

Inspection of the volume enables one to form some idea of the relative activity in chemistry at different periods; in 1792 there were three papers published on the subjects included; in 1840 there were 14 papers; in 1860, 22 papers, and in 1892 there were no less than 68 papers. These numbers do not include abstracts and reproductions of original publications.

It is also interesting to note the relative frequency of the occurrence of the names of certain chemists; thus J. W. Döbereiner published 43 papers between the years 1814 and 1845; his great contemporary Berzelius, 25 papers between 1812 and 1847; H. St. Clair Deville, a generation later, published 31 papers (1852-1882), and S. M. Jörgensen has published 27 papers between 1867 and 1896, his activity being still productive. Of course, the number of the papers does not indicate the relative importance of the discoveries; W. H. Wollaston, for example, published only nine papers, but his influence on the chemistry of platinum has been notable.

The volume is clearly printed and seems to be quite free from typographical errors; Edmonde Fremy's name, however, appears as Frémy throughout the work, but Fremy never used the accent on the first vowel in his name.

Howe's 'Bibliography of Platinum' will be a necessity to every working chemist and to every scientific library.

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The Development of the Frog's Egg. An Introduction to Experimental Embryology. By THOMAS HUNT MORGAN, PH.D., Professor of Biology, Bryn Mawr College. New York and London, The Macmillan Company. Pp. xi + 192. Price, \$1.60.

As the first attempt to present a connected account of the development of any animal from the standpoint of the new experimental school of morphologists, Professor Morgan's book on the development of the frog will be received with much interest. The time is ripe for a summary of the experimental work on the early stages of development, showing what has and what has not been accomplished by this much discussed method of investigation. Professor Morgan gives us an account of the embryology

of the frog, laying especial weight 'on the results of experimental work, in the belief that the evidence from this source is the most instructive for an interpretation of the development.' We shall hope, therefore, in its perusal to learn how much has been accomplished in making clear the course of events in the embryology of a single animal by means of experiment. The egg of the frog has become the classical object for this sort of research, so that a more favorable choice of subject for this purpose could not be made.

The scope of the work is not confined, however, to results achieved by experiment. The book undertakes to give a 'continuous account of the development, as far as that is possible, from the time when the egg is forming to the moment when the young tadpole issues from the jelly membranes,' drawing upon both descriptive accounts of the normal development and experimental work to make it complete. The sub-title, however, makes us justly expect that the experimental results will form the chief aim of the book.

After a half-page introduction on the egg laying and copulation of the frog, Professor Morgan opens his account in Chapter I. with a discussion of the formation of the sex-cells, followed in Chapter II. by a description of the processes of egg laying, formation of the polar bodies and fertilization. With Chapter III. we enter upon the first account of experimental work, a short *résumé* of the researches of Pflüger, Born and others upon cross-fertilization in the Amphibia.

Chapter IV. treats of the normal cleavage of the frog's egg, with the variations met with under natural conditions. The question is proposed: What determines the plane of cleavage in the unsegmented egg? Roux's contention that this is determined by the plane of apposition of the two pronuclei is stated, but the actual determining factor is held to be still in doubt, with the evidence rather against Roux's view. Further discussion of this question is reserved for a later chapter. As to the factors determining the form and arrangement of the cleaving cells, the author discusses here only the surface tension theory, again reserving, according to a plan which can hardly be said to conduce to unity other supposed factors

to a much later chapter. The discussion at this point takes the form of an illustrated account of Roux's experiments on the form and arrangement of oil-drops divided into parts similar to the blastomeres of the egg. The conclusion is drawn that surface tension is an important factor in the arrangement of cleaving cells, but that these are influenced also by many other factors which prevent them from showing always the typical arrangement demanded by surface tension alone.

Chapters V. and VI. are devoted to a descriptive account of the developmental processes from cleavage until after the establishment of the germ layers. The formation of the embryo by concrescence makes the basis of an exceptionally clear and satisfactory description of the complicated processes taking place. In this connection is given a brief statement of the experimental evidence (formation of extra-ovates, etc.) of the changes taking place, and of the correspondence of particular parts of the egg with parts of the later embryo, and the attempts of His to explain many of the processes of development by means of experiments with elastic plates are outlined.

The nucleus of the book is formed by Chapters VII. to XII., which are devoted to the experiments for which the frog's egg has served as the most frequent object in the study of early developmental processes. This account of experimental work is not brought into any close connection with the foregoing description of the normal development of the frog. The latter is closed off, up till after the formation of the germ layers, then the experimental work on early stages is taken up. The account of this is classified only loosely according to the processes and problems studied, the arrangement adopted being chiefly a historical one.

Chapter VII. gives an account of the experimental production of embryos with spina bifida, with especial reference to its bearing on the formation of the embryo by concrescence of the two halves of the germ ring.

Chapters VIII. to XI. are devoted to an account, arranged chiefly historically, of the experiments of Pflüger, Born, Roux and many later investigators on the modifications in development induced by an altered relation of the

egg to the direction of gravity, by compression and by killing or isolating individual blastomeres in early stages. This forms one of the most instructive chapters in the history of biological investigation and theory, illustrating and emphasizing, as it does, the necessity for extreme caution in generalizing the results of experiments and observations on single forms, and showing how false may be the conclusions based upon the clearest evidence when that evidence is not gathered from extensive comparative researches. The lesson thus gained has been of the greatest importance and has doubtless been one of the most valuable results of this series of investigations. It would be interesting to review here, following Professor Morgan, the problems proposed, the experiments undertaken to answer these questions, the conclusions drawn from these experiments, and the continued modification of these conclusions as the circle of experimentation became wider.

The history of the development of opinion as to the conclusions to be drawn from the 'total' or 'partial' development of isolated blastomeres, of the theories concerning the part played by gravity in cleavage, and of the general factors determining the direction and position of cleavage planes, is remarkably instructive. Almost more important, as leading to more definite positive conclusions, is the history of the gradual change from the view that the nucleus is the all-important factor in formative processes, to that which seeks the essential factors in the cytoplasm, culminating with Driesch and Morgan's demonstration that in the ctenophore purely cytoplasmic injuries to the egg result in corresponding modifications in the larva. But for a full discussion of these and other matters the reader must be recommended to a perusal of the book itself.

A few words may be added as to Professor Morgan's own conclusions in regard to some of the problems discussed. Although he states in the preface that he has avoided the discussion of theoretical questions, as out of place in such a book, he does give his views on a number of important points.

In Chapter XII., 'Interpretations and Conclusions,' a clear and appreciative survey is given of Roux's profound analysis of the problems of

development in his earlier papers, and of the grounds for his later conclusions in favor of the qualitative nature of cleavage and the 'self-differentiation' of the blastomeres. This review is most satisfactory in its spirit of fairness and in its appreciation of the magnificent work of Roux, and stands in refreshing contrast in these respects to much recent scientific (?) discussion of this investigator's views on the other side of the Atlantic. The author then proceeds to develop the difficulties in Roux's theory and presents grounds for a different view. He points out that in all cases, except the ctenophore egg (and the unmentioned gasteropod egg), it has been shown that the early blastomeres have each the power to produce the whole embryo, though under certain circumstances they may not do so. The author believes that there is no profound difference in principle between the conditions in the ctenophore (and gasteropod?) egg and elsewhere; the divergent results in this case, he thinks, may be explained by the fixity of the protoplasmic forms in the ctenophore egg, or some kindred condition. This totipotency of the embryonic cells may persist, Professor Morgan believes, to late stages. The chief reason why cells of later cleavage stages cannot produce entire embryos is because their power of cell division is limited; hence enough cells cannot be produced to form a complete embryo. (The very important work of Crampton, showing that the development of the isolated blastomeres of the gasteropod is, like that of the ctenophore, throughout partial in character, is unaccountably left unmentioned by the author, though he cites other articles which appeared in later numbers of the same journal in which Crampton's paper was published.)

What, then, brings about the later differentiation of cells if all the blastomere are totipotent? The author rejects the theory of qualitative division of the nucleus; he holds it impossible also that the interaction of equivalent blastomeres should induce differentiation. That the distribution of yolk, etc., does not determine differentiation is shown by the production of normal larvæ from that half of the echinoderm eggs which contain no yolk. Professor Morgan can only emphasize again that the experiments on the ctenophore egg indicate that the factors

in differentiation, whatever they may be, are situated in the cytoplasm. What these factors are, or even whether they may be placed in the category of physico-chemical causes, we do not know.

The remainder of the book, except the last chapter, is taken up with a descriptive account of the development of the frog's egg, from the establishment of the germ layers to the moment when the young tadpole emerges from the jelly membranes. This account is chiefly abridged from Marshall, and the figures are mostly copies from the same author. Experimental work on the later stages is not introduced, the remarkably interesting experiments of Born on the grafting of parts of young tadpoles being too recent to be included in the present volume.

The last chapter is a brief review of researches on the effects of different temperatures and different lights on development. An appendix gives some hints on reagents, methods of preservation, etc., and the whole is closed by an extended bibliography.

Those chapters of the book (VII.-XII.) which deal with the experimental work on the early stages of development will be found a most satisfactory presentation of the results in this interesting line of work. The *résumé* is extended enough to bring out all essential points, is clearly written, fair and appreciative in its account of opposing views, and the conclusions set forth by the author are cautious and undogmatic.

The partially historical arrangement of the material is advantageous in many respects. It brings out with especial clearness the necessity of caution in interpreting experiments on simple organisms, shows the fluctuations of opinion in regard to the problems involved, and aids essentially in understanding the present status of investigation and opinion in regard to these matters. On the other hand, this arrangement brings the discussion of the experimental work out of relation with the rest of the book. We should expect, from the title of the work and the preface, that the descriptive account of the embryology of the frog would give the order of development of the subject. Certain processes which require explanation coming up in this account, it might be antici-

pated that the experiments bearing upon these points would be detailed and the conclusions to be drawn from them pointed out. In this way it would have become much clearer how much or how little experimental work had done in elucidating the development of the frog, and the book would have been given a unity which it does not now possess. The descriptive portions and the account of experimental work might have been bound under separate covers, neither volume showing a decided lack of the matter treated in the other. It may be questioned if a volume on the general subject of 'Experimental Embryology,' from so competent a hand as that of Professor Morgan, with no attempt even nominally to limit the discussion to a particular egg, would not have met the demand more precisely than the present work. The descriptive chapters will hardly take the place of Marshall's work on the embryology of the frog, and this portion of the book seems in some respects not so well presented as that on the experimental results. In some chapters the arrangement is a confused one. Thus, after an extended discussion of the cleavage of the egg and especially the variations in that process, and after the egg has been brought to the blastula stage, we find again (p. 41) a paragraph adding some new facts as to the first and second cleavages. At times one misses a clear-cut statement of the question upon which a set of observations or experiments bear. For example, in the account of Roux's experiments with oil-drops, pp. 43-47, it is mentioned only incidentally that the question here is as to the part played by surface tension in cleavage, so that the point might easily be missed by one not acquainted with previous discussions on the subject. In the descriptive chapters typographical and other errors also are more frequent; a particularly confusing matter is the incorrect reference in the text to the lettering of the figures, in a number of cases. Thus occurs on p. 41 ('Fig. 12 G. H.'), p. 105 ('A'-B' and 'Fig. 33 B'), p. 156 ('Fig. 47 B'). In several cases the discussion would be made much clearer if the successive cleavage planes could have been numbered in the figures.

The descriptive part, however, whatever be its merits or demerits, is not the distinctive

feature of Professor Morgan's book; it is for the account of experimental work that it will be read, and for this it will be found of the greatest value.

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Geologic Atlas of the United States, Folio 36.
Pueblo, Colorado, 1897.

The folio consists of seven pages of text, signed by Grove Karl Gilbert; a topographic map; maps showing the areal geology, economic geology, structure sections, deformation and data pertaining to artesian water; a sheet of columnar sections, and a sheet showing typical fossils and special types of outcrop. The scale is 1:125,000, and the area described is comprised between parallels 38° and 38° 30' and meridians 104° 30' and 105°.

The quadrangle includes a portion of the Great Plains close to the base of the Rocky Mountains. The topography is partly of the foothill type and is in general sufficiently rugged to exhibit clearly the stratigraphy and structure. In the western part are portions of the great hogback formed by the upturned edge of the Dakota sandstone.

The formations range from Archean to Pleistocene. The Paleozoic rocks have a thickness of but two or three hundred feet and their exposures are unimportant. The Juratrias rocks, comprising bright-colored shales and sandstones, have an extreme thickness of 2,500 feet, but their surface extent is small. The Cretaceous rocks range from the Dakota formation to the Pierre and cover nine-tenths of the area. They consist chiefly of gray shale; in a total thickness of 3,800 feet there are only 75 feet of limestone and 300 to 500 feet of sandstone, the latter being at the base of the series. One hundred feet of alluvial sand and gravel are referred to the Neocene, and other alluvial deposits to the Pleistocene.

Unconformities appear at the base of the Paleozoic, Cretaceous, Neocene and Pleistocene formations, and the geologic history is correspondingly complex. The structure of the Paleozoic and Juratrias rocks was ascertained only in the limited area of their exposure. The