hence, the first possibility is that at the quake itself the energy is spread over such a wide area that the waves emitted, unless brought to a focus, possess too little energy to make a perceptible record.

The other possibility is that the seismologists receive waves only from the real image of the hypocenter and not even feeble ones from the hypocenter itself. In this case we should have to postulate that the waves from the hypocenter were screened from the observing stations. The nature of this screening brings us to the question of how such a real image could be formed.

If we adopt Airy's view of mountain roots, it is easy to picture the roots as forming a vast parabolic basin which would act as a mirror with the reflecting surface the denser material in which the mountains may be considered as floating. If we take the Himalayas or the Hindu Kush Mountains where the quakes which occur are consistently of the same depth of focus, about 200 kms, the mountain roots would have to form a parabolic mirror extending this depth into the isostatic level and in length and width extending roughly the length and width of the mountain range.

Such a parabolic mirror, formed by sufficiently deep roots of a mountain range such as the Himalayas, could conceivably account for a real image of a surface fracture such as we have pictured, but the mountain roots would have to be deeper than previously imagined. For land quakes such as those occurring in the Hindu Kush Mountains, the fracture might occur above sea level, and hence only those rays brought to a focus below would be recorded. Those traveling direct from the fracture would strike the side of the mountain and give rise to but very feeble surface waves. For sea quakes, *i.e.*, quakes with their origin in sub-oceanic areas, we should have to postulate a screening effect by internal reflection from the sides of the parabolic mirror.

In conclusion, it must be emphasized that there is no evidence so far adduced to show that such image foci actually exist, but on the other hand there seems to be no evidence to show that they can not exist. Their existence is suggested as a possible alternative to overthrowing the existing geological picture of an earth with a rigid outer structure extending only some sixty or seventy miles. One step toward testing the theory is being made. Records of deep-focus quakes are being carefully scanned for evidence of phases earlier than the regular P phases. Naturally, one would not expect perfect screening of waves from an extended fracture and if there are two such hypocenters, a real one and its image, one should expect at least occasionally to pick up waves from each.

JOSEPH LYNCH, S.J.

FORDHAM UNIVERSITY

RESISTANCE TO SULFANILYL DERIVATIVES IN VITRO AND IN VIVO

DURING the past year and a half, we have characterized the growth of bacteria in broth by two constants, the time T required to reach a slight but definite turbidity,[1] and the slope K of the logarithmic increase thereafter. Organisms grown in the presence of sulfanilamide, sulfapyridine, or sulfamethylthiazole can show a marked increase in T accompanied by a much smaller change in K, indicating the development of resistance after a period of inhibition.

This resistance is partly temporary, and partly "permanent" (*i.e.*, appears in subcultures). The "permanent" resistance may be intensified by continued subculture in the presence of the drug, as shown by others for Pneumococcus[2] and Gonococcus.[3] We have found that eventually both T and K of the resistant strain grown in the presence of the drug approximate those of the parent strain tested in the absence of the drug.

The development of such resistance appears to be a general phenomenon. It also occurs *in vivo* during a course of therapy, as reported for Pneumococcus against sulfapyridine,[4] and as we have found in Staphylococcus aureus against sulfamethylthiazole.

The question arises whether organisms made resistant to one drug also are resistant to related drugs. We have found that two types exist, A, those in which resistance induced by one drug (*e.g.*, sulfanilamide) is carried over, and B those in which it is not. The metabolically versatile E. coli and Staphylococcus aureus belong to type A, whereas the fastidious Hemophilus parainfluenzae belongs to type B.

The implications of the foregoing for the theory of drug action and the control of therapy are obvious.

JEROME S. HARRIS
HENRY I. KOHN

DUKE UNIVERSITY SCHOOL OF MEDICINE

COLLECTING SUBTROPICAL PLANTS AND ANIMALS IN NORTHERN OHIO

CONCERNING the spread of animals and plants throughout the United States, it is of interest to consider the probable roles played by the various aquatic plant nurseries, such as the William Tricker Company in Independence, Ohio, which import plants from many tropical and subtropical areas throughout the world, and, in turn, ship them to places all over the country.

During the entire year, the pools of this company serve as a reliable source of extremely interesting

[1] The optical density determined in the Evelyn photoelectric colorimeter is directly proportional to the number of organisms.

[2] C. M. MacLeod and G. Daddi, *Proc. Soc. Exper. Biol. and Med.*, 41: 69, 1939.

[3] L. Westphal, R. L. Charles and C. M. Carpenter, *Jour. Bact.*, 39: 47, 1940.

[4] R. W. Ross, *Lancet*, 1: 1207, 1939.

forms, which come and go. Those which are not quite so ephemeral remain and can be observed at any time.

For the last four years, collections of the red algae, *Compsopogon coeruleus,* have been made there. It is one of the rarer members of the family, and it is especially interesting to observe it spreading among local indoor pools and aquaria.

In January, 1934, approximately, *Lophopodella carterii,* the bryozoan, first appeared in the warm water of the greenhouse pools, and since has spread throughout northern Ohio. I have actually seen many plants covered with this beautiful form being sent to water-garden enthusiasts in various sections of the country. Interestingly enough, too, this same company has its main plant, seventeen acres of growing pools and greenhouses, located at Saddle River, New Jersey, the same state in which Dr. Dahlgren, of Princeton University, observed the animal.

CHARLES OTTO MASTERS
WESTERN RESERVE UNIVERSITY

COLLECTION OF UNORTHODOX CURIOSA

THE writer has in his possession about two cubic feet of pamphlets and books, nearly all "published by the author," which fall in the category perhaps most charitably designated as unorthodox hypotheses in science (they bear earmarks which scientific men will recognize from this description), and which he has thought of donating to some institutional library where there might be a special interest in the history of science. The collection, for its possible value as curiosa, may not be considered worth shelf room, but, on the other hand, it might prove to be of interest or value to future historians of science and civilization, showing as it would that ours was not yet altogether an age of science, and that there existed among the public considerable opposition to what is often sarcastically described as "orthodox science."

ALBERT G. INGALLS
SCIENTIFIC AMERICAN

SCIENTIFIC BOOKS

THE PAGEANT OF ELECTRICITY

The Pageant of Electricity. By ALFRED P. MORGAN. xxvi + 363 pp. D. Appleton-Century Company. 1939.

THIS book is one in the series of "Science for the Layman." The author has written numerous books on popular science and has been an editor of a boys' magazine. However, this book is for mature readers.

The pageant of electricity is a brilliant and fascinating exhibition from whatever angle it is viewed. Here is pictured chiefly the application of electrical principles in commerce, industry, human affairs. The body of the text is preceded by eight pages of chronology of important dates (about 120) in the history of electricity from Roger Bacon to the present time. Three chapters, seventy pages, suffice to bring the story up to Faraday. In these chapters brief, very qualitative statements are made concerning electrical principles. Then the author turns to applications, the development of the telegraph, the career of Edison, the history of the telephone, "electrons dispel darkness" or the story of electrical illumination, electricity carries burdens, electricity and chemistry (the story of aluminum), electron bullets or x-rays, Hertzian waves and radio (100 pages), Doctor Electron or electricity in the hospital.

The story is well told. There is a wealth of historical material, quite a little of which is not found in histories of physics. The author is obviously well acquainted with the commercial side of electricity, and with museums in which are kept models of early forms of telegraph and telephone instruments, early incandescent lamps, electric generators, electron tubes, etc. Many interesting cuts illustrate these devices. Any one desirous of reading the story of the evolution of electrical applications will find these pages appealing and instructive.

The book can not be regarded as a history of electricity from the point of view of a physicist. For example, in the first few pages the author discusses the electron theory of matter. Here he is at least eight years behind the times. For, according to him, the nucleus still consists of electrons and protons instead of neutrons and protons. The term neutron appears once, but there is no place for it in an atom. A conventional model of a hydrogen atom is shown as consisting of two positive and two negative charges. There are other minor criticisms which may be made by a physicist.

But when the author turns to the development of commercial electrical devices, he is at home. Especially is this true in dealing with the contribution of Edison, of Bell, Marconi, DeForest and Major Armstrong. The patent litigation between the last two *inventors* requires several pages for its telling. Here the author very vigorously takes sides. He intimates that the Supreme Court was incapable of understanding the point upon which judgment was to be rendered. "Decision was rendered in favor of De Forest on a matter of *law,* the court not undertaking to *pass on the facts*" (italics are the author's). "But Armstrong had