Fourth, senescence is at its maximum in the very young stages, and the rate of senescence diminishes with age.

As the corollary from these, we have this—natural death is the consequence of cellular differentiation.

Those interested in education will find in this last chapter a fine statement of rapid mental growth of the infant.

Clearly in ultimate analysis the growth of an organism is but a small factor in the problem of its entire life. At a guess, the energy expended in growth is to the entire energy output of the organism as one to one thousand. It should also be remembered in this connection that all the material which enables the embryo to grow so fast at first is a function of the adult life work of the parents. An adult hen may lay 200 eggs in a single year, the materials of which may enable 200 chicks to complete 98 per cent. of their growth at hatching.

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The Development of the Chick: An Introduction to Embryology. By FRANK R. LILLIE. Pp. xi + 472. 251 Figs. New York, Henry Holt and Company. 1908.

The intention of the author of this book is to present in a simple, straightforward way the essential facts of the development of the chick for the use of beginners in embryology. This purpose has been to a very large degree realized, despite the ever-present temptation to enter into comparative discussions.

The book is divided into two sections, the first of which is devoted to a description of the formation of the embryo and is to an exceptional degree original and excellent. The second part, consisting of eight chapters on the development of the organ systems from the beginning of the fourth day of incubation to hatching, occupies a little more than half of the work.

The introduction is a statement of certain embryological theories and facts of general interest which can not properly be included in the body of the book.

The first chapter is a description of the structure, chemical composition and formation of the egg.

So little is known of the processes which occur while the hen's egg is in the oviduct that a consistent account of them is impossible. Consequently, Dr. Lillie in the second chapter bases the description of the development before laying, which includes the fertilization, maturation and cleavage of the ovum, and the formation of the ectoderm and entoderm, upon the work of Harper, Patterson and Blount upon the egg of the pigeon. This is an unavoidable exception to the author's rule of limiting the description to the development of the chick.

The third chapter contains a variety of material such as an outline of development, a statement of the orientation of the embryo in the egg, a discussion of the methods of classifying embryos, and an excellent table of the time of appearance and rate of differentiation of the organs. It would be wiser, perhaps, to omit this chapter because it makes too great a break in the account of the development of the embryo and contains much that the student can not yet understand. The content of the chapter could well be used elsewhere: for example, the section on orientation should be used, I believe, in connection with the account of the formation of the entoderm, given in the preceding chapter. The table, being merely for reference, should be used as an appendix.

The fourth chapter, entitled, From Laying to the Formation of the First Somite, is divided into four sections. The first is a description of the blastoderm in the unincubated egg and amounts to a review of the latter part of the second chapter. The primitive streak is described in the second section under four heads: Whole Views, Sections, The Head Process and Interpretation of the Primitive Streak. This division, especially the separation of the description of the whole views from that of the sections of the primitive streak, seems unwise. Four views of the blastoderm and three sections of the primitive streak of the sparrow, copied from Schauinsland, serve only to show by contrast the excel-

lence and fidelity of Dr. Lillie's figures. The last two sections of the chapter, describing the mesoblast of the opaque area and the germ wall, are very satisfactory. The chapter as a whole is a good account of the origin of the mesoderm.

The fifth chapter, Head-fold to Twelve Somites, is divided into parts upon the head-fold, fore-gut, neural tube, mesoblast and an embryo with ten somites. The attempt to describe the growing embryo, as a whole, breaks down in this chapter, and it might have been better to begin the part upon organogeny at the end of this chapter or earlier instead of after the next chapter. As it stands, portions of this chapter and of the next anticipate statements which are made later.

The second part of the book contains, in addition to chapters on each organ-system, a chapter on the external form of the embryonic membranes and one on the body cavities, mesenteries and septum transversum. There is an extensive and useful bibliography.

The book contains the inevitable errors of a first edition. There is no mention of the origin of the feathers, of the lymphatic vessels and of the muscles of the eye. The anterior division of the embryonic heart is called the bulbus arteriosus, or the bulbus, in the text, index and the original figures, but is named the bulbus cordis in copied figures. The choroid fissure is said to provide "an aperture in the wall of the optic cup for the entrance of the arteria centralis retinæ" (p. 166), but the author himself says elsewhere "There is no arteria centralis retinæ in the bird's eye" (p. 281). Happily such slips are infrequent.

The book contains a large amount of new material, for in addition to the second and fourth chapters upon the development of the egg before laying and upon the origin of the mesoderm, which embody difficult and fundamental research, it makes many small contributions to our knowledge of the embryology of the chick. The value of the book is greatly enhanced by this original matter, which, although it usually serves only to decide between conflicting opinions or to add small details, and although in conformity with the purpose of the book discussion of the literature and of interpretation is reduced to a minimum, gives a great store of facts that will be constantly referred to by students of embryology.

The numerous figures are well chosen and executed, but the publishers have poorly reproduced a number of them. More than half of the figures are new and among these are some very excellent drawings of whole embryos, and new diagrams of the structure of the egg and of the embryonic membranes. Some of the figures of sections could well be replaced by drawings of models.

The typography of the book is unusually good.

Professor Lillie's book, being a comprehensive and accurate statement of the processes by which the body and organs of a single animal are formed, will be of great service in the class-room where the careful observation and correlation of phenomena giving a training in true scientific method, are of more value than a broad and vague knowledge of many things and theories.

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A Canyon Voyage. By FREDERICK S. DELLENBAUGH. New York, Putnams. 1908. 50 plates.

Major Powell's "Exploration of the Colorado River of the West" is famous as a daring enterprise of forty years ago. His first river voyage in 1869 was briefly chronicled in his official report of 1875, and described in a more general manner in a popular book of later issue. His second voyage through the canyon in 1871 from the same starting point at Green River, has never been adequately described, although the results of observations then made were incorporated in the report above cited. At this late date, Dellenbaugh, a member of the second party, who has already written the "Romance of the Colorado River," in which earlier explorations are described, now gives us what he regards as a sequel to his previous book, in the form of a minute narrative of the second boat trip down the river, when he was artist and assistant topographer of the party. There is no attempt at scientific discussion, but a faithful effort is made to record every