ventral skin to open the abdomen, the hind legs kick vigorously. The exceptional species is *Bufo variabilis,* about a dozen of which I killed in Naples.

The living *Bufo variabilis* is very sluggish. When handled, especially if roughly handled, it remains perfectly quiet, only distending the body to a great size by inflating its lungs. One can prick or cut the animal and produce no effect except a further distention, till the skin is stretched taut as a drum-head. Even cutting the spinal cord never produces much action and often produces none.

The interesting thing is that after one has cut the spinal cord and has destroyed the brain, the animal refuses to react by observable movements to any sort of abuse or injury, remaining as quiet as would an animal upon which no operation had been performed.

Bufo variabilis, like most toads, has very perfect protective coloration. It is further protected by the poisonous secretions from its skin glands. (I have had *Rana esculenta* die from being left twelve hours in a small aquarium, in a little water, with this toad.) The toad's habit of remaining quiet, even under abuse, is probably connected with its protective coloration and poisonous skin secretions, and is doubtless a recent acquisition. This reaction, or rather lack of reaction, in the normal animals may be either "conscious," or reflex, or both. In the animal whose brain has been destroyed it must be purely reflex.

MAYNARD M. METCALF

WÜRZBURG, BAVARIA,
July 3, 1907

BOTANICAL NOTES

THE ORIGIN OF ANGIOSPERMS

WITHIN the past few months two important papers have appeared upon the origin of the higher seed plants (angiosperms). The first is by E. A. Newell Arber and John Parkin, of Cambridge University, and appeared in the *Journal of the Linnean Society, Botany* (vol. 38, pp. 29–80, July 11, 1907). In it the authors first refer to the recent progress in our ideas as regards the phylogeny of the gymnosperms, which are evidently closely related to the *Pteridophyta,* and to the increasing isolation of angiosperms. Just as we find closer affinities between gymnosperms and *Pteridophyta,* we find the gap between *Pteridophyta* and angiosperms increased, until "it may be said that no definite theory as regards the origin of angiosperms has up to the present been elaborated." While "the gap that originally existed between the phanerogams and vascular cryptogams was now bridged, in its place there appeared a wide gulf between the gymnosperms as a whole and the angiosperms."

After a summary reference to certain principles of evolution (the law of corresponding stages, homoplasy and mutation) the authors discuss "primitive features among living angiosperms," basing their discussion upon the theory that the typical angiospermous flower is essentially a strobilus. They regard "the simpler, unisexual flowers, including apetalous forms, as derived from an amphisporangiate strobilus by reduction." They restrict the term "flower" to the angiosperms alone, and regard it as typical "when it possesses both micro- and megasporangia, as well as a perianth which in many cases has an attractive function."

In their critical examination of Engler's theory they hold that *Piperales, Amentiferae,* and *Pandanales* are not primitive in type, but that they are reductions from hermaphrodite types with well developed perianths. They regard *Apetalae* as forms "reduced from amphisporangiate strobili, in each case possessing a perianth," and not as primitive plants from which the petalous forms have evolved. In further criticism of Engler's theory, while admitting its merit of simplicity, they affirm that "its application as a working hypothesis does not assist us in our search for a clue to the phylogeny of the angiosperms as a whole: nor does it help to bring this group into line with any of those now known to us in the fossil state."

For the theory which they adopt, namely, "that the monosporangiate apetalae were derived by reduction from an amphisporangiate strobilus possessing a distinct perianth" they affirm that it "leads us back naturally to a great group of Mesozoic plants, the *Bennettiteae,* which afford the key to the ancestry of the race in question." They then construct a mental picture of a primitive strobilus (flower) consisting of a large, elongated, conical axis, bearing megasporophylls above, and microsporophylls below, and still below these a perianth of usually more than one whorl. Such a primitive flower is conceived to have been polypetalous, hypogynous, and apocarpous. Structures similar to this imaginary primitive flower occur in *Magnoliaceae, Ranunculaceae, Nymphaeaceae* and *Calycanthaceae* among dicotyledons, and in *Alismaceae, Butomaceae* and *Palmaceae* among monocotyledons.

The authors then take up an examination of the *Bennettiteae,* which "appear to afford the long sought for clue to the phylogeny of the angiosperms." They show that in these plants the anthostrobilus is sufficiently like that of the simple angiosperms to warrant the suggestion that the latter are derived from structures much like the former. They are able to reconstruct the anthostrobilus of *Bennettites,* and a comparison of this with the pro-anthostrobilus of the hypothetical *Hemiangiospermae,* and the primitive flower referred to above shows that the steps from the *Bennettiteae* to the angiosperms are easy and quite probable. In their discussion they make one remark which will surprise many a botanist who has not kept in touch with the recent advances in paleobotany, namely: "the seed itself is an exceedingly ancient organ, dating far beyond the period at which we first became acquainted with fossil plants; in other words, it was a highly evolved structure at a very remote period in geological time." Yet while all these early seed plants were gymnospermous, it does not follow that they gave rise to the sub-class *Gymnospermae,* as now understood. On the contrary, it is shown to be probable that the gymnospermous *Bennettiteae* gave rise rather directly to the *Angiospermae.*

The authors show how entomophily helped shape the developing primitive flower, and regard it as an important factor in the evolution of the angiospermous flower. They close their paper with a couple of pages of general conclusions and summary, including a helpful geological table of angiospermous relationships, and finally a bibliography of seventy-one titles.

The second paper, by O. F. Cook, "Origin and Evolution of Angiosperms through Apospory," was published in the *Proceedings of the Washington Academy of Sciences* (vol. 9, pp. 159–178, July 31, 1907). In it the author first refers approvingly to the now widely accepted hypothesis as to the origin of gymnosperms through the ferns and the *Cycadofilices,* and then remarks that while evidence of such origin of the gymnosperms has increased rapidly in recent years, it "has not been accompanied by any equally convincing indications that the angiosperms shared the same pteridophytic ancestry." He, therefore, suggests that "morphologists may be willing to consider an alternative possibility, that the origin of the angiosperms should be sought more directly in some such primitive condition as the thallose liverworts, without the need of following back through the stages of development represented by the ferns and other vascular cryptogams." In brief, his suggestion is that "the female reproductive apparatus of the angiosperms is analogous to the fern-prothallia which are sometimes produced directly from the parent plant without the intervention of spores, that is, by aposporous growth from cells of the parent fronds."

The author then develops the theory that angiosperms have descended from an *Anthoceros*-like type. He holds that *Anthoceros* is not representative of ancestral pteridophytes, a contention which appears to us to be quite unnecessary, even from his own standpoint, since it is evident that pteridophytes and angiosperms have much in common. He suggests that were the capsule of *Anthoceros* to become perennial, and "produce prothallia instead of spores" the transition to the higher plants would be accomplished.

The paper is quite markedly philosophical, and while one may not be able to accept its conclusions, every botanist will find it profitable reading.

THE STUDY OF DIATOMS

THE "Report on the Diatoms of the Albatross Voyages in the Pacific Ocean, 1888–1904," by Albert Mann, published as one of the Contributions from the United States National Herbarium (vol. 10, part 5) is a notable addition to our knowledge of this group of plants. In the introductory pages the author describes the methods of work, and points out the importance of a fuller study of these plants than has yet been given them by our government officials. The generic and specific names accord with "the rules now generally prevailing in botanical nomenclature," necessitating in some instances "the substitution of obscure and inappropriate names for those universally known and recorded among living diatomists," which the author "feels to be a grave misfortune." The "Annotated Catalogue" which occupies 160 pages, includes three hundred species, of which forty-three are here described for the first time. The author has not found it necessary to establish any new genera, and this fact taken with the very moderate number of new species, shows him to be conservative in his treatment of the group. It is interesting to note that of the species, 169 belong to the subfamily *Centricae,* while 131 belong to the *Pennatae.* The large genera are *Coscinodiscus,* with 34 species; *Tripodiscus,* 13; *Biddulphia,* 30; and *Navicula,* 54. A most useful bibliography (the work of P. L. Ricker) including about four hundred titles, and eleven full-page plates, including 56 figures (mostly of new species) complete this very interesting and valuable paper.

CHARLES E. BESSEY
THE UNIVERSITY OF NEBRASKA

MEDALS FOR RESEARCH IN TROPICAL MEDICINE

THE Mary Kingsley medal, instituted by the Liverpool School of Tropical Medicine to commemorate Miss Mary Kingsley, the African traveler, who died in 1900, has been presented to the following for distinction in work of special research into tropical medicine:

1. Colonel David Bruce, F.R.S., C.B., Royal Army Medical Corps, who in 1887 discovered the cause of Malta fever, and proved that that malady was produced by the milk of infected goats.

2. Professor Dr. Robert Koch, Nobel Laureate, who ascertained the cause of cholera, and who has contributed much to the knowledge of tropical diseases, especially the discovery of the frequency of malarial infection in children.

3. Dr. A. Laveran, Pasteur Institute, Paris, and D.Sc., University of Liverpool, who in 1880 made the great discovery that malarial fever is caused by parasites in blood.

4. Sir Patrick Manson, F.R.S., K.C.M.G., London School of Tropical Medicine, who in 1878 discovered that one of the parasites of man belonging to the group of *Filaria* is carried by a kind of mosquito.

5. Dr. Basile Danilswsky, professor of physiology, University of Kharkoff, who discovered numerous parasites of blood in a large number of animals shortly after Laveran's discovery was made.

6. Dr. Charles Finlay, chief sanitary officer of Cuba, who in 1880 originated the theory that yellow fever is carried by mosquitoes.

7. Dr. Camirlo Golgi, professor of pathology, University of Pavia, who in 1887 made a complete study of the life cycle of parasites of malaria.

8. Colonel W. C. Gorgas, United States Army, who as chief sanitary officer of Havana gave practical effect in 1902 to the discoveries of Finlay and of the American commission in connection with yellow fever, and succeeded in banishing the disease from the city.

9. Waldemar Mordecai W. Haffkine, C.I.E., who in 1893 discovered a method of inoculation beneficially used in India.

10. Dr. Arthur Loos, professor of parasitology, School of Medicine, Cairo, for work in connection with parasitology.

11. Dr. Theobald Smith, professor of comparative pathology, Harvard University, who in 1893 discovered a new kind of blood parasite in the so-called Texas cattle fever.