matters of molecular concentration, osmotic tension, cryoscopy, periodicity, Ostwald's surface energy, relations to thermodynamics, diffusion, fields of force, all considered as elementary factors which enter into the synthesis of organic phenomena. In the matter of diffusion Leduc's experiments show curiously close parallels with organic processes, producing geometrical forms, circulation of "cytoplasm," "life" which survives freezing or drying, pseudosegmentation of a "germ," and phantoms of karyokinetic figures. Especially striking are osmotic growths, which are unquestionably the most complete parallels between the lifeless and the organic which have been devised. Following Leduc's formulæ one may cause "organisms" to grow which are curiously like algæ or fungi. Leduc points out that they will grow roots, stems and "fruit," the last sometimes appearing quite different in color. The growths have their periods of "youth, maturity, senility and death," they exhibit periods of activity and rest, they show cell-like divisions, definite form relations, and a circulation of their fluid contents; they will repair wounds, and show responses to external and internal stimuli. Peculiarly sensitive are these colloidal osmotic productions to changes in milieu: thus those "growing" around the sides of a jar will occasionally behave differently from those in the middle. Each salt, it appears, has its specific morphogenic properties. With some salts the "productions" are first attached: they then become amœboid and motile, sometimes forming spicules at the surface. The degree of concentration of the solution, also, determines sensitively the branching or the heaviness of the growth, the outcome of reactions which Leduc compares, by numerous chemical formulæ, to metabolism.

Altogether Leduc's book is interesting and it deserves to be carefully read. We need not admit that it *is* biology; but we must admit that the inorganic conditions which here are given detailed consideration have occurred and are occurring constantly in organisms. And we shall be apt to admit that the synthetic method promises results which will prove of great value. Leduc would be the first to agree that living substance may not be synthetized for ages, if at all. But each advance brings the goal nearer, in the solution of single problems, and even of their separate components. Leduc points out the immediate task of synthetists, and an essential one, is not the artificial production of albumenoids, but of a chlorophyllian substance which will decompose carbon-dioxide dissolved in water and be capable of assimilating carbon. In this direction one recalls the interesting notes of Matthews and of McPherson in recent numbers of SCIENCE.

BASHFORD DEAN

Praktikum der Bakteriologie und Protozoologie. Von KISSKALT und HARTMANN. Zweite, erweiterte Auflage. Zweiter Teil: Protozoologie. Von Dr. M. HARTMANN. Pp. vi + 106. Mit 76 teils mehrfarbigen Abbildungen im Text. Jena, Gustav Fischer. 1910. M. 4.

The task of securing adequate laboratory material for instruction in protozoology has been considerably simplified by the "Praktikum" of Kisskalt and Hartmann. The author of the second part, Dr. Hartmann, is the director of the laboratory of protozoology in the Royal Institute for Infectious Diseases at Berlin, a pupil of Professor R. Hertwig and the successor of Schaudinn as editor of the *Archiv für Protistenkunde.* The work is therefore authoritative and reflects the current practise in one of the greatest centers of research. The hand-book is written primarily for the medical student and includes only parasitic forms and especially those of medical interest. It is not a book therefore primarily for the biological laboratory though the range of forms it discusses is sufficiently wide to make the work indispensable to every student of the protozoa, and of greatest value in all laboratories in which the protozoa are studied.

The second edition has been considerably enlarged by the addition of a section on the technique of investigation in protozoology and by a chapter on the Myxosporidia and the Sarcosporidia. A number of new parasitic

types, principally from culture animals, have been added, including *Amœba lacertæ, A. diploidea, Entamœba muris, E. tetragena, Trichomonas muris, Lamblia* (and *Octomitus*) *muris, Leucocytozoon ziemanni, Proteosoma præcox* and *Balantidium coli.*

The plan of treatment is comprehensive, including general introductions to each group, and detailed accounts of the morphology and life history of each of the forms discussed together with directions for securing, controlling, cultivating and preparing the material for study. Illustrations often in color, illustrate the various stages and assist materially in the interpretation of laboratory material. Brief bibliographies of a few pertinent papers are appended.

It is to be regretted that the student of *Babesia canis* is left uninformed of Nuttall's work, that Fantham's work as well as Schellack's on spirochætes is not cited and that the sexual phase of the cycle of *Trypanosoma lewisi* is described as reported by Prowazek in *Hæmatopinus* without any hint as to the reserve with which his conclusions on this point have been generally received. This lack of caution is all the more regrettable in the light of Minchins's experiments with fleas as carriers and Doflein's recently published results of his experimental cultures and his conclusions as to the necessity of caution in interpreting stout and slender forms as sexual gametes and their conjunction as conjugation.

No chapter on technique of parasite flagellates is complete either historically or technically without calling the student's attention to the culture methods of Novy and MacNeal. Such omissions as these are hardly to be condoned by the fact that the author is writing primarily for the German student.

The figures are often original and are uniformly excellent. The condensed but comprehensive and lucid account of the significant features of the structure and life history of the important pathogenic and parasitic types available for laboratory use will be of greatest assistance to the student in this difficult field.

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TRIPHENYLMETHYL

Since modern methods of formulation were established, organic chemists have been able to represent the many thousands of compounds, whose constitution has been elucidated, by formulas in which the carbon atoms are always tetravalent. The single exception was carbon monoxide, CO, in which the carbon is necessarily represented as being bivalent.

In view of these facts it was natural that Gomberg's discovery of "triphenylmethyl," $(C_6H_5)_3\overset{*}{C}$, should arouse widespread interest, because, if it be correctly formulated, the carbon atom marked * is trivalent. During the ten years which have elapsed since Gomberg's discovery was first announced, a very large amount of work has been carried out in order to elucidate the true nature of triphenylmethyl. The most important contributions, which are summarized below, have been made by Gomberg himself, by A. E. Tschitschibabin, A. von Baeyer and more recently by W. Schlenk[1] and his co-workers in Baeyer's laboratory.

"Triphenylmethyl" is prepared by the action of certain metals, such as zinc, on triphenylchloromethane, $(C_6H_5)_3CCl$; the metal simply removes the chlorine atom. "Triphenylmethyl" exists in two forms, a white, solid modification, which is relatively stable, and a soluble yellow form exhibiting very great chemical activity. This colored variety has a molecular weight corresponding to the simpler formula, $(C_6H_5)_3C$.

As regards the colorless material, the facts pointed to its being hexaphenylethane, $(C_6H_5)_3C\cdot C(C_6H_5)_3$, but many chemists hesitated to accept this view, chiefly, perhaps, for the following reasons. The substitution of phenyl groups for hydrogen in hydrocarbons results, in general, in an increase in the stability of the product, consequently, in passing from ethane, $CH_3\cdot CH_3$, to hexaphenylethane, $(C_6H_5)_3C\cdot C(C_6H_5)_3$, we should expect to obtain an inert substance, but we find that the "hexaphenylethane," mentioned above, is so unstable that its mere solution, at the ordi-

[1] *Ber. d. chem. Ges.*, **43**, 1753, 3541, 1910.