of sterile solidified blood serum into the anterior chambers of several healthy rabbits' eyes. Absorption took place slowly, and with well-marked anatomical changes. The animals were killed at intervals of from a few days to six or more weeks after the operation. He gives a careful account, excellently illustrated, of the various histological changes seen, of which the following is a brief summary. The giant cells formed in the absorption of coagulated blood serum subdivide into uninuclear small cells, that take part with other new formed cells, derived from the lining of the anterior chamber, to form a densely fibrillated mass of tissue, that resembles the cornea in its structure. He is of opinion that this strengthens his previous contention (Journ. Exper. Med., Baltimore, 1898, vol. iii. p. 21), that the giant cells in healing non-degenerated tuberculous tissue may separate into small living cells, and that the giant cells of tuberculosis are not necrobiotic elements, as has been the general teaching, especially in Germany.

---

**PHYSiOLOGY.**

---

**UNDER THE CHARGE OF**

T. H. MILROY, M.D., B.Sc.,

LECTURER ON PHYSIOLOGICAL CHEMISTRY, EDINBURGH UNIVERSITY.

---

**INTRACELLULAR SECRETIONS.**

In an exceedingly interesting paper by Krause (Arch. f. mikr. Anat., Bonn, Bd. xlix. S. 707–769) on the salivary glands of the hedgehog, the subject of the nature of Giannuzzi's crescents has been fully discussed. Three views have been held as to their nature. The first one is usually associated with the name of R. Heidenhain, who held that these cells were the developmental forerunners of the mucin-forming cells; the second one, ardently supported by Stöhr, is that they are simply the mucin-forming cells in a different phase of functional activity; while the third and far the most probable view is, that the two types of cells are absolutely distinct, those of the crescents secreting albuminous substances (serous cells), and not mucin as the others do. The proofs in support of the last view are as follows:—(1) Between the cells and the crescents, and possibly also within the cells themselves, there are fine canals which act as channels for the passage of the serous secretion. (2) Pigments injected into the blood stream of the living animal are found to be deposited in the crescent cells and not in the mucin-forming ones. (3) The secretion found in the lumen of the ducts is similar to that occurring in the intercellular capillaries and also to the granules found in the cytoplasm of the crescent cells. (4) The amount of albumin in the saliva depends partly on the number of these crescent cells. Thus, in animals with few crescents of Giannuzzi, or with small cells in these zones, there is but little albumin secreted; while in others, where they are well represented, the opposite condition exists.

Although Krause holds that it is proved, it is still doubtful whether
the intercellular canals give off lateral branches, which pass into the cells. Recently a large amount of work has been done on the relationship between histological structure and physiological function of cells, especially with regard to secretory products. Attention has been directed to the nature and source of granules in such cells as those of the pancreatic acini (Galeotti), the oxyntic cells of the newt's stomach (Carlier), and the leucocytes (Ehrlich, "Die Anaemie," 1898), in order to arrive at some definite conclusions as to how physiological activity of a cell may alter the characters of its constituents. This has been especially worked out from the standpoint of alterations in the reaction of granules towards acid or basic dyes, and also as to the relationship of these granules to the condition of the nucleus. We know that the nucleus is the directing agent in the cell life, and that there must be interchange between its constituents and those of the cytoplasm, only it is difficult to differentiate between alterations due to bodies passing inwards and those passing outwards. Micro-chemical reactions have been employed by Macallum, to find out whether the cytoplasm or nucleus contained organically bound phosphorus; but, unfortunately, the methods are still too crude to admit of exact intracellular analysis, as it is practically impossible to distinguish between a substance containing phosphorus in organic combination and one which merely contains firmly bound inorganic phosphates. We can only say that in certain parts of the cell, e.g. the nucleus and the granules, the reaction for firmly bound phosphorus is a distinct one, while in others it is absent.

We can only arrive at a definite knowledge of the nature of intracellular metabolic processes by combining the purely histological with the micro-chemical, and also by a careful study of the effect of certain cell changes on the general metabolism. And by histological examination one must include not merely the examination of the cell in one stage of functional activity, but after it has been affected by experimental (physiological) or pathological conditions, and also the alterations which it undergoes in the developmental life. In a paper read by Carlier at the Physiological Section of the British Medical Association, 1898, and at present being published in *La Cellule*, Paris (August 1899), the changes which the oxyntic cells in the newt's stomach undergo during digestion are fully discussed. The cells were examined at different stages of digestion. He showed that the stages of exhaustion and recuperation were marked by distinct alterations both in the cytoplasm and the nucleus. Secretion begins in the cesophagus soon after food has been taken, and then it gradually sweeps through the whole organ, usually affecting the pyloric glands about one and a half hours after the commencement of the process. One may say roughly that the cell undergoes exhaustion, as shown by loss in chromatic substance, in about four hours, the chromatin, which disappears, going to form granules of prozymogen (intracellular), and subsequently passing into the cytoplasm to form the zymogen. It seems not unlikely that in the transformation of prozymogen into zymogen there is a linking on of albumin, rendering the compound more acidophil, while the zymogen is converted into the active enzyme ("the zymin") by means of such a hydrolytic agent as a weak acid. The nucleoli appear to be effete products derived from nuclear degeneration. They are certainly extruded from the nuclei, and
their later destiny is unknown. If it be difficult to interpret what occurs during exhaustion, it is almost impossible to understand the nature of the changes occurring during repair of the chromatin. It seems most likely that, in part at least, the nucleins are synthetically formed in the nucleus. After the chromatin of the nucleus has returned to its normal condition, then, when the cells are again stimulated by food, they pass through the different stages of exhaustion described by Carlier. It is interesting to note that mitotically dividing oxytotic cells also secrete zymogen.

Formation and Decomposition of Uric Acid.

Hugo Wiener (Arch. f. exper. Path. u. Pharmakol., Leipzig, Heft 5 and 6, Bd. xlii. S. 375) has recently made a very valuable contribution to the subject of uric acid formation and destruction in the animal body. His principal results may be shortly summed up as follows:— (1) In the liver of the dog and pig, uric acid is partly destroyed, while in that of the ox it is formed. (2) In the kidney and muscles of the ox and horse, uric acid undergoes destruction, while it is unaltered (neither formed nor destroyed) in the same tissues of the dog. (3) The blood of the ox and horse does not break down uric acid, neither does dead or boiled kidney substance. Chloroform, however, does not hinder the decomposing action of the kidney in these animals. (4) With the loss in uric acid, under the above condition, there is an increase in glycocoll, though not so much as one would expect, if from one molecule of uric acid one molecule of glycocoll were produced. Thus—

\[ C_3H_4N_4O_3 + 5H_2O = 3NH_3 + 3CO_2 + CH_2NH_2 \cdot COOH. \]

(5) As in the liver, so also in the spleen and thymus of ox, there is an increase in the formation of uric acid, but never so marked as in the case of the first organ. This is a very important point, as it goes to disprove the theory of the origin of uric acid from the nuclein of leucocytes. The author therefore does not agree with Horbaczewski, in his well-known views on the direct connection between the number of leucocytes in the circulating blood, and the excretion of uric acid and the alloxuric bases. The author also refers to the following important action. If an alcoholic extract of the liver of the ox be taken, the alcohol removed by evaporation, and the residue extracted with water, the aqueous solution has the power, on being added to fresh liver substance, of markedly increasing the amount of uric acid formed. The author wisely emphasises the fact that there were no xanthin bodies in the alcoholic extract, which might have been oxidised to uric acid, had they been present. Hypoxanthin seems to increase the amount of uric acid on being added to the liver. The ammonium salt of sarcolactic acid and glycocoll, added together to the liver substance, did not affect the amount of uric acid formed. Seeing that there are such marked differences between the organs in different animals, with regard to their action on uric acid, it is difficult to draw deductions from the author’s papers as to the seats of its formation and destruction in the human body. There seems, however, to be little doubt that a disturbance in the nitrogen metabolism, leading to an increased production of uric acid.
at the expense of urea, cannot be directly associated with leucocytosis, as so many German writers believe. It by no means follows that a simple increase in the number of leucocytes must result in an increased formation and excretion of uric acid, merely because there is an intimate connection between the nuclein of the leucocyte nuclei and uric acid, with the alloxur bases as binding links. The theory that the kidneys are the seats of formation of uric acid is almost entirely based upon the assumption that uric acid, under normal conditions, does not occur in the blood. There is good evidence for believing that there is always a small amount of uric acid in the normal blood, quite large enough to account for the small secretion of uric acid in the urine. We know almost nothing of the nature of the changes in metabolism which lead to an increase or decrease in the uric acid excretion in man. There can be no doubt that even in that condition, when the uric acid formation and excretion are supposed to be markedly increased, namely, leucocythæmia, there may, in some cases, be hardly any disturbance in the nitrogen metabolism.

DISEASES OF THE EYE.

UNDER THE CHARGE OF

GEORGE A. BERRY, M.B., F.R.C.S.Ed.,
OPHTHALMIC SURGEON, EDINBURGH ROYAL INFIRMARY;

AND

W. G. SYM, M.D., F.R.C.S.Ed.,
ASSISTANT OPHTHALMIC SURGEON, EDINBURGH ROYAL INFIRMARY.

RACIAL DISTRIBUTION OF TRACHOMA.

In regard to the liability of various races to granular conjunctivitis, Yarr divides the various peoples of the world into three groups, these containing respectively those who are receptive, relatively immune, and positively immune. At the head of the first of these classes he places the Chinese and Japanese; according to various observers, trachoma accounts for as much as 78 per cent. of all eye disease in certain districts of China, and about 75 per cent. in Japan. In the same group, though they are less susceptible than the nations just mentioned, he places the natives of Egypt, Persia, and India, and among white races the Jews, Poles, Italians, and Irish. In the second or relatively immune class are to be placed the pure-blooded negroes; Van Millingen of Constantinople denies this supposed immunity of the negro, on the ground that he has seen a considerable number of cases of trachoma among the blacks in Turkey; but Yarr points out that the Turkish negro is by no means of pure blood, but the inhabitants of North Africa, from which place most of the Turkish negroes of course come, are very largely mixed with Semitic blood, and this carries with it a very decided proclivity to trachoma. It is interesting to note that in Cuba, where the population consists of three races, namely, whites, negroes (some-