differing elevations on accuracy and range of vision. The following comments upon what could and could not be well observed are based chiefly on papers (one and a half pages, typewritten) required later from each student.

(1) Observation of faults: Physiographic evidences of faults seemed to be noted by all. Though the particular Whittier fault suggested for consideration was merely guessed at by all but two students, who connected a scarp behind the Brea oil field with the fault, another fault, the San Jacinto line, which bounds the Perris peneplain to the northeast of the Santa Ana Mountains, was observed by about two thirds of the students of their own initiative.

(2) The river terraces, due to uplift, were not well located; at least, statements concerning them were vague. On the other hand, a partially dissected and uplifted fan-terrace, never observed from the earth except as the students dutifully "knew" it was there, attracted their eyes as something plainly discernible and "new."

(3) The contacts were variously estimated as "clear" to "obscure." A color change between the red of the Lower? Cretaceous and the gray of the Upper Cretaceous was rather generally located. Frequently, also, mention was made of "being able to see the continuity of a contact across canyons and divides." Such observation strikes me as very valuable, even if the exact bed was wrongly allocated.

(4) The Perris peneplain was observed with enthusiasm and very early. "From 1,900 feet the hills on what we had been told on auto trips was the peneplain looked like bumps on a wide stretch of flatness."

Students seemingly were able to observe, though scatteringly, more than the required four points. Straightness of certain streams, youthful and mature topography, springs along fault lines, braided rivers, arrangements of oil wells, the shape of Santa Catalina Island far to the west, the asymmetricality of the Santa Ana Mountains from an elevation of 4,500 feet, silver mines in a dike ("I see now it *is* a dike," wrote one student)—these and other details drew comment in one or another paper. Average strike and dip of formations were often determined, though Brunton compasses were unusable.

On the whole, then, the experiment was a success, particularly in giving a bird's-eye instead of our ordinary ant's-eye view. The visibility was excellent; at 1,900 feet, our average elevation, gas station signs were entirely legible. The speed was about 100 to 115 miles per hour.

We plan, in connection with a field geology course for the same group of students next semester, to fly over a region unknown to them. If, as seems probable, this flight can be preceded by another over known territory, so that the students become more accustomed to note-taking in the air, the results of the third flight should be very interesting.

ARTHUR J. TIEJE,
Chairman, Department of Geology
UNIVERSITY OF SOUTHERN CALIFORNIA

SCIENTIFIC BOOKS

THE OPUS MAJUS OF ROGER BACON[1]

The Opus Majus of Roger Bacon: A Translation by ROBERT BELLE BURKE, Professor of Latin and Dean of the College, University of Pennsylvania. 2 volumes. Philadelphia: University of Pennsylvania Press, 1928.

AMONG the records of scientific thought we find here and there, separated usually by long intervals of time, certain books which stand out like landmarks. Broad and general in their scope, written by men who attracted unusual attention from their contemporaries, each book may be taken as a fair representation of the state of scientific thought at its best at the time the book was written. To the understanding reader such works present a picture of the intellectual life of their time as full and clear as Hogarth's drawings of the daily life of the eighteenth century London which he loved so well. Among such books may be mentioned Newton's "Principia" (1687), Gilbert's treatise "On the Magnet" (1600), and the writings of Roger Bacon (1266).

Taken jointly, these three books illustrate, for one thing, in graded succession a steady tendency away from the occult and the supernatural in scientific thought. The writings of Bacon are deeply tinged with the superstition of the Middle Ages, but by Gilbert's time, three centuries later, this element had become of minor importance, and in the "Principia," less than a hundred years after, it had practically disappeared.

It is easy for the twentieth century to be impatient with Roger Bacon; with his prolixity, his endless citation of ancient authority, and above all with his superstition. To our thinking, this latter seems inconsistent with a type of mind that delighted in the study of the anatomy of the eye, in optical principles and in their application to the rainbow. Indeed, the suggestion has not been lacking that he who upheld experiment and observed the stars from his tower at Oxford, who knew at least the pyrotechnic properties of gunpowder, must have been insincere in his monastic profession, desiring only the loaves and fishes

[1] Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

that the Church could offer him, in order that he might pursue those profane studies in which his real interest lay.

This opinion appears to have originated with his contemporaries. The common people suspected him of witchcraft (small wonder, with his fireworks!) and his superiors in the Franciscan order had doubts of his orthodoxy. That this latter opinion has survived to the present day is partly due to the fact that, buried in medieval Latin, the writings of Bacon have been unable to speak for themselves. In making it possible for us to become acquainted with the man himself, Professor Burke in translating the "Opus Majus" has done the scholarly world a service. May the reception of this work be such as to encourage him to do the same for the "Opus Minus" and the "Opus Tertium."

The reviewer comes from the reading of the "Opus Majus" with the feeling that Bacon was a misunderstood man even in his own day. It is impossible that one could maintain the part of a hypocrite to such perfection through the length of these two portly volumes. His words have everywhere the ring of sincerity. Bacon's recital of the story of the demon and the heretical bishop (Vol. II, page 816) is given with a childish faith that is touching.

When we turn from this to the famous passage foreshadowing the invention of the telescope (Vol. II, page 582) we may wonder at the apparent inconsistency of this grasp of natural principles with the superstition of the times, but in another passage (Vol. II, page 581) we see that to the medieval mind there was no inconsistency in the two. Bacon seems to have been acquainted with the phenomenon and cause of sun-dogs, for he says naïvely:

"Moreover, if one knew that the air is dense, so that reflection could be obtained from it, he might produce many unusual appearances of this kind. In this way we believe that demons show camps and armies and many wonders to men."

A sympathetic understanding of the "Opus Majus" requires a knowledge of the conditions under which it was written. For this purpose a parable may be helpful.

There was once a young man, ambitious and patriotic, desiring above all things to serve his country. As the most available means of self-expression in this respect he sought and obtained a minor clerkship in the Government service. In the course of time he became disillusioned. He found about him those who regarded their positions merely as means of making a living which, while neither luxurious nor ample, was at least safe and secure in troublous times. He was thrown into association with those who took no pride nor professional interest in their work, and who followed for the most part rules laid down by those long dead, which our hero saw clearly were no longer suitable to changed conditions.

Our young clerk followed a different course. He read and studied much, convinced that all knowledge, however remote it might seem from his daily tasks, could not but be beneficial and helpful to him and his fellows, and must contribute to the strength of that nation which they had all sworn to serve. He even went to the length of experimenting in the hope of finding new knowledge, a thing decidedly not done in the best official circles of his time.

More than this, he did not hesitate to speak his mind to those about him, superiors as well as equals, pointing out that new knowledge would be an excellent thing for them all professionally. But his superiors were old fogies. They refused to listen to him, and when his persistence became annoying they transferred him to a post in a distant city, sending with him injunctions to his new chiefs to keep him strictly to his duties and to put a seal on his lips.

And then—wondrous good fortune!—one of the few who had ever shown any interest or sympathy in him was elected president!

We may well believe that our hero lost no time in writing to him, and that with his congratulations he expressed the hope that this turn of affairs would be the means of lifting the civil service out of the rut in which it had so long moved.

His hope was not in vain. He soon received a kind and sympathetic letter from the president, asking (or rather commanding) him to write out fully his plans and ideas for the betterment of the service, disregarding any orders to the contrary that might issue from his immediate superiors.

Would he write? Will a duck swim? History records not the conclusion of the story, but without doubt our hero wrote as fully and completely and as hopefully as Roger Bacon, the Franciscan friar, wrote at the command of Pope Clement IV; wrote from his prison in the House of Franciscan Friars in Paris, whither he had been sent from Oxford as a troublesome character, under suspicion of witchcraft and heresy; wrote in defense of his studies and experiments, ever insisting that his motives were unimpeachable, and that such knowledge of the ways of Creation could not but redound to the greater glory of the Creator.

Bacon is commonly regarded as a lone instance of scientific activity in his day of tradition and scholasticism, a voice crying in the wilderness; but from the fact that at least one other intellectual took an interest in him, we may infer that there may have been others of his type to be found here and there, exceptional souls, "mute, inglorious Bacons," (with

apologies to Gray) perhaps equal to the Franciscan in all save opportunity. And for the opportunity and the protection afforded Friar Bacon the name of Pope Clement IV deserves to be held in grateful remembrance.

In Roger Bacon we see a man of natural ability fettered by the limitations of his time, a mind struggling toward freedom but handicapped by hereditary modes of thought. We should emphasize what he attempted to do rather than that which he failed in doing. Still upon every one of us tradition, convention, circumstance, lays a restraining hand.

> Thou little child . . . . .
> Full soon thy soul shall have her earthly freight,
> And custom lie upon thee with a weight
> Heavy as frost, and deep almost as life.

PAUL R. HEYL

AMERICAN ASSOCIATION OF PHYSICAL ANTHROPOLOGISTS

THE recent meeting of Section H of the American Association for the Advancement of Science (December 29–30, 1928) has resulted in an event of much importance to the future of physical anthropology in the United States and the neighboring countries. This event was the definite organization, on this occasion, of the American Association of Physical Anthropologists.

The need of such an organization has been felt increasingly for several years. An initial proposal for its realization was made in 1924 by Hrdlička, but to some of the workers the time then did not seem to be quite ripe. Since then developments in this country in physical anthropology, in its research, personnel, publications and its prospects, have steadily advanced, and it was felt more and more clearly that, as in the history of all other branches of science, the time had arrived when an organization of the workers in this line was becoming a necessity.

In view of these conditions Hrdlička presented the whole matter once more before the well-attended meeting of Section H, in New York, and it met with a favorable reception. As a result there met, following the session of December 28, about twenty anthropologists and anatomists, and each of these individually and unreservedly expressed himself in favor of the founding of a special association for physical anthropology. There was then elected a committee of organization with power to act, composed of Drs. Fay Cooper Cole, Charles H. Danforth, George A. Dorsey, William K. Gregory, Ernest A. Hooton, Aleš Hrdlička and Robert J. Terry; and this committee, assembled after the final session of Section H, December 29, adopted unanimously the following resolutions:

> *Resolved:* I. That there should be, and hereby is, founded an organization of American and allied scientific men and women active or interested in physical anthropology, to be known as the American Association of Physical Anthropologists.
>
> II. That the general object of this organization will be the promotion, by all legitimate means, of the interests and serviceability of physical anthropology.

Thereupon all present, as constituent members of the new association, proceeded to the election of the officers; the results were: *Chairman,* Dr. Aleš Hrdlička; *secretary-treasurer,* Professor Dudley J. Morton.

In the detailed organization it was decided to follow, in the essentials, the American Anthropological Association.

It was further decided that the new association shall cooperate, to the limit of possibilities, with the American Anthropological Association, with Section H of the American Association for the Advancement of Science and with the American Association of Anatomists.

A still further basic principle of the new organization will be the fullest possible support of the *American Journal of Physical Anthropology,* which will be its official medium.

The eight initial members were then charged with the preparation of a detailed platform of the new association, the understanding being that its activities will be directed, in main, to the following objects:

(1) To the promotion of contacts, of cooperation and of service in this and other countries, with all branches of anthropology; with the anatomists and physiologists; with the biologists, and with medicine and dentistry.

(2) To the promotion, in the broadest sense, of research and publication in physical anthropology.

(3) To the promotion of sound anthropological teaching in universities, colleges, medical schools, art institutes and all other establishments of learning where such instruction, in suitable forms, would be useful.

(4) To the preparation of proper text-books, charts and other aids to anthropological instruction.

(5) To the promotion and harmonization of anthropometric instruction, and to that of standardization and production of anthropometric instruments in this country.

(6) To the extension of standard methods of measuring, with proper metric instruments, into all