Measuring the Invisible World. The life and works of Antoni van Leeuwenhoek. A. Schierbeek. Abelard-Schuman, New York, 1959. 223 pp. $4.

The author of this book, A. Schierbeek, is editor-in-chief of the 280 or so letters of Antoni van Leeuwenhoek (1632–1723), the collecting of which is still in progress. *Measuring the Invisible World* is a useful book that adds much to our knowledge of Leeuwenhoek and gives us an evaluation of his contributions to scientific knowledge. It constitutes a major step toward realization of the author's anticipation that "in the year 2000 we shall have a much better understanding of Leeuwenhoek than we have today."

Leeuwenhoek, who never wrote a book, entrusted the recording of his observations and discoveries to his letters alone. Because one letter often embraces more than one topic and, in addition, the same subject may appear in several letters as research advances, the task of Schierbeek was not an easy one, especially in his endeavor to present a "true impression of Leeuwenhoek's investigations." His method was systematically to gather together and translate into English adequate samples of Leeuwenhoek's writings, classifying them into categories. Then under each topic he critically studies and comments upon the subject matter, thus making accessible a vast amount of hard-to-get and hard-to-organize material. As a result, we have a more accurate picture of Leeuwenhoek, the central figure of this book.

The general order of Schierbeek's classification, from chapters 3 through 9, falls under the following main topics: In chapter 3 are considered Leeuwenhoek's microbiological investigations, which caused a great sensation in scientific circles; his finding of the "animalcules" in a great variety of specimens; his original research that led to the discovery of the unicellular organisms, the Protozoa, as well as his pioneering and almost startling notes on the observation of bacteria. Chapter 4, on the theory of generation, discusses his views on the ovarian structure of many species (human ovum, however, was not discovered until 1827, when it was announced by Carl Ernst Von Baer), and his discovery of spermatozoa, which formed a step toward making embryology a science. Such investigations show why Leeuwenhoek became a vigorous opponent of the doctrine of spontaneous generation, which was prevalent from antiquity up to the 17th century, and why he embraced his preformistic interpretation of the origin of spermatozoa. This chapter also reports his description of the minute fresh-water creatures: the formation of the daughter colonies in volvox, the budding of the hydra and the rotifers. Chapter 5 presents Leeuwenhoek's fascinating investigations in histology: red blood corpuscles and his interpretation of their origin; capillary circulation which Malpighi had discovered earlier; and his pioneering microscopic observations of the tissues of nerves, muscles, and the lenses of the eyes of many animals, as well as of bones, teeth, and hair. Then, in a most elegant manner, the author displays in chapter 6 Leeuwenhoek's careful entomological reports on the plant louse, the grain moth, the flea, and the "compound" eyes of insects.

Chapter 7 deals with Leeuwenhoek's investigations of lower animals, while chapter 8 is concerned with his writings on wood structure, the stings of nettles, the transport of nourishment in plants from "globule to globule," and the seeds of plants which are contained in the "embryos." Chapter 9, on medicine, shows Leeuwenhoek's interest in therapeutic observations and his liberty in criticizing both the quackery and the irrational procedures found in medical practices during his time. It also contains his remarks on crystals and salt in plants. The concluding chapter makes a brief survey of the contributions of this immortal scientist from Delft, his place in the period during which he lived, and his impact upon his contemporaries and upon later generations.

Of special interest to the historian of science is the informative and well-organized material in chapter 2, which serves as the author's introduction to his systematic studies in the chapters that follow. Chapter 2 contains a brief history of microscopy and the method by which this great microscopist constructed his some 550 single-lens microscopes, using the simple magnifying glass; a description of his use of a counter in the earliest known attempt to measure the size and estimate the number of examined microscopic objects; and his first letter (May 1673) to the Royal Society of London.

Chapter 1, written by Maria Rooseboom, is a biography of Leeuwenhoek. It includes an account of the noteworthy events during the illustrious days of the Dutch Republic, the role played by the middle class, and the new philosophy that spread among learned men of the 17th century who sought to understand the universe by knowing the laws which govern it. Such a historical and geographical setting is especially appropriate for understanding a man who spent almost all his life in the land of his birth and who, in spite of his diligence in research, never knew any language other than his mother tongue. Leeuwenhoek, nevertheless, we are told, enjoyed good relations with the Royal Society and was generous to his visitors, among whom were dignitaries and eminent men who came to Delft from many parts of the Western world to pay homage.

In her brilliant approach and persuasive style, Maria Rooseboom gives us profound insight into the intellectual activities of Leeuwenhoek within his environment. She helps us not only to become acquainted with his life but also enables us to appreciate more completely how the aims of the book are ably fulfilled in the chapters that follow. I regret, however, that her narrative-chronicle has repeated and unnecessary interruptions that somewhat disturb both the reader's concentration and the harmony of the contents (see, for example, pages 15–25). She also overemphasizes several ideas and observations, later mentioned in the main text, in her endeavor to explain their importance; as a result, when they are expounded in detail by Schierbeek under the appropriate topic, their appeal is minimized. Neither Rooseboom nor Schierbeek has escaped the temptation to give an extra measure of praise to their renowned countryman whom they both love and highly admire. This explains, moreover, why they insist on attributing to Leeuwenhoek, though often with much justification, the title of being the first, or the father, of a science or of a discovery.

Although in my estimate (especially in regard to the author's aims) chapters 1 and 6 constitute the most efficiently handled parts of the book, by and large Schierbeek has done great justice to his subject in other chapters as well. His preludes under the various classified categories are again of particular interest to the historian of science, for they link together earlier developments of a subject with the degree of its advancement in Leeuwenhoek's time. Therefore, it does not diminish in any way our

large debt to an able author to say that more adequate coverage is needed for a number of the topics discussed in these surveys—for example, in the prelude on man's knowledge from antiquity to the 17th century of blood circulation. Here we might expect the author at least to mention in passing the improvement made in the understanding of blood circulation, because this understanding differed from the Galenic interpretation and was expressed 4 centuries prior to the monumental experiments and resolutions of William Harvey. Also, the attempt to connect Sarton's comment on Leonardo da Vinci with Leeuwenhoek's achievement seems artificial, because the circumstances that led da Vinci to write his notes for "his own private use" were completely different from those of Leeuwenhoek. In fact, it seems in several passages that Schierbeek tries to put words into Leeuwenhoek's mouth by interpreting his ideas and modifying the interpretations to fit modern scientific concepts. Such ideas, it is fairly safe to say, were in all probability not so clearly conceived in the mind of our 17th-century scientists. For the same reason we might have hoped that Schierbeek would translate Leeuwenhoek's own words on the axons of nerve fibers and their structure, as he faithfully does other passages, rather than give us Cole's summary.

A minor criticism is in regard to the language of the book. Since English is not my native tongue nor that of the author, I am more appreciative of the difficulties faced in avoiding weak sentence construction, and from this point of view, I am sure that the author has secured a greater measure of success. Nevertheless, here and there a few grammatical errors and awkward sentences do appear. They are not serious mistakes, but they could be corrected. Up to a point, however, originality of expression in several passages rendered the discussion more interesting and genuine.

In concluding, I must state that this book, which deserves large credit, has given us a remarkable presentation of the intellectual activities of an immortal scientist. A close study of it will repay not only those concerned with the history of biological studies but also other historians of science who are interested in scientific progress in the early modern period.

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Medizinische Grundlagenforschung. vol. 2. K. Fr. Bauer, Ed. Thieme, Stuttgart, Germany, 1959 (order from Intercontinental Medical Book Corp., New York). viii + 827 pp. Illus. DM. 168.

Volume 2 of the scheduled series, *Medizinische Grundlagenforschung* (Fundamental Medical Research Problems), continues the tradition of volume 1 and presents the acute borderline problems of medicine and natural sciences in a form which, although apparently heterogeneous, nevertheless tends to assist in finding a synopsis for the multiplicity of modern scientific life. This main purpose of the series has been achieved with volume 2. In 17 chapters it deals with such problems as the formation of structure in nature and the second law of thermodynamics, cellular theory, cell electrophoresis, the importance of fibrinolyses, the chemotherapy of tumors and skin diseases, cancerogenic substances, and others. The presentation is clear and concise with the author's original work skillfully blended into the general review of the problems. Numerous, well-selected references encourage further studies and research.

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Photographic Lunar Atlas. Based on photographs taken at the Mount Wilson, Lick, Pic du Midi, McDonald, and Yerkes Observatories. G. P. Kuiper, Ed. University of Chicago Press, Chicago, Ill., 1960. $25.

This atlas is a magnificient achievement, prepared with loving care. I well remember my astonishment, while spending a day at the Lick Observatory in June 1957, at finding Kuiper in the darkroom making some of the prints which are now published.

Planning for the project began some 5 years ago. Fine photographs of the moon were already in existence at a number of the major observatories, and these were the source material for the volume. In August 1955 the proposal was discussed at the Dublin meeting of the International Astronomical Union, and the work of copying the negatives was begun in 1956. From some 1200 prints, final selection of the prints to be used was made late in 1959.

The prints are on a scale of 1:1,370,000, which corresponds to a lunar diameter of about 100 inches. On this scale a mile equals 1.2 mm. A supplement is planned, on double the scale, giving high-quality photographs of selected objects.

The atlas is divided into three parts: (i) an introduction (11 sheets), showing the subdivision of the lunar surface into 44 fields, and so forth; (ii) the main body (184 sheets); and (iii) 35 supplementary sheets. The total number of sheets is 230 and each sheet measures 17 by 21 inches.

In the main section, 176 sheets are printed in sets of four and folded. This makes them extremely awkward to handle in normal office use. These 34 by 42 inch sheets will doubtless be even more awkward to handle at the telescope. It seems unlikely that the paper will survive more than a few refoldings without cracking. Most users will probably decide to cut these sheets.

The atlas was planned for use at the telescope, and the type of reproduction and the paper were selected to permit the charts to be retouched at the telescope with pencil, crayon, or ink. Kuiper recommends "that observers use at least two copies, one for reference and the other(s) as research material at the telescope. The cost of the atlas has been held to a minimum, roughly 10 cents a sheet, not much more than drawing paper." It would be a real service to observers if replacement sheets could be purchased separately.

Packaging anything as heavy and bulky as this volume always presents problems, and these problems have not been completely solved in the present case. The box containing the review copy started coming apart shortly after it was received, and it is obvious that it is not sturdy enough to be used for library storage and handling. The charts could be kept in a table drawer, or they could be stored vertically in a standard x-ray file cabinet. Such files have been used very successfully for the *Palomar Sky Atlas*, and those who own that atlas might have enough space left for the *Lunar Atlas*. A more durable box could be made by having an inner box that slides into an outer box with the openings on the 2½ by 22 inch side. A more durable holder should be seriously considered when future editions are prepared.

Kuiper's introduction states that "The purpose of this atlas is to present the surface record of the moon as