causes, together with its astonishing virulence, they believe it should be named. This organism is therefore designated as *Klebsiella paralytica,* because of the paralysis it causes. A detailed report, covering all experimental and cultural work to date, is about to go to press.

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CRYSTALLINE d-MANNURONIC ACID

CRYSTALLINE d-mannuronic acid has recently been isolated in my laboratory by Mr. Eugene Schoeffel. Heretofore, d-mannuronic was known only in the form of its lactone. The lactone m. p. 140–141° $(\alpha)\frac{25}{D} + 89.8°$ was isolated for the first time by Nelson and Cretcher,[1] and subsequently by Schoeffel and Link.[2] The free acid was obtained by decomposing barium d-mannuronate, prepared from the algin of *Macrocystis pyrifera* and *Fucus serratus* after the procedure of Schoeffel and Link,[2] at − 10° in the presence of ethyl alcohol. The acid melts at 165°, has an initial specific rotation of –50° and a final value of –20° (after 2 hours) in water. Dr. C. S. Hudson, of the National Institute of Health, Washington, D. C., has calculated that the specific rotation of the beta form should be –37° (private communication). It appears, therefore, that the form of d-mannuronic acid which we have in hand is the beta variety. Experiments are under way by my collaborator, Mr. Carl Niemann, to synthesize d-mannuronic acid by the reduction of d-mannosaccharic acid. The details of this work will be published elsewhere.

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[1] W. L. Nelson and L. H. Cretcher, SCIENCE, 67: 527, (1928); *Jour. American Chemical Society,* 51: 1914, (1929); 52: 2130 (1930).

[2] E. Schoeffel and K. P. Link, *Jour. Biol. Chem.,* 95: 213 (1932).

TWO BUSTS OF GREAT SCIENTIFIC MEN

DURING the past summer I happened upon two lifesize marble busts that I am sure would be of interest to all physiologists and medical men—one of Johannes Müller, the biologist, and teacher of R. du Bois-Raymond, Helmholtz and Virchow, the other of the great Graefe, father of scientific ophthalmology. The sculptors, Drake and Siemering, respectively, are of hardly less renown. Their artistic and historical creations to-day adorn salons, public buildings or parks not only in Europe but also in America.

These two busts are now in the possession of Frau Professor Engelmann, of No. 52 Knesebeck Strasse, Berlin, W15, Germany, who must sell them at once on account of straitened circumstances. These busts would be a lasting adornment of historical value to any library of medicine, or to any medical school. Persons interested in the purchase of one or both statues should correspond with Frau Engelmann directly or with the undersigned.

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SCIENTIFIC BOOKS

Chemical Embryology. By JOSEPH NEEDHAM, M.A., Ph.D., fellow of Gonville and Caius College, Cambridge, and university demonstrator in biochemistry. Three volumes, 2021 pp., 1931. Cambridge: at the University Press; New York: The Macmillan Company. Price, $35.00.

THIS book, which, as its title indicates, marks a turning-point in the mode of approach to the traditional biological problems, is one of the most remarkable among recent works of biological scholarship—remarkable alike in its comprehensiveness, its critical and philosophical spirit, its excellence of style and arrangement, its clearness and lack of bias in discussion, its prevailing good sense and fairness in the appraisal of fact and theory. The treatment is extended and detailed, even leisurely. The author aims at giving an exhaustive account of our existing knowledge with regard to the chemical and physico-chemical aspects of embryonic development. He is well aware of the provisional nature of his undertaking, which is largely to clear the ground for the future; his main purpose is the furtherance of the study of embryology as an exact science, and he is conscious of the limitations of our present knowledge and of the need of advance in new directions and by new methods. The variety and range of material reviewed —not merely summarized but discussed with a keen sense of its general significance—are impressive. The bibliography alone occupies 242 pages, the reference to each treatise or paper being accompanied by a statement of the page where it is cited in the book. A feature of the treatment is the large number of original tables, graphs and diagrams. Wherever possible the material is presented quantitatively; in his final paragraph the author emphasizes the advantage, both in conciseness and exactitude, of substituting graphs and nomograms for verbal description. The historical side receives much attention and is illustrated by many citations and by reproductions of older pictures and portraits.

Such a work starts from the recognition that parallel with the morphological development runs a chemical development; to the specific morphogenetic sequence of ontogeny corresponds an equally specific chemical and physical sequence; the main task of the chemical embryologist is to trace the connection between the two. The microscopical methods show the morphological transformation of the germ; this process is observed to depend on local inequalities of growth associated with progressive differentiation; but it is evident that underlying each local morphogenetic process is a local biochemical process; this has both a synthetic and a catabolic side and is intimately associated with physical processes having to do with the deposition, removal and redistribution of reaction products. The physico-chemical factors of diffusion, surface action, osmotic pressure, bioelectric processes, temperature, catalysis, ion-action all contribute to the total result. Since the developmental sequence, considered as a whole, has orderly and constant character and leads to a definite and complexly organized end-product, the problem of the nature of the integrative factors coordinating the various component processes (often widely separated both in space and time) also comes up for consideration; this problem proves to be the most fundamental and difficult of all.

It must be confessed that our knowledge of the physiological factors controlling the course of development as a whole is at present far from adequate. Genetics shows a constant relation between the behavior of nuclear units (genes), in maturation and fertilization, and the appearance of definite characters in later development; but it has little to say regarding the special physiological conditions which determine and coordinate the separate chemical and physical events of the complex intervening sequence. The genes represent a factor of stability; so much seems clear; but stability, although a necessary factor in any transformation, does not account for its detailed course. It is true that certain definite factors of physiological control can be demonstrated experimentally; *e.g.*, the dominance or Organisator influence, the hormone influence (*e.g.*, in sex-determination); there are also the special provisions for embryonic nutrition (yolk, placenta), and many special structural devices like the amnion (the "private pond" of the embryo) and allantois of vertebrates. The author describes in detail the biochemistry of the egg-yolk, of the embryonic blood and tissues, of the amniotic and allantoic fluids, of the placenta; the factors of placental interchange are also discussed. One feels that much of this information has no special relevance to the problem of development as such; many biochemical stages, like many structural stages, appear to be important chiefly as scaffolding or temporary factors of stability. The relation of a descriptive biochemistry of the embryo to the factors of development is not always clear. This impression becomes stronger on reading the excellent chapter on the "Energetics of Development"; eggs and embryos of equal energy-content, but of different species, develop differently; evidently the factor of energy as such, while integral to the developmental transformation, has nothing to do with determining its special course. As Driesch has recently remarked,[1] the physical concept of energy is purely quantitative and non-directive; what we require to know is the special direction and time of its application, especially in the submicroscopic processes controlling the inner detail of the transformation.

In the concluding section ("Epilegomena") the author gives a list of provisional generalizations for chemical embryology; these are largely factual summaries independent of theoretical interpretation. A brief discussion on organization follows. In the formative action of the germ Needham sees evidence of an organization extending beyond the molecular level. "Living matter shows a constellation of processes strung together in a more highly organized manner than anything in the non-living world." The ultimate factors of development are to be regarded as immanent in the organized matter itself, and not as superposed from outside. All vitalistic hypotheses of a non-material entelechy are to be set aside as irrelevant to science. The unique fact about the living germ is its advance in complexity as it develops, in contrast to the tendency toward increase in randomness or non-organization so characteristic of the non-living world. The author touches on a fundamental problem here, but does not discuss it at length. He expresses himself as hoping much from the applications of the new physics to biology.

These are problems for the future. To the reviewer it seems unlikely that the directive feature so conspicuous in embryonic development can be understood physically without reference to ultimate small-scale factors of an intra-atomic nature; apparently these factors would have to be conceived as acting asymmetrically in space and in orderly sequence in time in correspondence with some kind of internal control. The chief scientific difficulty here is that such internal factors are, in the nature of the case, largely removed

[1] In a review of the work of E. Rignano, *Scientia*, January, 1932, p. 69.

from the possibility of observation, for the reason that observation itself requires transfer of physical influence (quanta) from one atomic system to another and eventually to the sense organs of the observer. The inner conditions determining the precise time and direction of any such transfer are themselves outside the range of possible observation. If we regard the physical as that which is externally or publicly observable (directly or indirectly), there would seem to be implied in such a view a transition to unknown factors of the metaphysical world. Since science aims, above all, at clearness and intelligibility, such a reference might seem inadmissible to many biologists. But we must not overestimate the finality of our present methods. Philosophical considerations have their place in science, although, as Needham everywhere insists, in the work of investigation itself reliance can be placed only on methods of precise and (where possible) quantitative observation and formulation.[2]

The presswork and bookmaking of these three volumes are admirable, and they are remarkably free from misprints. We have noticed a misplaced decimal on p. 793, where the isotonic concentration of a salt solution is given as 8.5 per cent. instead of .85 per cent.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A DEVICE FOR MEASURING THE MASS OF SMALL AQUATIC ANIMALS

IN the course of experiments concerning the density and growth of populations of certain small fishes (*Lebistes reticulatus* Peters),[1] it became desirable to obtain an accurate measure of the total mass of living material without injury to the specimens. The common method of estimating such a quantity, by means of noting the simple increase on introduction into a graduated measure partly filled with water, proved to be insufficiently accurate. This was chiefly because of the irregular introduction of drops of fluid which occurred if very small fishes were handled with sufficient rapidity to avoid injury.

In order to circumvent these difficulties, the device illustrated in Fig 1 was constructed. A reservoir "R" contains water identical in temperature and chemical condition with that from which the specimens to be measured were taken. A membrane filter "F," minus the membrane but retaining the perforated porcelain strainer, forms a receptacle for the fishes. These two elements are connected by a three-way cock "C" to a two-way burette "B." The measuring chamber of "F" is marked by two horizontal lines H_1 and H_2 which may be located at any convenient place. The volume contained in the chamber between H_1 and H_2 must be somewhat less than the capacity of the burette. The operation is as follows:

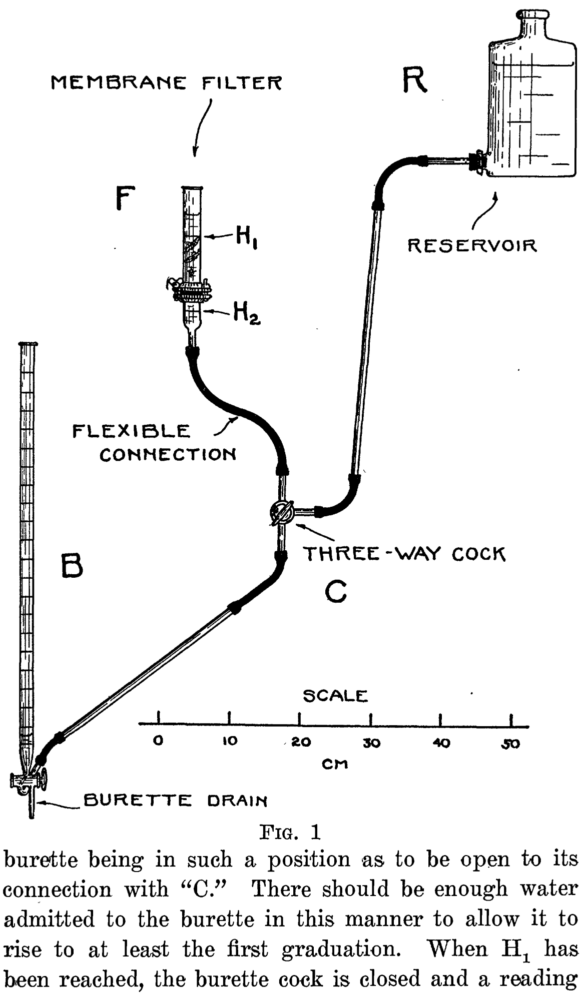

FIG. 1

Chamber "F" is nearly filled with water from "R" by means of cock "C." The fishes to be measured are introduced into "F." The water level in "F" is then lowered to H_1 by means of cock "C," the cock on the burette being in such a position as to be open to its connection with "C." There should be enough water admitted to the burette in this manner to allow it to rise to at least the first graduation. When H_1 has been reached, the burette cock is closed and a reading taken. Cock "C" is left open. The burette cock is now opened again, allowing the water to rise in the

[1] The specific problem on which this apparatus found its chief use was discussed under the title "A Preliminary Study of Population Stability and Sex Ratio in *Lebistes*," at the May, 1932, meeting of the American Society of Ichthyologists and Herpetologists, in Washington, D. C. This paper is to appear in an early number of *Copeia*.

[2] This is also Driesch's contention (*loc. cit.*, p. 70): "The sciences of nature with their rigorous method are the treasure of true knowledge."