, except ephedrine, are oxidized by dibromophenolindophenol. Adrenaline and its ether derivatives are oxidized by only the last mentioned oxidizing dye. Adrenalone, methylacteopyrocatechol, and dimethylacetopyrocatechol are oxidized by naphtholdichloroindophenol and indigo carmine. Adrenalone and methylaminoacetopyrocatechol are oxidized by all of the dyes. Dimethylacetopyrocatechol is not oxidized by methylene blue, but is oxidized by indigo carmine. These results emphasize the fact that the configuration of the oxidizing dyes is of greater importance than the intensity of oxidation produced by the dye.

Adrenalone, methyl and dimethylacetopyrocatechol will oxidize reduced indigo after they have been oxidized with the dyes. The oxidation is quantitatively reversible. Adrenaline and its ethers cannot be reversibly oxidized. The probable point of attack of the oxidizing agent in all of these compounds is the two hydroxyl groups on the benzene ring, with the formation of an ortho-quinone. This derivative of adrenalone can be reduced, but, with adrenaline some other part of the molecule absorbs the oxidizing power of the ortho-quinone, resulting in an irreversible reaction. At a pH of 7.4 and in the presence of a third component, adrenaline will act as a cyclic catalyst bringing about the oxidation of adrenaline with molecular oxygen. The essential configuration of the third component has not been determined, but it is prepared by the action of sodium hydroxide on glucose.

Although adrenaline and its derivatives can be oxidized, they do not have a characteristic effect on the platinum electrode and they do not form oxidation and reduction systems in which the oxidized and reduced forms are in equilibrium. It has been shown that the potential of any solution is not determined by the ratio of the oxidized to the reduced form, and that an unstable oxygen addition-product is apparently the most important factor establishing the absolute value of the potential of the solution containing these substances. Oxygen and hydrogen dioxide do not oxidize this series of compounds, they do, however, appear to form some type of addition-product which is stable for many hours, and which has a determining influence upon the equilibrium point of the solutions, which is within limits independent of the ratio of the oxidized to the reduced forms.

This is a preliminary report.