at this age, had in the experimental males undergone an average hypertrophy (with wide individual variation) of 355 per cent. as estimated by the camera lucida paper tracing method. The testicular medulla was not significantly affected. In the experimental females the ovarian cortex showed an average increase in volume of 94 per cent., due chiefly to a multiplication of oogonia, as compared to normal cortex. The increase in experimental ovarian medullary volume was not judged to be statistically significant. Microscopic examination indicated that the striking hypertrophy of the oviducts and the male Müllerian duct rudiments in the injected animals was due largely to an extensive growth of the mucosa, which often projected into the duct lumen in prominent longitudinal folds. The muscular strata of the experimental oviducts were also precociously developed as compared to those of the controls. Shell glands were not identified. The Wolffian ducts and mesonephroi of both sexes were unaffected.

Evidence of some degree of bisexuality in the normal females was found in the retention of fully formed Wolffian ducts many months after the mesonephros had ceased to be a secretory organ and in the persistence, in the posterior portion of the ovary, of a testis-like area of medulla lacking the typical cortical investment. This atypical medulla was not significantly affected by oestrone treatment. A degree of bisexuality in the normal male was indicated by the retention of vestigial Müllerian duct segments and by the persistence of fungiform cortical areas on the testis.

It is concluded from the experimental data that oestrone, when administered to sexually immature alligators under the conditions described: (1) produces testicular and ovarian cortical hypertrophy and (2) selectively stimulates the oviducts and male Müllerian duct segments without affecting the Wolffian ducts of either sex, and that (3) neither the oestrone nor the hypertrophied testicular and ovarian cortical components inhibit the testicular and ovarian medulla. An extended report of this experiment will be published later.

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THE FLAGELLATION OF BACTERIA[1]

NEARLY twenty years ago it was pointed out[2] that the apparent occurrence of both monotrichic and peritrichic species among the legume nodule bacteria might be explained on the assumption that all species have actually several flagella but appear monotrichic in young preparations. Attention was called to the fact that even with those species where only one flagellum can be found, it is as apt to be attached at the side of the cell as at the pole.

Smith and Brown[3] have published illustrations showing that *Bacterium radiobacter* is not unlike some of the nodule bacteria in this respect, appearing sometimes with a single flagellum which may be either polar or lateral, and sometimes with two to four peritrichic flagella. Verification of this observation has been secured by A. W. Hofer (of the writers' laboratory) and is to be published shortly. This fact, together with similar statements in the literature concerning the violet chromogens and other bacteria, has suggested that there may be a type of flagellation distinct from polar flagellation, on the one hand, and even from true peritrichic flagellation, on the other. Accordingly, a collection of various soil and water non-spore-formers has been secured and a series of flagella stains made from all of them.

The results in detail will be presented elsewhere. Here we wish merely to call attention to the fact that there does seem to be evidence of three distinct types of flagellation. Fig. 1 shows a typically peritrichic

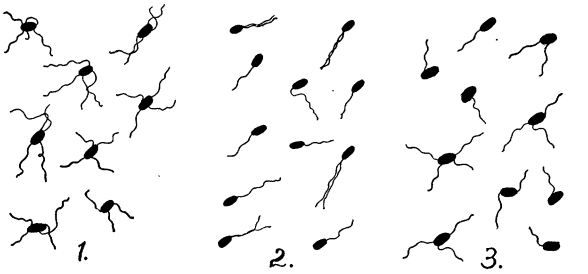

FIG. 1. *Escherichia coli* Castellani and Chalmers, showing true peritrichic flagella. FIG. 2. *Bacterium parvulum* Conn, showing polar flagella. FIG. 3. *Bacterium radiobacter* Löhnis, showing possibly degenerate peritrichiate arrangement of flagella.

organism. Fig. 2 shows an organism with definitely polar flagella, most cells being monotrichic but a few showing two flagella at one pole. Fig. 3, on the other hand, shows the type of flagellation which is now under consideration. It is apparently a degenerate form of peritrichic flagellation, but the flagella are so few in number and all but one so often missing that unless an extensive study is made one might easily be tempted to call such a culture unquestionably monotrichic.

Attention is called to this point because it is felt that considerable confusion has occurred in the classification of bacteria in the past from trying to make a rigid separation between peritrichic and monotrichic

[1] Approved by the Director of the N. Y. State Agricultural Experiment Station for publication as Journal Paper No. 258, March 2, 1938.

[2] H. J. Conn and R. S. Breed, SCIENCE, 51: 391–2, 1920.

[3] F. B. Smith and P. E. Brown, *Iowa State Col. Jour. Science*, 10: 17–25, 1935.

organisms without realizing that type of flagellation may occur which is essentially peritrichic, although some cultures are monotrichic. True polar flagellation includes lophotrichic and definitely monotrichic organisms. True peritrichic flagellation is best shown by forms that possess four or more flagella. A degenerate type of peritrichic flagellation, on the other hand, may show one to four flagella and, if only one, the attachment may be either polar or lateral.

It is felt that much greater progress can be made in the classification of bacteria if organisms with only one flagellum are not separated from those which have three or four peritrichic flagella. A more satisfactory plan seems to be to group them on the basis of a correlation of characters. A considerable number of organisms have been observed (*e.g.*, the violet bacteria, the legume nodule organisms, *Bacterium radiobacter*, *Alcaligenes fecalis* and numerous still unidentified soil non-spore-formers) which either show this type of flagellation or else lack all flagella. These organisms resemble each other in their physiological characteristics. Such a classification as that here suggested, therefore, does not run counter to the prevailing systems of grouping bacteria, in which much weight is laid on fermentation reactions and similar characters, as well as on morphology.

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THE MOLECULAR WEIGHT OF CRYSTALLINE CATALASE[1]

THE apparent relationship of the enzyme catalase and methemoglobin, as suggested by comparison of the absorption spectra and hematin side-chains of these two substances, makes the determination of the molecular weight of catalase of considerable interest. Recently Stern and Wyckoff[2] concentrated horse catalase of a purity of 4,000 to 9,000 *Kat.f.* by sedimentation in an air-driven high-speed centrifuge and obtained a product with a *Kat.f.* of from 8,500 to 33,400. The sedimentation constant of this material they found to be 11×10^{-13}, indicating a molecular weight of 250,000 to 300,000. They obtained a sedimentation constant of 12×10^{-13} for a nearly pure catalase preparation from beef liver, but do not tell how this catalase was prepared.

The method of Sumner and Dounce[3] for preparing crystalline catalase from beef liver has made it easy to obtain this enzyme in what is apparently pure condition. We have prepared the enzyme in this laboratory and have determined the sedimentation constant of the recrystallized material by centrifuging an approximately 1 per cent. solution at 65,000 r.p.m. The value obtained over a pH range of 6.3 to 9.6 was 12.0×10^{-13}. A complete description of the method employed will be given in a later publication. Here, it suffices to note that the catalase was found to be a homogeneous substance, very slightly contaminated by impurity. Qualitative tests after centrifuging in a separation cell[4] showed that there was no enzymatic activity found in the solution removed from the upper portion of the cell and that the activity followed the high-molecular colored substance. Determination of the diffusion constant gave a value of 4.1×10^{-7}, while the partial specific volume was found to be 0.73. From these data the molecular weight of beef liver catalase is calculated to be 263,000. This value is almost exactly 4-fold the molecular weight of horse hemoglobin.[5] Now the percentage of iron in catalase is one fourth of that of hemoglobin, and accordingly the number of iron atoms per molecule must be four in catalase as well as in hemoglobin.

In conclusion, we wish to express our thanks to Professor The Svedberg for the use of his laboratory and to the Guggenheim Foundation for generous financial assistance.

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NILS GRALÉN

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