(s. *Mongold,* 1910, p. 245) also described luminosity in sponges. Dahlgren (*J. Franklin Inst.,* 1916, p. 243) examined luminous sponges at Naples and proved that the worms and protozoa living in their canals were the actual source of the light. The matter is, however, different in *Grantia* sp. as observed by Harvey (*Biol. Bull.,* 1921, p. 286) at Friday Harbor. According to this author the sponge produces a good luminescence in the dark and gives a luminous slime when squeezed. The organisms living in its canals are not luminous. Harvey is of the opinion that the light of this species of sponge is an autogenous luminescence. Thus, there is uncertainty and diversity of statement as to the fact and the probable source of the luminosity in sponges, and we lack careful observation and study affording either positive or negative evidence on the subject.

In the evening of August 25, 1919, the writer, while engaged in examining the dredgings from the bottom of the Sagami Sea at a depth of about one thousand meters, observed a large specimen of *Crateromorpha meyeri* Gray to be brightly luminous. The whole body of the sponge glowed for several hours after being brought into a dark room. The luminescence consisted of a thousand spots of a blue light resembling the stars in the sky. On dipping the sponge into fresh water the light shone particularly brightly, but at the same time the luminous spots were observed to be transferred from the body of the sponge into the surrounding medium. Each spot proved to be a small annelid belonging to the family *Alciopinae.* More closely examined, the sponge itself showed numerous individuals of this same annelid filling the entire canal system. After the annelids were entirely removed the sponge gave no more light, while the removed organisms themselves glowed momentarily on stimulation. The light of *Crateromorpha* is apparently a secondary luminescence.

Whether or not other luminous sponges are analogous to this is an open question, but it is a usual feature that annelids and other small organisms live in their canals. I am inclined to believe that sponges do not produce autogenous luminescence.

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THE FAMILY CLIONIDAE

THE name Clionidae was adopted by Topsent in 1887 for a family of sponges which bore into the shells of molluscs. The type genus was *Cliona* of Grant. However, the name Clionidae (Gray, 1840) has long been in general use for a family of Pteropod molluscs, with *Clione* Pallas as the type genus. The sponge family may be called Thoosidæ, from *Thoosa* Hancock, the next oldest genus.

T. D. A. COCKERELL

SCIENTIFIC BOOKS

SOME NEW BOOKS ON GENETICS

Genetics in Plant and Animal Improvement. By D. F. JONES. viii + 568 pp., 229 figures. John Wiley & Sons, N. Y. Price $4.00. 1925.

Principles of Genetics, an Elementary Text with Problems. By E. W. SINNOTT and L. C. DUNN. xviii + 431 pp., 140 figures. McGraw-Hill Book Co., N. Y. Price $3.50. 1925.

Animal Genetics, an Introduction to the Science of Animal Breeding. By F. A. E. CREW. xx + 420 pp., 67 figures. Oliver and Boyd, Edinburgh. Price 15/— 1925.

THREE new text-books on genetics have recently been published. There was no dearth of texts before. Apart from the pioneer and standard books by Bateson and Punnett in England, followed by those of Lock, Doncaster and Darbishire and the German texts by Baur, Goldschmidt and Johannsen, there had been published in America alone books by Babcock and Clausen, Castle, Conklin, Coulter, Morgan and Walter, besides several texts dealing primarily with eugenics. It would seem to be a bold author who would seek to extend the list. Yet at the present time genetics is of such general interest in biology that a variety of treatments of the subject is required to meet all needs, and our knowledge of genetics has been increasing so rapidly that no text remains up-to-date unless it is frequently revised or rewritten. In this state of affairs a fresh and original treatment of the topic is welcome and any new contribution to the only-partly-solved problem of how successfully to teach genetics is thrice welcome.

Jones has produced one of the best text-books on genetics that has yet appeared. He approaches the subject from the viewpoint of one interested in the increase of the world's food supply consisting of plant and animal products. He recognizes that the area available for agriculture is already largely occupied and can not be extended much further. It is therefore incumbent on the farmer to utilize to its fullest capacity the agricultural land now available. This can be done in part by better methods of farming and by improved machinery. It is possible also to discover or produce better varieties of cultivated plants and of domestic animals than those now in use. This last can be done best by an intelligent use of the principles of genetics. Those principles Jones proceeds to develop in an orderly way, beginning with the simplest case of Mendelian heredity and proceeding by gradual steps to more complicated and debatable cases, not however giving the reader occasion to doubt for a moment the complete adequacy of Mendelism to explain all cases. One wishes at times that Jones were less of a "fundamentalist" in his devotion to Mendelism; perhaps a dash of scepticism as to some of the orthodox doctrines might give relish to the dish. It should be stated, however, that there is little to criticize in Jones's treatment of his subject. He develops it in an orderly and interesting way. His statements are clear, his information full and authentic; his examples are well chosen, apt and adequate, but never superfluous, in many cases taken from his own extensive and fundamental researches. He speaks from the fullness of first-hand knowledge, but never to impress the reader with its extent. He has gathered and imparts in an entertaining way much information about the history of cultivated plants and domestic animals. The information is particularly full about what has been done in the way of crop improvement in the agricultural experiment stations of the United States. This feature makes his treatise preeminently useful as a text-book in the agricultural colleges. His chief original contribution is probably found in the discussions of the subjects of inbreeding and crossbreeding to which his own studies have added much. In this connection may be noted a fondness of the author for a pet theory of his own about hybrid vigor (heterosis), that it is only the summated inheritance from the two parents, not due in the slightest degree to the crossbred state itself. The reader will find it difficult to reconcile this view with the high praise bestowed upon "grading," wherein common stock is crossed with pure bred stock, resulting in the production of offspring superior to either. On the whole, Jones has produced an excellent book. Of course there is the occasional slip to which every author is liable, as where on page 7 he refers to the zebu and water-buffalo as one and the same animal. In Chapter II, "training" is treated as coordinate with inheritance and environment, a third factor in determining the character of the individual. This seems of questionable propriety, particularly as regards plants. On page 64, an example of Mendelian inheritance in guinea-pigs is credited to a German plant-breeder, although it was worked out by an American zoologist.

Sinnott and Dunn have written the latest book on genetics, a good one, too, primarily pedagogical in its aims and origins, and for this reason more likely to meet the needs of the teacher than most books on the subject. Much attention has been given to the preparation of "problems" presented at the end of each chapter, with the aim of giving the student practise in applying the principles discussed in the text. This is perhaps a worth-while way to try to get the student to think, but it is doubtful whether it is in any sense a fair substitute for a laboratory course in which the student handles the live material, gathers his own data and feels his way along toward conclusions. Most biological problems involve in their solution other powers of the mind than those used in arithmetic or elementary algebra. For training in scientific method the student should, if possible, be given *real* problems, rather than hypothetical ones.

The text of Sinnott and Dunn is an extremely clear and well-balanced discussion of "principles of genetics" illustrated by well-chosen examples, many of them taken from materials with which the authors themselves have worked, one of them being a botanist, the other a zoologist. A wide range of subjects is covered and the very latest discoveries in genetics are reported with a due sense of the proportion demanded in an elementary treatise. The chapters on "inheritance in man" and the "problems of eugenics" are naturally based on the least percentage of established fact and the largest percentage of speculation of any part of the book. They present eugenics as the eugenicist would have it, the inevitable Edwardses growing in goodness as the plumule of a seedling grows upward, and the Kallikaks going to the bad as the root of a seedling grows down. It is assumed that heredity (not environment) made the Edwardses and Kallikaks what they are reported to have been, but the text does not make it clear, as it should, that this is largely assumption. Also the professional and moneyed classes are assumed to be "abler" than the industrial and laboring classes, and as the former have fewer children it is assumed that the general level of ability is declining. But again the reader is not informed that this conclusion rests on a string of assumptions.

Crew's book is written exclusively from the viewpoint of an animal breeder and makes no use of botanical material, except in connection with the classical experiments of Mendel on garden peas. He does not limit himself, as do Jones and Sinnott and Dunn, to a presentation of principles with a limited number of illustrative cases. He attempts rather an inclusive summary of the more important work to date on animal genetics with especial reference to farm animals, because of their economic importance, and of Drosophila because of its scientific importance.

His book will be found harder reading, especially for the beginner, than either of the other books mentioned, but will be valuable to more advanced students and particularly in America because it includes much material and many references not found in other texts. He gives particular attention to questions of sex-determination, sex-linked inheritance and sex modification, more than a third of the book being devoted to these and related topics. The discussion of Mendelism and its illustration by cases among farm and laboratory animals, with which the book begins, is not particularly lucid, being overloaded with symbols, diagrams and tables, which weary rather than assist the reader. One gets the impression that the writer has not thoroughly assimilated his material or he would be able to present it in simpler form. The Drosophila work has been studied carefully and is presented in all its theoretical aspects well. On the whole, the book is a distinct and welcome contribution to the literature of genetics.

W. E. CASTLE

SPECIAL ARTICLES

THE SECRETION GRANULES AND THE VACUOLES IN THE LIVING THYROID GLAND

SEVERAL years ago the writer made an extensive study of the development of the various structures of the thyroid gland of the salamander *Ambystoma opacum*. The method employed in this study was the usual histological technique. The histological slides representing the records of this work were demonstrated at several meetings as well as to a number of individual investigators here and abroad and several short articles outlining the results were published.[1] The manuscript of the final paper, which has gone through the hands of editors for the last two years, is now in press. As the present study on the living thyroid gland corroborates the essential findings of the histological study, brief reference to the results of the latter must be made here.

Through the work on amphibian metamorphosis as conducted during the last fifteen years in American and European laboratories the fact has been well established that the metamorphosis of an aquatic salamander larva into a terrestrous animal is the direct result of the function of the thyroid gland. Therefore the structure of thyroid glands taken from metamorphosing salamander larvae should be expected to be representative of the structure of a functioning thyroid gland. Study of such thyroid glands should yield conclusive information as to which of the various known structures of the thyroid gland are the expression of the specific function of this organ. Upon comparing sections through the glands of metamorphosing animals with sections through the thyroids of earlier stages it was found that the most conspicuous characters of the thyroid at the time of metamorphosis are the presence of large numbers of unstainable vacuoles in the cells (these vacuoles I called Anderson vacuoles after Anderson, who was the first one to describe them),[2] the presence of similar vacuoles in the colloid, the scarcity of stainable colloid in the lumen of the thyroid follicles and the collapse of the follicles into frequently solid and star-shaped masses of epithelium. These characters do not develop gradually, but on the contrary come about in a very sudden manner, taking not more than approximately twenty-four hours for their development. The structural peculiarities enumerated above are among the characters typical for the thyroids of exophthalmic goiter patients. Similar resemblances between the thyroids of metamorphosing salamanders and those of exophthalmic goiter patients were found in nearly every other respect.

Although Anderson in 1894[3] described vacuoles in the cells of the thyroid and saw that the colloid vacuoles, under certain conditions, communicate with the vacuoles in the cells, anatomists and pathologists interpret the colloid vacuoles as artefacts due to shrinkage of the colloid in the fixation fluids. In the thyroid of metamorphosing salamanders the colloid vacuoles are found in a condition indicating clearly that they are an unstainable material excreted by the cells in especially large numbers during stages of highly increased functional activity and identical with the unstainable material contained in the Anderson vacuoles of the cells, with which, in the salamander gland, they are found to be in open communication. Careful fixation of human material showed the same relation to be true for the colloid vacuoles in the human thyroid gland. Through the kindness of Professor Martin Heidenhain I had at my disposal, for comparison with my own material, a human thyroid fixed and stained by Professor Heidenhain himself after the Heidenhain-Mallory method, a technique which I found particularly useful in the study of the thyroid. This thyroid shows exactly the same condition as my own material; in many places colloid vacuoles are found in direct communication with the Anderson vacuoles.

From these observations the conclusion was drawn that the colloid vacuoles are not an artefact, but represent an important secretion of the thyroid gland and are derived from the Anderson vacuoles of the thyroid cells.

The precursor of the stainable colloid was found in an acidophilic substance accumulated in the apical cell ends. The so-called secretion granules were found accumulated in the apical cell end and imbedded in the acidophilic substance. As these granules were never found to lie in the follicular lumen and as no other sign indicating that they are excreted could be noticed, their nature as true secretion granules was

1 Uhlenhuth, E., Proc. Soc. Experim. Biol. and Med., 1923, XX, 494; *Anat. Rec.*, 1924, XXVII, 222; *J. Gen. Physiol.*, 1924, VI, 597; *Zeitsch. wiss. Zool.*, 1925, CXXV, 483.

2 Anderson, O. A., *Arch. Anat. und Physiol.*, Anat. Abt., 1894, 177.

3 *Ibid.*