ered to about 5.4, but tadpoles will survive even at this low pH. The pH is somewhat higher if less sphagnum moss is added. Several of the tadpole cultures containing sphagnum moss in tap water have been tested, and the pH was found to vary from 6.2 to 6.9. Therefore, in using sphagnum moss as food, not only is bacterial growth reduced, but also laboratory tap water can be used without any harmful effect on the tadpoles. This method of rearing tadpoles is economical as well as time-saving.

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Oaths and Affidavits

Dr. Grundfest omitted from his discussion ''On Political Oaths and Affidavits'' in SCIENCE for July 21, 1950, the core of the problem, namely, the criminal aspects of the Communist Party. He repeatedly referred to *political* beliefs but said nothing about *criminal* beliefs. The word ''Communist'' carries a connotation of lawlessness that does not apply to our major political parties. For example, few professional Democrats and Republicans enter this country under false names or by means of untruthful affidavits.

I don't care about the *politics* of my doctor or my lawyer, but I do not wish either one to be a member of, or in sympathy with, a criminal organization. At the same time I see little merit in miscellaneous ''oaths and affidavits.'' It doesn't do much good to ask a man if he is a criminal or if he associates with criminals.

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Basic Processes of Erosion

We who are interested in the conservation of our soil resources appreciate your article ''Soil Erosion by Rainstorms,'' by W. D. Ellison (*Science*, **111**, 245 [1950]). The article should be quite beneficial in disseminating information on the basic processes causing erosion.

Two faulty statements were made, however, that should be corrected. These statements appear on page 246, column 2, last two paragraphs as follows: ''However, these experimenters apparently did not recognize splash erosion as an important independent erosion process. The first known reports on splash erosion were made by the writer (*3, 4, 5*).''

Much of Mr. Laws' work on raindrops and erosion has remained unpublished, as he left Soil Conservation Service research for work more closely connected with our war efforts. As one closely associated with Mr. Laws and the work on effects of raindrops, I can definitely state that not only did Mr. Laws recognize the importance of splash erosion, but it was also recognized by the men in charge of this research (Donald A. Parsons and Howard L. Cook).

Mr. Laws not only recognized the significance of splashes but photographed the splashes and splashed soil (*Agr. Eng.* **21**, 432 [1940], Fig. 3, *B* and *C*, left, entitled: *B.* Just after striking. *C.* The air is filled with flying soil particles).

In addition, I would like to quote from the *S.C.S. Research Project Monthly Report* for May, 1941. (Note items 1*a* and 2.)

A few of the phenomena of general interest that have been observed, or that are deducible from the observations, are outlined below.

1. Raindrops impinging upon soil cause:
   (a) *Splashing* which results in large quantities of soil and water being transported from one place to another. It is easy to reason that on sloping land, the distance of travel of these splashes is greater down the slope than up; also, soil splashed into nearby rapidly flowing water becomes highly susceptible to being carried away.
   (b) *Loosening* of the soil particles at the surface, giving the run-off waters an opportunity to act upon them.
   (c) *Turbulence* in the run-off water which aids in the maintenance of the soil particles in suspension.
   (d) *Shattering* or breaking down of the soil aggregates into more easily erodible material.
   (e) *Rearranging* of the particles at the ground surface which serves to reduce the infiltration rate.
   (f) *Puddling and tamping* which tends to alter the soil structure near the surface, resulting in a thin compacted layer which further reduces the infiltration rate and thereby increases the run-off rate and rate of soil erosion. As rearranging, puddling and tamping progress, the erodibility of the surface decreases.
   (g) *Leveling,* or localized erosion and deposition, which reduces depression storage and results in greater amounts of run-off and soil loss. Leveling is a result of several of the primary actions.
2. Because of splashes, a large part of the run-off occurring from each small area of bare soil consists of water and soil transported to that area by means of splashes from the adjacent areas. Consequently, the soil and water losses by run-off from any small area of bare soil are less if the area is bounded by areas from which splashing does not occur. It was observed that a large part of soil and water losses from a 2-foot square plot of soil subjected to an erosive rain took place through the medium of splashes rather than through the medium of run-off. This phenomenon is implicity involved in the balk method of farming.
3. In some of the tests the soil surface was covered for brief periods with a roof that shielded the soil from direct hits by the raindrops, but drained their water gently onto the soil. Under this condition, overland flow was occurring without rainfall impact effects. When the roof was removed, the same magnitude of flow existed but with disturbances caused by the striking raindrops. A run-off rate of 3 inches per hour was observed to produce no erosion when the roof protected the soil surface. When the roof was suddenly removed, the soil concentration jumped to 2 percent by weight of the run-off.
4. Experiments of this type have wide application because they show individual processes, uncomplicated by external factors. Thus, one practical value of the above experiment is to demonstrate the essential function of soil covers. It is evident that any cover, whether it be metal, stone, vegetation or plant residues, that protects the soil surface from rainfall impact, will reduce soil losses materially.
5. Depending upon plot conditions, the results also show that there is a certain rate of overland flow below which erosion will not occur from the action of run-off alone. Although in these experiments the bed material was an agricultural soil and the depths of flow were only a few hundreths of an inch, this result should not be surprising, since many experimenters concerned with the movement of bed load in open channels have determind that for any

given bed material and flow condition there exists a critical velocity below which scour does not occur.

6. With these facts in mind, the following important paradox in the mechanics of erosion can be stated: *The velocity of non-erosive flow affects erosion.* With the aid of the disturbances caused by beating rain, otherwise sub-critical or non-erosive flows do move soil and—just as in erosive flows—their velocity affects the erosive rate. It is easily observed that many particles raised from their resting places for a brief moment at raindrop impact, travel down slope. The distance of travel is undoubtedly dependent upon the velocity of run-off.

7. There is some evidence, obtained from mechanical analyses of the sediment load from two tests which differed in run-off rate, that variations in run-off rate and consequently velocity, affected the amount of the largest particles but not the finest. Thus, it may be concluded that a condition exists in these shallow "sheet" flows that is closely analogous to that reported as existing in streams. Here, as in rivers, the quantity of fine soil carried in suspension does not appear to be influenced greatly by the rate of run-off. On the other hand, the amount of larger particles which move as bed load appears to increase with increasing flow velocity. If this be true, then insofar as the test conditions represent field conditions—and it is believed they do for an appreciable portion of most cultivated fields for most run-off periods—the erosive forces accompanying rainfall impact are solely responsible for the losses of the finer portion of the soil. And methods devised to reduce the velocity of overland flow, which do not protect the soil surface from rainfall impact or reduce the total quantity of run-off, will not effectively reduce the losses of this highly important finer portion of the soil which carries much of the fertility.

Finally, it appears that Mr. Ellison's reference (*5*) (*Sci. Mon.* 1940, **63**, 241) is nonexistent.[1]

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[1] Ed. Note: This reference was erroneously recorded. The article in question starts on p. 241 of vol. 68, 1949, of *The Scientific Monthly*.

Book Reviews

Anatomy of the Dicotyledons: Leaves, Stem, and Wood in Relation to Taxonomy, 2 vols. C. R. Metcalfe and L. Chalk. New York: Oxford Univ. Press, 1950. 1,500 pp. $25.00 the set.

During a period when it seems that altogether too many botanists are wasting their time and effort in adding to an already marked superfluity of elementary botany texts, it is indeed refreshing when others demonstrate that they have a far better understanding of the real needs of the botanical sciences. The present book is a basic and truly monumental contribution toward a comprehensive knowledge of the vegetative organs of the Dicotyledons on a taxonomic basis.

The work is founded upon Solereder's *Systematic Anatomy of the Dicotyledons* and has the same chief aim—namely, to emphasize the taxonomic and phylogenetic values of anatomical characters—but the oft-repeated complaints against Solereder's treatise have been circumvented. The larger part of the book and the introduction are the work of the senior author, the junior one being responsible mainly for the descriptions of secondary woods. They were assisted by many other specialists.

The introduction is superb; every aspect of each subject treated, the pros and cons as advanced by various workers, have been fully discussed with admirable perspicacity.

Treatment of the families follows Bentham and Hooker in general, with the addition of those whose erection since their time has been generally recognized. Each family is begun with a terse summary concerning (1) general features and (2) wood anatomy, following which the leaf, axis, and root are discussed, together with paragraphs on ecological anatomy, anomalous structure, economic uses, and taxonomic notes. Roots are too briefly described and are omitted entirely for many families; in the reviewer's experience, these organs deserve more attention than most botanists seem to realize.

Factual errors are remarkably few. The reviewer checked numerous statements concerning plants of which slides were available but found only one inaccuracy. The leaf of *Petalonyx thurberi* (p. 669), said to be centric, actually is isobilateral, and the vascular tissue of the midrib consists entirely of lignified, pitted cells. Most of the errors concern geographical distribution, but many of these plainly were copied from sources which in turn were mistaken. As one instance, the citation for the distribution of the Saururaceae (p. 1127), which is given as Malayan, is apparently taken from Hutchinson's *Families of Flowering Plants*, yet the latter illustrates *Anemopsis californica* as representative of the family. All authors concerned should have observed that the specific epithet hardly refers to a Malayan region. No typographical errors have been noted, but one wonders why ''s'' is substituted for the ''z'' in Schizandraceae.

One specific criticism concerning morphological-taxonomic relationships is pertinent: the inclusion of *Trapa* in the Onagraceae (p. 664 *et seq.*). All the morphological and embryogenic evidence, which should have been noticed by the authors, excludes that genus from the family.

The typography is most pleasing, with important terms or characters in bold-face type. The binding, however, reveals immediate evidence of rather cheap and careless workmanship.

The hope of the senior author that taxonomists will recognize the value of anatomical characters in the delimitation of all taxonomic groups from families down to species seems to be somewhat optimistic, if the extent to which readily available cytomorphological, not to mention embryonomic, data have been ignored in the past by all