making exaggerated claims of achievement which he was not able to substantiate that it is easy to show that most of his claims are without foundation. He did do a great deal in the study of the diffraction and interference of light, and Newton should have made a more complimentary and extended reference to Hooke's work than he did. Hooke's suggestion of the law of gravitation amounts to nothing more than a guess, and he never proved that his law could account for the planetary motions.

Newton's difficulties with Flamsteed, the Astronomer Royal, began when Newton asked him to furnish observations of the moon's positions. It appears from the record that Flamsteed furnished them as soon as he could and withheld none; but Newton complained to his friends that Flamsteed refused or delayed to furnish them. There was certainly delay in the development of the lunar theory, but apparently it resulted from Newton's procrastination rather than from Flamsteed's slackness. When the time came to publish the results gathered by Flamsteed in thirty years of observation, Newton was president of the Royal Society and controlled the committee which had the publication in charge. The history details a series of conflicts, in which Flamsteed's claims to the right to determine the main features of the publications were persistently ignored or overridden, and in which, apparently, agreements made by the committee and even by Newton himself were violated. Flamsteed was pertinacious and must have been irritating, but he seems generally to have asked for no more than his due. Newton's conduct seems inexcusable. We have no statement from him in justification.

The famous controversy between the Newtonians and the Leibnitzians as to whether Newton or Leibnitz first invented the differential calculus is given at length and with entire impartiality. There is now no doubt that Newton invented his method of fluxions several years before Leibnitz published his calculus. The evidence seems good that Leibnitz's invention was not based upon any hint which he received from the slight intimation which Newton had given of his method in two or three letters. Perhaps if the two principals had been asked, early in the discussion, before passions were aroused, to state on their honor what they had done and when they had done it, and to outline the course of thought which led them to their inventions, the full truth might have been known, due credit given to each and all controversy avoided. But such a course was not followed. Newton at first recognized Leibnitz as an independent discoverer, and Leibnitz admitted Newton's priority. But one of Newton's friends, irritated perhaps by the boasts of the Leibnitzians, accused Leibnitz of getting hints from Newton's work which led him to his discovery, and Leibnitz retaliated by hinting that Newton owed most of the development of the fluxional calculus to the model which Leibnitz had given him in his differential method. The quarrel dragged on for years. It is hard to decide which of the two principals was more unfair in his suspicion of the other, or which descended to the more unworthy methods of attack. Neither of them comes out, after a fair examination, free from reproach.

Unlike most of the biographers, Dean More, in detailing these controversies, has kept free from partisanship. Perhaps his judicial attitude was made easier for him because he had no national hero to defend. And yet it is hard for any English-speaking person not to feel a bias in favor of Newton. He is the crowning intellectual glory of our branch of the human family, and it hurts our pride in him to learn that he was suspicious and irritable, often on slight provocation, and implacable in his resentment when he felt himself offended.

An important chapter of the book is devoted to a review of Newton's work in chronology and theology. It is customary to depreciate this work as unworthy of so great a genius and even, as Biot did, to look at it as a result of his nervous collapse. But Dean More shows that such studies had occupied him from his early days and that some of his most important work had been done before his illness. It is shown, that, though his chronology is hopelessly wrong, the system which he proposed exhibits immense reading and great ingenuity. From some hitherto unpublished material we learn that Newton, as has often been suspected, was an Arian, though he had no scruples in maintaining his connection with the Established Church.

In the preceding paragraphs have been cited a few of the topics which Dean More has introduced in his book to elucidate the history of Newton's life. They are only examples of his method and indications of the wealth of scientific and historical learning which his book contains. He has accomplished a great work, and it may well be that he has written the definitive biography of Isaac Newton.

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THE KINETIC THEORY OF GASES

The Kinetic Theory of Gases. By LEONARD LOEB. xi + 687 pages. Published by the McGraw-Hill Book Company, Inc., New York City.

THIS is the second edition of the well-known book by this author. The general style of the first edition has been maintained. The aim is apparently to keep the student interested at all costs and to lead him by successive approximations to the theory from the simple to the more complex. The factor of safety which the author has employed to insure success in

this direction is largely responsible for the great length of the book.

Besides the problems usually treated under the kinetic theory of gases there is included about fifty pages on specific heats and about sixty pages on electric and magnetic susceptibilities. These subjects are dealt with in a necessarily sketchy fashion, since they belong more properly in statistical mechanics. A most unusual feature of the book is the chapter of about one hundred pages on the subject of ionic mobilities on which the author is a distinguished authority.

Another novel feature of this book is the extensive use of the results of molecular beam experiments in discussing the basic questions of velocity distribution, low pressure and surface phenomena. There is unfortunately a serious slip on page 540, where it is stated that the magnetic deflection pattern has a maximum at a distance z_a. This maximum, as is well known, occurs at a distance more nearly equal to $(1/3)z_a$.

There are also extended changes in Chapter 5 on the "More Accurate Equation of State" and in Chapter 6 on "Transfer Phenomena" to include a treatment of molecular force fields. The changes have proved rather unfortunate, since they come at a time when the work of Massey and Mohr and of Uhlenbeck has shown that these considerations are quite inadequate and that the results of the quantum theory of collisions can not be neglected.

However, despite some defects this book remains one of the best to put into the hands of beginning students of kinetic theory.

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CYTOLOGY FOR STUDENTS

Introduction to Cytology. By L. W. SHARP. Pp. xiv + 567. McGraw-Hill Book Co. 1934.

THE third edition of Sharp's "Introduction to Cytology" maintains the high standards of the previous editions, which have made this book the leading text in its field. The subject is treated from the standpoint of cell structure and morphology, with emphasis on chromosome behavior in relation to genetics. A general description of cells and tissues is followed by several chapters on various cell constituents. A description of chromosome structure, chromosome morphology, mitosis and meiosis serves as an introduction to six chapters on the more important aspects of the new hybrid science, "Cytogenetics." These are followed by chapters on chromosomes and sex, apomixis and cytoplasmic heredity. A historical sketch of the development of cytology is presented in the last chapter, followed by an extensive bibliography.

The transfer of most of the literature citations to footnotes makes the references available without breaking up the continuity of the text. An outstanding feature of the book is the impartial treatment of controversial subjects. A good balance is maintained between facts and theories which should be stimulating without misleading the student. The emphasis on cytogenetics is in keeping with the numerous important contributions on chromosome behavior in relation to genetics, taxonomy and evolution. To students in these fields of biology, as well as to students of general cytology, Sharp's book is indispensable.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

ON THE CULTIVATION OF SEVEN SPECIES OF TRYPANOSOMES IN VITRO[1]

DURING the last five years the writer has successfully cultured the following species of trypanosomes on N.N. media.[2] One or two strains representative of each species have been maintained *in vitro* for periods of from nine months to over three years.

With some experience one can distinguish the cultural forms of certain species from the others herein reported, on the basis of their morphology and rosette formation as they appear when cultivated *in vitro* under identical conditions. Thus the individual cell, as well as rosettes of *Tr. duttoni,* differ from *Tr. americanum* and *Tr. avium.* The *Tr. americanum* in culture differs from that of *Tr. melophagium;* the former has its peculiar groupings and movements and the individual cells are relatively much larger, while *Tr. cruzi,* by virtue of its broad and slender forms, its movement and rosette formation, can also, at times, be distinguished from species mentioned above.

All species studied formed circular colonies on the slant portion of blood agar tubes. *Tr. americanum, Tr. duttoni* and *Tr. cruzi* colonized much sooner and more readily on this medium than *Tr. lewisi* or *Tr. rotatorium.* The latter species formed colonies only after several months' cultivation; however, once they commence forming colonies, afterwards they colonize readily. The colonies of *Tr. rotatorium* at times reached about 8 mm in diameter and closely resemble colonies of *B. megatherium,* while the colonies of *Tr.*

[1] From the Hygienic Laboratory, University of Michigan.

[2] F. G. Novy and W. J. MacNeal, "Contributions to Medical Research, Dedicated to Victor Clarence Vaughn," p. 549. George Wahr, Ann Arbor, Michigan, 1903.