The presence of the growth-promoting principle in the globulin group is in accord with the observation of Evans that alkaline extractives are most efficient. Further after the addition of twenty volumes of water to a paste of ground glands, the growth effect appears to be in the water-insoluble fraction which further suggests the adsorption with or identity of this substance with the globulin and water-insoluble group of proteins. It is interesting that the growth-promoting principle is destroyed by about the same temperature as that at which this group of proteins is denatured.

SUMMARY

(1) The growth-promoting principle of the anterior hypophysis may be salted out of the more crude extracts by means of sodium sulphate.

(2) Attempts to further fractionate the globulin group of proteins in which the growth-promoting principle comes down resulted in a division of the substances between the fractions.

HAROLD M. TEEL

SURGICAL LABORATORY,
HARVARD MEDICAL SCHOOL

SPECIAL ARTICLES

THE FIRST SPECTRUM OF XENON[1]

A NEW list of estimated intensities and measured wave-lengths has been obtained for about 300 lines characterizing the first spectrum of xenon. The observed wave-lengths range from 3442.7A in the ultra-violet to 9923.10A in the infra-red. Spectral terms which account for practically all of these lines have been identified. The largest term is $^1S_0$ (p_0) representing the normal state of the neutral atom. The value of this term in xenon is 97835; from it the ionization potential of 12.078 volts is derived. In the notation introduced by Paschen in his analysis of neon the main atomic energy levels may be grouped as four s-terms, ten p-terms and twelve d-terms. These in turn are each separable into two subgroups coordinated to the two $^2P_{2,1}$ levels of the rare gas ion. The absolute values of the four s-terms and of the set of p-terms related to the lower level of the Xe^+ ion are as given.

2	$1s_5$	30766.90	
			977.64
1	$1s_4$	29789.26	
			8151.60
0	$1s_3$	21637.66	
			988.30
1	$1s_2$	20649.36	
1	$2p_{10}$	20565.23	
			850.58
2	$2p_9$	19714.65	
			283.24
3	$2p_8$	19431.41	
			552.98
1	$2p_7$	18878.43	
			256.48
2	$2p_6$	18621.95	
			906.47
0	$2p_5$	17715.48	

Inner quantum numbers are shown in the first column while the last contains the separations of the levels; the large value between $1s_4$ and $1s_3$ is connected with the coordination of these levels to the $^2P_{2,1}$ levels of the Xe^+ ion which appear to be separated by 9621 cm^{-1}. The general features of the Xe I spectrum closely resemble those of the analogous spectra Ne I, A I, Kr I, and are in excellent accord with the theoretical expectations. Complete details of the wave-length measurements and analysis will appear in an early number of the Bureau of Standards *Journal of Research.*

WILLIAM F. MEGGERS
T. L. DE BRUIN
C. J. HUMPHREYS

[1] Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

DEVELOPMENT OF THE MOUSE ADRENAL

BETWEEN the cortex and the medulla of the adrenal gland, a band of tissue which is free of adrenalin has been observed by Cramer[1] in mice which had received adrenalin injections. He describes this tissue as medullary tissue which is drained of its adrenalin and inhibited from producing more by a mechanism of secretory control which reacts to the presence of excess adrenalin in the circulation. He observes "essentially the same changes" after such various experimental treatments as injection of thyroid extract and exposure to heat.

The writer failed to find this reaction following adrenalin injections, but has observed similar appearances in experimentally untreated mice, in the course of the development of the adrenal.[2] It is suggested that this normal stage in development could account for Cramer's observations.

Adrenalin injections were made into adult male mice, following Cramer's procedure of the injection of 0.015 mg of adrenalin per mouse, and fixation of the adrenals after twenty minutes. The tissue was

[1] W. Cramer. *Brit. Jour. Exp. Path.*, 7: 88, 1926, quoted by G. N. Stewart, in Cowdry's "Special Cytology," 1: 636.

[2] E. Howard Miller. *Amer. Jour. Anat.*, 40: 251–298, 1927; and R. Deanesly, *Proc. Roy. Soc.*, B, 103: 523, 1928.

fixed in 3 per cent. potassium dichromate, which reacts to form a brown precipitate in cells which contain adrenalin.[3] In these specimens no alteration in the normal intensity or extent of this reaction could be observed.

In experimentally untreated normal mice, at certain stages of development, a wide band of tissue may be found between cortex and medulla which does not give the reaction with bichromate at any time, and which during the first part of its existence does not stain with Sudan III, in contrast to the overlying cortex. This band of tissue is definitely separated from the overlying cortex by cellular differentiation at the boundary. On the other hand, there is no connective tissue band between this intermediate tissue and the medulla, but the cell groups intermingle. The combined effect is strongly suggestive of a medulla which has lost part of its adrenalin. However, this does not seem to be the case, because one can follow the development of this intermediate zone of tissue from a very narrow inner band of cortex cells.

At two weeks of age in the mouse the zone develops very quickly, degenerates in the male before sexual maturity is reached, and degenerates in the virgin female during the first half of the reproductive period. On the degeneration of this inner zone the usual type of boundary between the medulla and the cortex is established. The apparent close connection of this zone with the adrenal medulla may be explained as a result of simple mechanical factors operating during its growth.

This reaction occurs normally in the mouse as a phase of development. An apparently similar sequence of events is found in the human adrenal during the first year of life. Analogous reactions in other species have not been reported.

It is this large cortex zone which Cramer seems to have described as "exhausted medulla." Although it may be possible to produce the zone experimentally by other means than adrenalin injections, it should be recognized as cortical rather than medullary tissue.

E. HOWARD MILLER
UNIVERSITY OF PENNSYLVANIA

[3] E. H. Miller. *Amer. Jour. Physiol.*, 75: 267, 1926.

STRUCTURE OF PLANT COMPOUNDS AND SOLUBILITY

DURING some recent work in plant analysis the writer had occasion to work with a number of organic acids and was surprised to find how readily certain carbohydrates, as well as other plant constituents, dissolved in cold formic acid of about 75 per cent. or more of acid. It is well known that the different sugars are quite soluble in water, and also that as the molecular weight increases and the structure becomes more complicated the solubility is decreased. Thus there is a lessened solubility among the carbohydrates in about the following order—dextrose, sucrose, raffinose, dextrins, starch, pectins, mucilage, gums (cherry), lignin, cellulose, etc. Hence, as the carbohydrate ladder is ascended from dextrose toward cellulose, each rung brings new structures not well understood. The term carbohydrates includes all the simple sugars and all substances which can be converted into simple sugars by hydrolysis. It is known that there is much variation in solubility even among starch grains. When some are boiled in water they break loose from their shells of amylo-pectin material leaving amylose in solution, and the shell coverings may be separated by filtration. Other starches do not even break open, but only swell and tend to form a gel structure.

FORMIC ACID DISSOLVES STARCH GROUPS

Although water does not dissolve many of these carbohydrate compounds, it was found that formic acid dissolves not only sugars but also dextrin, starch, inulin, glycogen, agar, chlorophyll, glucosides, etc., together with some of the plant pigments usually found combined or associated with glucosides, as the blue from privet berries giving a wine-colored solution, the pigment from cotton-seed meal which gives the solution a very red color, and also chlorophyll from tomato leaf giving a blue-green solution. Formic acid does not dissolve much mucilage, cherry gum, lignin, cellulose, or proteins in the cold (unless very concentrated acid is used). When starch is dissolved in this acid it makes a clear syrupy liquid partly hydrolized as it gives a blue color with iodine solution shortly after dilution with water, but not after standing. Corn and potato starches are precipitated when the syrup is diluted with water, but inulin remains in solution.

FORMIC ACID IN RELATION TO PHOTOSYNTHESIS

Erlenmeyer[1] in 1877 suggested that formic acid is the most probable intermediate compound in the production of carbohydrates by photosynthesis. He believed that the synthesis took place by a reduction of carbonic acid producing formic acid and hydrogen peroxide. Wislicenus[2] in 1918 concluded that the hydrogen peroxide produced as a by-product to formic acid probably brings about a further reduction in the plant, resulting in the production of formaldehyde in the presence of light and leaf pigments.

[1] Erlenmeyer, *Ber. Deut. Chem. Ges.*, 10: 634–637. 1877.

[2] Wislicenus, *Ber. Deut. Chem. Ges.*, 51: 942–965. 1918.