tors and used them in the decomposition of fractions into partial fractions; John Bernoulli (1667–1748) who exhibited the connection between the arc tangent and the logarithm of an imaginary argument, and Leonhard Euler (1707–1783), who introduced in 1740 the use of imaginary exponents. The large number of interesting results which had been obtained by the use of complex numbers before the legality of this use had been proved may partly account for the fact that this proof failed to attract much attention until many years after it was first published. Correct results have frequently inspired faith in the correctness of the methods employed and were often accepted as proof of this correctness.

Although negative numbers were used much earlier than complex numbers, the solution of a quadratic equation having two complex roots seems to have preceded by about eighty-four years the solution of such an equation having two negative roots. The earliest known example of the latter appears in the "Invention nouvelle" by A. Girard which was published in Amsterdam, 1629. The late appearance of such a solution directs attention to the fact that the general use of negative numbers came much later than might be inferred from the modern early use of them in our schools. Among the late strong opponents to the use of these numbers was Robert Simson (1687–1768), who was professor of mathematics in the University of Glasgow for forty years after 1711.

Hence it results that what the modern high-school student is supposed to master easily gave much trouble to a noted professor of mathematics less than two hundred years ago. Possibly the concealing of difficulties in elementary mathematics is too frequently regarded as a simplification of the subject. While a clear explanation of the theory of operating with negative numbers does not seem to be older than the corresponding theory relating to complex numbers it is a clear exaggeration to assert that "the one glimmer of mathematical intelligence in the early history of negatives is the suggestion of Fibonacci that a negative sum of money may be regarded as a loss." This assertion appears in the "Development of Mathematics" by E. T. Bell (page 158, 1940). On the contrary, the ancient Babylonians already used the terms "tab" and "lal" with respect to numbers as we now use + and − to represent distances in opposite directions from a fixed line.[1]

G. A. MILLER

UNIVERSITY OF ILLINOIS

AN UNRECORDED CAUSE OF "RED WATER"

RED WATER has attracted the attention of seafarers since early times. Various marine organisms have been cited as giving rise to this phenomenon, frequently ascribed to one or another species of dinoflagellate, as, for instance, *Gonyaulax polyhedra* off our own west coast, but never before do trochophore larvae seem to have produced it.

In 1935 I had the good fortune of accompanying Captain Allan Hancock, of Los Angeles and Santa Maria, California, on another of his memorable Pacific Expeditions aboard his motor cruiser, the *Velero III,* now in the service of the U. S. Navy. The third of January saw us headed southward off the coast of central Peru, angling across the Humboldt or Peruvian current. During that afternoon, while a little more than 50 miles to the westward of the Lobos de Tierra Islands (6° 28′ S., 81° 51′ 30″ W.), many patches of "red water" were seen all afternoon. A sample dipped up in a bucket from one of them was preserved in formalin for later study.

The contained organisms, thought at the time of collection to be peridinians, though very much plasmolized as the result of preservation, were unmistakably some species of trochophore larva, either mollusk or annelid. Dr. Martin Johnson, of the Scripps Institution, in commenting on the material says, "There is a possibility that the larvae could be those of a bivalve mollusk—the trochophore stage of gastropods usually occurs while yet enclosed in a case. I was, however, unable to make out any shell gland, a feature characteristic of bivalves in this stage. The trochal cilia also seemed to be more characteristic of annelids." He adds that it was perhaps not possible to settle the question from the specimens at hand. It is to be regretted that these larvae were not sufficiently far advanced in development to permit definite determination.

As trochophores apparently have not heretofore been observed as causing "red water," the fact that they were present in such enormous numbers as to give rise to this phenomenon seems worthy of note. No temperature reading was made at the time of the taking of the sample, but while on the same course the surface temperature at 10:05 A.M. registered 19.50° C. (6° S., 81° 41′ W.) and at 5:30 P.M., 20.32° C. (7° 50′ S., 81° 53′ 30″ W.).

Besides Dr. Johnson, I am also indebted to Dr. Herbert Graham, Mills College, and Dr. Olga Hartman, Allan Hancock Foundation, University of Southern California, for critically examining the sample; and to Captain Allan Hancock for permission to publish these notes upon it.

WALDO L. SCHMITT

U. S. NATIONAL MUSEUM

THE TEACHING OF TROPICAL MEDICINE

THE request of the armed forces that medical schools give more emphasis to tropical disease presents new

[1] *Cf.* O. Neugebauer, "Vorgriechische Mathematik," page 18, 1940.

problems in methods of instruction. Most schools of medicine in the United States are located in regions where there are few if any examples of the important parasitic diseases, and hence clerkship or ward teaching is not possible. An alternative is a series of lectures or "dry clinics," supplemented by lantern slides and charts. This latter method is obviously deficient, since a thorough knowledge of a disease is rarely acquired without the study of patients. When a hospital patient is not available for study, the best substitute is the presentation of a case at a clinicopathological conference. In this exercise, if the case is treated as an unknown, it is possible to discuss the differential diagnosis and treatment in much the same way as in ward teaching. There is the added advantage that the pathologic changes can be presented at the conclusion of the clinical discussion.

At the Washington University School of Medicine an attempt has been made to develop the clinicopathological method of teaching tropical medicine. Representative gross specimens of specific cases, together with a full abstract of the clinical record, have been borrowed from other laboratories. The abstract is mimeographed and given to the staff and students two days in advance of the conference to allow ample time for study. At the conference the clinical record is briefly reviewed, and a senior clinician then discusses the differential diagnosis and treatment. Specific points are brought out by questions directed to members of the attending staff, each of whom has previously read the abstract and formulated an opinion. Finally the gross and microscopic observations and a summary are presented by the pathologist.

Since January 1, cases of leprosy, amebic dysentery, yellow fever and schistosomiasis have been presented in clinicopathological conferences to members of the third and fourth year classes of the medical school. The reaction of both the staff and the students has been sufficiently favorable to suggest that clinicopathological conferences may serve as a valuable method of teaching tropical medicine in medical schools of the United States.

HARRY L. ALEXANDER
ROBERT A. MOORE
W. BARRY WOOD, JR.
WASHINGTON UNIVERSITY SCHOOL OF MEDICINE,
ST. LOUIS

THE ELGIN BOTANIC GARDEN

THE question "Who Established the Elgin Botanic Garden?" which Dr. C. Stuart Gager puts as a title for his able article in SCIENCE, November 13, 1942, has arisen largely because certain reviewers of "Dr. Bard of Hyde Park" have implied that more credit should be given to Samuel Bard than to David Hosack.

It is fairly stated in my biography of Dr. Bard that his medical partner, Dr. Hosack, who was 27 years his junior, conceived the idea of the Elgin Garden in 1795 (p. 188). It was some six years later that Dr. Hosack purchased land for this botanic garden in what is now the midtown section of Manhattan, but in another six years he found the financial burden of maintaining the garden was too much for him to continue, and therefore in 1807 he offered the land for sale (p. 233).

At this point Samuel Bard came forward publicly and privately with the plea that the State Legislature should purchase the garden from Hosack and so established it for posterity (pp. 243, 244). Even after this was accomplished in 1810 the maintenance of the garden was still a dilemma. The College of Physicians and Surgeons with Bard as president and Hosack as professor undertook to carry on the garden until in 1816 the land where now rises the Rockefeller Centre was ceded to Columbia College. Thus in spite of Hosack's creation and Bard's sponsoring this ambitious adventure came to an end in 1819 so that the answer to the question seems to be that no one succeeded in establishing the Elgin Garden.

Another experimental garden which had its first inception in plans laid out by Samuel Bard in 1746 (pp. 80, 81, 83) for his great-grandfather's estate on the Hudson River called Hyde Park, still continues, however, as a monument of the botanical effort of Bard and Hosack. This estate was purchased by David Hosack after the venerable Dr. Bard's death and has received expert care from subsequent owners to the present day. It is now part of the National Parks Service and is known to many as the setting for the Vanderbilt Mansion National Historic Site at Hyde Park. After the war it is planned to make this eighteenth century garden a center for those interested in the science of botany.

J. BRETT LANGSTAFF,
President of The National Historic Site Association of Hyde Park

SCIENTIFIC BOOKS

NICHOLAS COPERNICUS

Nicholas Copernicus, 1543–1943. By STEPHEN P. MIZWA. The Kosciuszko Foundation. 88 pp. 20 illus. 1 map. 1943. $2.00.

REGARDLESS of these tragic and turbulent times, the spirit of humanism and culture endures. This philosophy of life may not always be able to express itself, yet we have had many evidences these past centuries that civilization does survive where culture and learning prevail. One form of this evidence is truly ex-