stems or size of leaves. The only visible difference is a darker green color and sometimes a slight wrinkling of the leaves. These explorated plants remain green longer than the controls but do not grow and eventually drop their leaves and die.

Several changes accompany the development of fruits in the normal soy-bean plant. As the growth rate decreases, following the blooming stage, there is a very rapid increase in the percentage of dry weight, which means that the moisture content of the tissues diminishes. Accompanying this decrease in growth rate and loss of water is a very marked decrease in the percentages of potassium in all parts of the plant. Phosphorus also becomes less abundant in the stem tips than during the period of active growth. The percentages of nitrogen, however, show only slight decreases as the plant matures, although large amounts are used by the developing fruits.

Explorated plants stop growing at the same time as the controls and the same changes occur in the chemical composition of the stems and leaves. This is a case of maturity which is not due to fruiting. The stems and leaves of explorated and control plants are very similar in respect to moisture, nitrogen and mineral contents, although large quantities of nitrogen, phosphorus and potassium accumulate in the fruits. The only difference is that the explorated plants show an abnormal storage of carbohydrates.

The soy-bean is a photoperiodic plant, and it is believed that the shortening of the day length not only initiates the reproductive phase but also curtails vegetative processes. It is significant that growth under normal seasonal conditions ceases simultaneously in explorated and control plants and is accompanied in each case by decreases in the percentages of potassium and moisture. Also fruiting does not deplete the nitrogen or mineral reserves of the plant. Our comprehensive data show that old age and death in the soy-bean are due to circumstances which accompany the reproductive phase but are not the direct result of it.

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SOME SUGGESTIONS ON DEMONSTRATION

IN the April number of *School Management* appeared a very well-executed summary of Professor Beauchamp's monograph, "Instruction in Science." This should provoke a great deal of thought in the thinking teacher and administrator. Almost every one of the four conclusions provides material for discussion. From the many things mentioned I select the following:

> Teacher-pupil demonstration has replaced the individual experimentation to a marked degree in the Junior high school. A great increase in the use of demonstration is also desirable in the specialized science courses. . . . This shift in emphasis has been accelerated by the use of the demonstration method.

These questions occurred to me: Did the teacher use specially designed instruments, specially adapted for demonstration? Was the demonstration table carefully designed for intelligent demonstration? Was the seating arrangement of the pupils such as to make the demonstrations clearly visible? Was the illumination of the demonstration desk of the best? Were the teachers trained specially in demonstration methods? Did supervisors or other superiors demonstrate to the teacher suitable examples for demonstration?

In looking over the apparatus purchasable at the various firms one must realize that the greater proportion of the instruments to be had there are designed for individual student use and not for demonstration purposes. The dimensions of the purchasable materials are all so small that they can not be seen at a distance. The type of experiments suggested in our present text-books also lack visibility, and it might be profitable to adopt the classical examples given by Helmholtz.

Having given considerable thought to the above, I took up in a General Science Class the subject of "the electric bell," employing the usual and accepted procedure. With a second class I adopted the following method and compared results:

Before reading the text-book about this subject I showed one of the films (through the courtesy of the Bell Telephone Company) which portrayed very clearly in animated pictures the action of the electric bell, the flow of the current, the changes of electromagnetism and the production of sound waves. This I followed up with a demonstration, using, however, a model of an electric bell 3 feet by 4 feet in dimension, constructed by some of my pupils for this express purpose. All parts of the electric bell were shown, and because of their large size could be seen clearly by every member of the class. The results were highly gratifying, and this procedure had the additional advantage of requiring no outlay of money for inadequate equipment.

The same idea was carried out in a demonstration of the steam engine. A cardboard model, showing all the moving and stationary parts of a steam engine, was used, also of the dimensions of 3 feet by 4 feet, and therefore also visible to every member of the class.

If the economic pressure of the times necessitates demonstrations rather than individual experiments, the designing of apparatus for such demonstrations should receive a thorough investigation, in which the experience of teachers with vision and imagination should be of great assistance.

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AMERICAN BOTANY, 1886–1932, AS SHOWN IN THE BOTANICAL GAZETTE

A list of the principal articles published in the *Botanical Gazette* during the ten years 1886–1895 and a like list of articles for the decade 1923–1932 has just been compiled under my direction by Miss Lillian Bondurant, a graduate student. Titles have been classified in accordance with the scheme used by *Biological Abstracts,* but to save space in the tabular summary which I have made the subdivisions of physiology and systematic botany have been omitted. The average length of principal articles in the earlier period was about seven to nine pages and there were many short notes of less than a page, while the papers in more recent times are nearly twice as long. The pages of the ten volumes of the earlier period are 3,976, while the number in the last ten years is 8,866. Contributions in the recent period in every field, unless it be taxonomy, are of a far more technical nature than those in the early days of the *Gazette*.

TABLE I

Number of Principal Articles in the Botanical Gazette for Two Ten-Year Periods, Classified by Subjects

Subjects	1886–1895	1923–1932
Botany, general with also methods and apparatus	26	5
Bacteriology and immunology	10	10
Cytology	14	46
Ecology, including "natural history"	53	38
Evolution	4	0
Genetics	1	25
Morphology and anatomy of vascular plants	45	100
Paleobotany	4	17
Physiology, in all its branches	33	176
Phytopathology	16	21
Systematic botany, including morphology of the lower plants	176	82
	382	520

The nature of articles in certain fields has changed greatly; the early papers tabulated under ecology were more properly "natural history" and would hardly be recognized as belonging to ecology; the lone article recorded as genetics belongs better as evolution. A great increase has occurred in plant physiology, and many of its present subdivisions were almost if not entirely untreated forty years ago—as light relations, chemical relations, mineral nutrients, enzymes.

The changes in the *Botanical Gazette* are, it is true, not an exact measure of change in botanical literature during the period. In recent years many special journals have come into being dealing with particular branches of botanical science. These furnish an outlet for articles which formerly would have been offered to the *Botanical Gazette.* Yet the magazine continues to receive now, as it accepted in the past, contributions in all fields of botany, and it represents rather well, now as heretofore, the activities of American investigators.

It is interesting to read over the list of early contributors, among whom may be noted George F. Atkinson, Charles R. Barnes, Charles E. Bessey, John M. Coulter, W. R. Dudley, W. G. Farlow, George L. Goodale, Asa Gray, Byron D. Halsted, Theodor Holm, Conway MacMillan, Roland Thaxter and Lester F. Ward. It would be possible to make another interesting list of contributors of the earlier period who are still active in botanical investigation, but such a list would need to be a long one, if inclusive, while any selection of names might lead to invidious comparisons.

The compiled lists are typewritten, and when bound will be placed in the University of Colorado library, where they may be consulted.

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THE FIRST AMERICAN LABORATORY OF PHYSIOLOGY

In the issue of Science for September 22, 1933, there was printed an obituary notice on Albert Martin Bleile, signed "F. A. H." In the notice it was stated that in 1876 "there was but one laboratory of experimental physiology in the United States, that of the late Professor H. Newell Martin, which had recently been established at the Johns Hopkins University." May I call attention to the fact that when Dr. Henry P. Bowditch returned from Ludwig's laboratory in 1871 he established a laboratory of experimental physiology in the Harvard Medical School. The apparatus in the laboratory was brought over from Germany at his expense. During the years between 1871 and 1876 Bowditch himself published papers on the lymph spaces in the fasciae, on a new form of induction apparatus, and on the force of ciliary motion. He and the late Charles S. Minot completed and published a research on the influence of anesthetics on the vasomotor centers. The late Dr. J. Ott published two papers, one on the action of lobelina on the circulation, and another on the physiological action of thebain. Experiments on the effect of bile in promoting the absorption of fat and observations