transparent. The medullary substance is at first arranged in a series of beaded threads running parallel to the long axis of the sheath, the threads undergoing a progressive side by side fusion, until eventually all merge into a single axial core for each of the now considerably elongated sheaths. This Cajal method, though notoriously capricious with the Golgi apparatus, gives some result for the present purpose in perhaps 75 per cent. of trials.

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The excretion of urea.

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The excretion rate of urea in normal men increases directly as the blood urea concentration, and as the square root of the volume of urine, so long as the latter remains within ordinary limits, under about 5 liters per day. These relations are expressed in the formula, $D = KB\sqrt{V}$, D representing the rate of urea excretion, calculated as grams per 24 hours, B the blood urea concentration (grams per liter), V the rate of urine excretion, calculated as liters per 24 hours. When the size of the individual (W = weight in kilos) is introduced the equation becomes $\frac{D}{W} = KB\sqrt{\frac{V}{W}}$, or $K = \frac{D}{B\sqrt{VW}}$. $K = 7.5 \pm 3$ for normal individuals. When deficiency of the urea-excreting function is present K has a lower value. Increase in volume output beyond the rate of about 200 c.c. per hour, or 5 liters per 24 hours, ceases to accelerate urea excretion, so that for volumes of V in excess of 5, the figure 5 may be inserted in place of the actual V. The above formula gives more consistent results than that of Ambard, which assumes erroneously that the excretion rate increases as the square rather than the first power of the blood urea; and correlates the excretion with the concentration of the urea in the urine rather than with the volume of the urine. In calculating the rate of urine and urea output from short time periods, errors occasionally occur from

failure completely to empty the bladder at either the beginning or end of the period. Such errors may be reduced by basing the output calculations on the creatinine content of the sample, rather than the time over which it is collected, since Shaffer has shown the hourly creatinine output to be constant throughout the 24 hours, *e.g.*, if the creatinine content of the sample analyzed is 1/20 of the individual's known daily creatinine output, the urea and volume output are calculated to a 24-hour basis by multiplying by 20.

35 (1495)

Enzymes of pollen.

By JULIA BAYLES PATON (by invitation).

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Pollen enzymes must be very important in rendering stored food available when pollen germinates, in facilitating the passage of the pollen-tube through the pistil, and in stimulating the development of the embryo and maturing of the ovary.

Moreover pollen anaphylaxis is now regarded as the cause of socalled hay-fever and other forms of pollen poisoning. Pollen enzymes may be concerned in these reactions, and the proteolytic enzymes may affect the stability of the pollen-protein solutions used in pollen vaccination.

Yet in spite of the significance of these enzymes few experiments in regard to their nature have been reported, and none recently. Erlenmeyer (1874) found amylase in pine pollen. Van Tieghem (1886) reported invertase in hyacinth, narcissus, wallflower, and violet. Rittinghaus (1886) made observations which indicate the presence of the cytase. J. R. Green cites amylase in pollen tubes. Strasburger (1905) mentions diastase and invertin in grains prior to germination. Kammann (1912) found proteases, diastases, catalases, and lipases in rye pollen.

Although it has been assumed that pollen tubes digest their way through the style there seems to be no experimental evidence as to the exact nature of this enzyme action. Histological exami-