fraction of the static friction between two clean, smooth glass surfaces in contact is due to molecular attraction between those parts of the surfaces which are so close to one another that their molecular adhesions come into play. This assumption would explain both the formation of the observed microscopic pits and the decrease in friction with decreased smoothness of the surfaces. If this interpretation applies to all friction between smooth, solid surfaces it would indicate that the friction is largely determined by the molecular attractions between the two surfaces in contact and by their mean distance apart.

G. W. HAMMAR
GORDON MARTIN

THE UNIVERSITY OF IDAHO

THE CONSCIENCE OF THE PAST AND THE PRACTISE OF THE PRESENT

INCREASING awareness among scientists of the barbaric uses to which their discoveries and inventions have so frequently been put—and in many cases are at the present time threatening the destruction of millions of human beings—has caused many scientists somewhat belatedly to take thought how best they can in future prevent such misuse of their labors. In our own day one of the greatest mechanical inventions of this or any other century, the aeroplane, has been turned into an instrument which power-crazed governments use to threaten not only the peace but the civilization of the world. It is therefore of peculiar interest for us to-day to hear what the inventor of the first airship, Father Francesco Lana (1631–1687), considered to be the strongest objection to his invention.

After enumerating the six technical objections which he foresaw to his invention (actually in his poverty he was unable to construct the ship), he goes on to say:

> Other Difficulties I see not, which may be objected against this Invention, besides one which to me seems greater than all the rest, and that is, That it may be thought, that God will never suffer this Invention to take effect, because of the many consequencies which may disturb the Civil Government of men. For who sees not, that no City can be secure against attack, since our Ship may at any time be placed directly over it, and descending down may discharge Souldiers; the same would happen to private Houses, and Ships on the Sea: for our Ship descending out of the Air to the sails of Sea-Ships, it may cut their Ropes, yea without descending by casting Grapples it may over-set them, kill their men, burn their Ships by artificial Fire works and Fire-balls. And this they may do not only to Ships but to great Buildings, Castles, Cities, with such security that they which cast these things down from a height out of Gun-shot, cannot on the other side be offended by those below.

This passage occurs in the author's "Prodromo," which was published in 1670. The first account and criticism of this work in English (probably by Robert Hooke) appeared in the *Philosophical Collections,* No. 1, 1680, pp. 18–29, and it is from this account that the translation given above is reproduced.[1]

M. F. ASHLEY-MONTAGU
HAHNEMANN MEDICAL COLLEGE,
PHILADELPHIA

SCIENTIFIC BOOKS

SCIENCE IN AFRICA

Science in Africa. By E. B. WORTHINGTON. New York: Oxford University Press, 1939. Pp. xv + 746. Illustrated. Maps. $4.00.

LORD HAILEY, the director of the African Research Survey, writes in the Foreword:

> This book is one of a series of reports prepared in connection with the African Research Survey. The problems of Africa, as they present themselves to those whose concern is with the development of the continent, are discussed in "An African Survey." The purpose of this volume is to summarize the present position of studies in the various sciences which have a bearing on African conditions.

Mr. Worthington starts in by pointing out the interrelations between branches of science, and then as an aid to the appreciation of the interdependence of scientific studies in Africa he mentions important points about the changing environment. For example, he says, "The picture really presented by Africa is one of movement, all branches of physical, biological and human activity reacting on each other, to produce what biologists would refer to as an ecological complex."

Mr. Worthington's first chapter deals with some problems of research in which he makes many practical suggestions arising from his investigations; for example, he points out the practical advantages of separating research organization from the executive

[1] A contemporary English translation of the relevant fifth and sixth chapters from the "Prodromo" is "The Aerial Ship, by Francesco Lana." The Aeronautical Society of Great Britain, London, 1910, 12°, pp. vi–7–27. The following are the studies which I have thus far been able to discover relating to Francesco Lana's invention: Wilhelm Balthasar, "An der Wiege der Luftschiffart. Francesco Lana und Barthol. Laurenço de Gusmao." *Frankfurter Zeitgemässe Brorchüren,* Hamm, Vol. 28, pp. 137–198, 1909; Anton von Brandis, "Studien über die Verfassungs-Geschichte der Gemeinde Lana," *Zeitschrift des Ferdinandeums für Tirol und Vorarlberg,* 3 Folge, Heft. 18, pp. 159–196, (Geschichtliche Abtheilung), Innsbruck, 1873; Angelo Ferretti-Torricelli, "Padre Francesco Lana nel terzo centanario dalla nascita," Ateneo di Brescia. Commentari, Brescio, 1931/32, pp. 331–390. See also Francesco Lana Terzi, *Magisterium Naturae, et Artis,* Brixiae, Libri 3, (1) 1684, (2) 1686 and (3) 1692.

work of the technical departments and placing it under a separate director of research, as in the system applied in the Anglo-Egyptian Sudan. He then shows how such an organization might be set up, taking the three subjects of Agriculture, Veterinary Service and Forestry.

He emphasizes the value of financing research, especially that of the long-range type such as land survey work, from special funds raised by loan rather than from current revenue, which fluctuates so much with economic conditions.

He points out, under the "Waste of Research," that great quantities of material are published mainly in official documents, such as several department reports, bulletins, pamphlets, etc. Information in this form is not readily available to the scientific expert. He suggests adopting a common format for the separation of scientific fact from administrative detail, a standardization of form for statistical tables and some means of referring to the contents.

In recent years organizations for the promotion of scientific studies in the colonies have been formed in Paris, Brussels, Portugal and Rome as well as in South Africa and England, but in spite of all this, which is mostly recent, this continent, which has been developed almost wholly in the twentieth century, has been led by economic development.

The rest of the book is divided into 17 chapters dealing with the following subjects: Surveys and Maps, Geology, Meteorology, Soil Science, Botany, Forestry, Zoology, Fisheries, Entomology, Agriculture, Cropplants, Plant Industry, Animal Industry, General Health and Medicine, Human Diseases, Health and Population, Anthropology.

There follows an alphabetical list of 192 authorities who have assisted by providing information or commenting on the drafts, also 73 governmental departments in British Africa which were helpful.

There is a 64-page bibliography, arranged alphabetically by chapters, an index and a physical map of Africa.

In various chapters of the book, the author refers to the important work being carried on by the Royal Botanic Gardens at Kew in botanical investigations, the Imperial Forestry Institute at Oxford in forestry, the forest organization of the Union of South Africa, the British Museum (South Kensington) in Zoology and Entomology, the Zoological Society with its largest collection of living African mammals, the Society for the Preservation of the Fauna of the Empire stressing conservation, the four National and Provincial Museums in South Africa in Zoology, the Bureau of Animal Population at Oxford in ecology, the Imperial Institute of Entomology in the identification of insects, the East African Agricultural Research Station at Amani—one of the projected control research stations in the Tropical Empire—the London and Liverpool Schools of Tropical Medicine, and the Bureau of Hygiene and Tropical Diseases that abstracts articles of interest to Empire workers.

In this book Mr. Worthington has most effectively set forth the interrelation between sciences in Africa, the part they can play in its further development and the importance of scientific knowledge in coping with such problems as erosion, locust plagues and sleeping sickness.

One is impressed by the enormous job there is to be done and what a good start has been made on several fronts.

If we grant that the author has attempted to cover too wide a field within the covers of a single volume, nevertheless the title is misleading. Applied science in British or South African controlled territories, south of but not including the Anglo-Egyptian Sudan, would more nearly apply to the areas and subjects treated in the book. In most sections French, Belgian and Portuguese territories have been sketchily dealt with if they are mentioned at all.

The author in his own preface states that a shortage of time has resulted in the omission of much interesting work and that there is consequently a lack of proportion in the treatment of some subjects. This is unfortunately true. For example, such sections as the ones dealing with soil science, applied entomology, cropplants or the plant industry are competently dealt with, whereas his chapter on anthropology or his treatment of the preservation of flora and fauna seem by the same standard to be extremely inadequate.

It is extraordinary that in a survey of this kind significant scientific reports on African research by American and other foreign investigators should have been completely overlooked and not even find a place in the bibliography; for example, Dr. Richard P. Strong's two-volume report on "The African Republic of Liberia and the Belgian Congo," published in 1930, covering a wide range of scientific subjects reported on by competent investigators in the fields of medicine, botany, entomology and zoology, and Dr. Wilfred D. Hambly's two-volume "Source Book for African Anthropology," published in 1937 by the Field Museum of Chicago.

In "Science in Africa" mollusks and invertebrates outside of insects are hardly mentioned at all.

Mr. Worthington has succeeded in producing a readable book covering a wide range of interest written in a uniform style, and at the same time valuable for reference on account of its splendid double index, helpful maps and bibliography as well as the thoroughly sound recommendations which he makes in his opening (not concluding) chapter. It is most fortunate that such a competent zoologist was selected for this task and that he was a man of such wide

vision with a sound critical judgment. Let us hope that many of his excellent recommendations may be favorably acted upon in the years to come.

HAROLD J. COOLIDGE, JR.
MUSEUM OF COMPARATIVE ZOOLOGY,
CAMBRIDGE, MASS.

THE ADVANCE OF MEDICINE

Thus We Are Men. By SIR WALTER LANGDON-BROWN, emeritus professor of physic and fellow of Corpus Christi College in the University of Cambridge. xii + 344 pp. Kegan Paul, Trench, Trubner and Co., Ltd., London, 1939. 10s. 6d.

The March of Medicine. Selected Addresses and Articles on Medical Topics, 1913–1937. By RAY LYMAN WILBUR, president of Stanford University, California. x + 280 pp. 1938. $2.75.

Milestones in Medicine: Laity Lectures of the New York Academy of Medicine. Introduction by JAMES A. MILL, president of the New York Academy of Medicine. vii + 276 pp. D. Appleton-Century Company, New York, 1938. $2.00.

THESE three volumes have a certain similarity in that they illustrate the manner in which various and diverse individual essays may be integrated about a single theme. This is an increasingly popular way by which busy intellectual leaders may coordinate a series of brief efforts about a more general philosophy.

Sir Walter's volume is deliberately planned in this spirit. Its general theme is stated in the first essay, the 1936 Maudsley Lecture, "The Biology of Social Life," in which it is pointed out that the demands of human evolution for a functioning social unit combining full cooperation with individual freedom are currently causing great stress as we bumble along in trial and error toward a surviving fitness. Psychological factors impose the greatest obstacles in this evolutionary process. To proceed we should learn more about our minds and the way they work. As Sir Thomas Browne phrased it three centuries ago, "Thus we are men and we know not how." Sir Walter's next essay has the provocative title, "We Have Reason to Think." He deals with the perplexing phenomenon of the "retreat from reason" in literature and politics on the basis of individual failure to evolve smoothly from infancy to manhood.

About this theme Sir Walter now plays many variations. A set of six essays deal with psychological states as illustrated from literature and science. The fascinating character of these studies is indicated by the titles: "Myth, Phantasy, and Mary Rose," "Robert Bridges—the Poet of Evolution," "Sir William Osler," "The Psychology of Authorship," "Dr. Jekyll Diagnoses Mr. Hyde" and "The Background to Harvey." In the latter it is recalled that Sir Thomas Browne (1606–1682) first used the word "electricity" and that he was an experimental scientist of considerable merit, especially in chemical embryology.

Another set of six studies deals with applications of this social and psychological evolutionary idea to art and religion. The discussion on "The Evolution of Death" brings the volume to a notable climax. Sir Walter's great scientific and literary ability make these essays stimulating and delightful reading.

President Wilbur's volume includes twenty-nine addresses delivered at various important functions since 1913 and dealing generally with current nontechnical problems of biology, medicine and public health. Many of the earlier ones contain much wisdom resulting from years of experience on methods of teaching in medicine. The later ones are more concerned with the economic consequences of medical advance, and with the social significance of public health. As chairman of the Committee on the Costs of Medical Care, Dr. Wilbur summarized his views on these matters in his address before the National Conference on the Costs of Medical Care, at the New York Academy of Medicine, November 29, 1932.

For several years the New York Academy of Medicine has sponsored a series of "Laity Lectures" in which distinguished leaders in various medical fields have summarized recent significant developments in lay terms, or have dealt historically with interesting or practically important lines of progress. In 1936 the lectures were collected in a volume entitled "Medicine and Mankind," and included surveys of anatomy and physiology, an account of the medicine of the Amerinds, constitutional make-up in relation to disease, vitamins and a Carrel mystification on death. The 1937 lectures have now been published under the title "Milestones in Medicine." These titles are not quite appropriate. The books might better be titled "Laity Lectures in Medicine," giving then the year so that the series might be kept distinct.

The current volume includes an historical survey of psychiatry by Smith Ely Jelliffe, a discussion of the mechanisms of heredity by Charles R. Stockard, a diverting discussion of medicine at sea in the days of sail by Karl Vogel, a description of the evolution of the human brain by Frederick Tilney, a stimulating and documented "history of medical history" by Henry E. Sigerist, a historic account of leprosy by Newton E. Wayson and a survey of current knowledge of the glands of internal secretion by Walter Timme. Nonmedical scientists will find that these essays afford a pleasant way to follow the historical development of medical ideas. Judicious documentation might add to their value for this purpose without detracting from their readability.

CHAUNCEY D. LEAKE
MEDICAL SCHOOL, UNIVERSITY OF CALIFORNIA,
SAN FRANCISCO, CALIF.