heartless, even to brutality. The psychologist who could tell his class to "park their souls out of doors" when they came to his class room, had at some time somehow suffered a bad twist to his mental and moral make-up. When and how the twisting happened, it may be impossible to tell exactly. But an important factor in it may be confidently supposed to be failure to recognize one of the most important differences between the physical sciences and the sciences of man. The difference referred to inheres in the different relation held by the investigator to what is investigated. The physical sciences are motivated entirely in the gaining of knowledge of, and control over, the objects and processes investigated. The well-being of what is investigated is considered not at all by the investigator. He may exploit his experimental materials without let or hindrance so far as their rights are concerned.

Quite otherwise is it in the sciences of man. In all these, knowing and controlling the objects and processes investigated are and must be subordinate, speaking broadly, to the wellbeing of the objects studied. The surgeon at the operating table may be taken to typify the essential relation between investigator and investigated in the whole group of sciences of man. Technical knowledge of investigator and skill of operator are here dedicated wholly to the purpose for which they primarily exist, namely, human welfare in the form of restoration to health of individual human beings. Obviously not in all these sciences can the objects studied become the beneficiaries of knowledge in such immediate personal way as in the case of the patient needing operative treatment.

How, then, are the benefits to be extended? Undoubtedly in many different ways, but most importantly through the increased intelligence of the public concerning the knowledge gained by the researches.

But again, how is such extension of intelligence to be accomplished? To illustrate, what part should school education play in making people at large effectively acquainted with the established results of investigations into the relation between the human sexes? What part should the newspapers play? What part should be taken care of in the home?

The evidence of the intellectual decadence of New England, so startlingly emphasized by Dr. Cattell's just-published résumé of his study of the distribution of scientific men in the United States, is too obvious in its sinister bearing on the future of our country to be missed by anybody who becomes acquainted with the facts. Is this study to be followed up so as to learn what factors are responsible for the decay, whether it affects all aspects of New England's cultural life, whether the disease is likely to extend to the entire nation? Suppose science should get certain or highly probable answers to these questions, how is the truth to be so brought home to the general public as to make it effective in the national life?

Because of the nature and complexity of the situation, I am going to do no more than make a suggestion which, if carried out, might do much to promote the desired end so far as journalism and science are concerned.

I suggest that the special efforts made at this meeting of the American Association toward increasing the dissemination of science to the public be the beginning of efforts in this direction that shall go much farther than anything of the sort this country has ever seen.

I suggest that the symposium held yesterday on publicity for science be repeated, perhaps many times, either under the auspices of this association or some equally competent agency, but extended in scope so as to secure the joint discussion between the very foremost representatives of the sciences and of the newspapers of the almost numberless points at which they impinge on each other, sometimes in friendliness, but sometimes in hostility.

Do not the indications of growing desire by newspapers for scientific news and opinions justify the belief that the time is favorable for such a move? It seems to me the results of the study just reported by the Permanent Secretary of the American Association of the space given by newspapers to the scientific proceedings of recent meetings of the association may be interpreted in this way. This instance by no means stands alone on the side of journalism itself in affording like encouragement. Is it possible that journalism is more ready than science for such a move?

We are all patriotic Americans. As men of science we may claim more. We may claim that our patriotism embodies knowledge of, and devotion to, the best ideals and traditions of Americanism. A few critics of America, some foreign and some of our own number, are saying that American ideals as held by the founders of the Republic have gone by the board. I would like this partnership address, as I have called it, to be viewed as an attempt by one journalist, E. W. Scripps, and one scientist, myself, to join forces in support of the basic ideas of journalism, of science, and of Americanism that were held by those two master builders of our Nation, Benjamin Franklin and Thomas Jefferson.

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MALNUTRITION IN PLANTS

NUTRITION problems are quite as common in plant as they are in animal life, and in both cases these problems become most evident where the living organism is forced to develop under unnatural environmental conditions. In plant life when plants are fed artificially, many disorders are common and recognized, and these disorders are most evident in plants when their culture is attempted under climatic and soil conditions to which they are not naturally adapted. The orchard industry as practiced in the more or less arid sections, both with and without irrigation, furnishes an outstanding illustration of this fact. In nature, orchard trees are best adapted to humid regions having a soil comparatively well supplied with organic matter and nitrogen, and where the precipitation is so distributed as to cause the plant food in the soil to become available through bacterial action in about the proper amount and proportion to meet the demands of the growing plant. When attempts are made to grow such trees in the arid regions where soils are primarily not abundantly supplied with organic matter and nitrogen and where moisture must be furnished either by irrigation or by conservation through clean cultivation, nature's influences are decidedly modified.

Among the apparent nutritional disorders of orchard trees in the arid regions the "disease" sometimes referred to as "roseatte," or "small leaf," or "die back," or "mottled leaf," or "multiple bud," is quite common. Its main symptom is that large numbers of small leaves develop in clusters in a more or less roseatted arrangement on the ends of twigs. Cultural indications are that soil nitrogen is a contributing factor to this abnormal condition. The influence of available nitrogen on the development of some of our annual plants is fairly well understood. For instance, large supplies of soluble nitrogen when present in the soil during the tillering stage of wheat will cause the plant to set many stools, when present after the jointing stage they result in luxuriant vegetative growth and during the fruitation stage their tendency is to produce a grain high in protein. While the influence of nitrogen in the development of a perennial plant like an orchard tree is not so easily traceable, and therefore, not so well understood, it is only reasonable to suppose that such influences may be quite as evident and prove quite as effective once it is learned how they may be detected. Using the "disease" referred to as an illustration of a case of malnutrition let us see what the conditions are under which it develops and the practices that have been effective in its control, so that a proper basis for a diagnosis may be established.

This roseatted condition develops under both irrigated and non-irrigated conditions in the more arid sections of the state of Washington where trees are grown under clean cultivation. When this "disease" which interfered so materially with the production of marketable fruit that it made the business unprofitable, was first experienced the more radical growers pulled up their orchards and resorted to the production of other crops from which the required returns could be derived. The more conservative orchardist left his trees but attempted to grow a crop between the rows. Alfalfa was known to be well adapted and it was introduced. This crop not only proved fairly profitable, but to the grower's surprise the orchard trees took on a deeper green foliage, made a more luxuriant leaf and wood growth and the roseatted condition rapidly disappeared. The natural effect of this beneficial influence on the trees was that not only alfalfa but other legumes were rapidly introduced in the growing orchards so that now there is little clean cultivation practiced where the irrigation water supply is adequate to make intercropping possible. The first reaction from such results might well lead to the conclusion that the beneficial effect of legumes in this relationship is traceable to their nitrogen fixing power and this is justifiable on the basis that most of the irrigated soils are, even in their virgin state, not over well supplied with nitrogen. Where intercropping with legumes was considered impracticable due to prejudice or to the lack of sufficient irrigation water, it was concluded, and reasonably so, that the same benefits could be derived if the trees were supplied with a readily available nitrogen fertilizer. In actual practice, however, this did not follow because it proved that the beneficial results produced by the legume could not always be duplicated in that way. Furthermore, roseatted trees were not always associated with nitrogen deficiency in the soil, because in a few cases trees growing in hog lots where there was every evidence of an adequate nitrogen supply also developed the "disease." Animal manures, on the other hand, when applied to roseatted orchards in liberal amounts were just as effective in overcoming this nutrition problem as were legumes.

Although these apparent inconsistencies may be difficult of complete explanation on the basis of actual controlled experimental work, it is reasonable to conclude that the form in which the nitrogen is applied and the time at which the application is made is a very important factor. In the orchard sections of the State of Washington it is not uncommon to have long periods of comparatively warm weather and considerable rainfall after the trees have reached their dormant state in the fall. This warm weather and the optimum soil moisture supply promote nitrifying bacterial activity with the result that in clean cultivated soils where there is no vegetative growth to utilize the nitrogen so made available, large amounts of nitrogen frequently accumulate in the autumn season. Where the succeeding winter precipitation is not sufficient to cause the accumulated nitrates to be leached into the drainage system, a condition that prevails in most irrigated sections, a comparatively large amount of available nitrogen will be present in the soil and ready to function as soon as the growing season begins in the spring. Such supplies of available soil nitrogen are not possible in the humid climates naturally adapted to tree growth and it is only reasonable to suppose that this abnormal food supply in the spring will produce abnormalities in tree development.

Liberal supplies of available soil nitrogen are conducive to excessive vegetative growth and in the case of trees nitrates, present in large amounts in the very early spring, may serve as a stimulant for the development of a large number of buds and leaves. When later in the season this supply of nitrates is exhausted as is likely to be the case with these soils, which are at best not abundantly supplied with total nitrogen, there is no corresponding twig growth and elongation. The result is that the leaves are left in a light green colored, partly developed state, grouped close together near the ends of branches. The use of a nitrogen fertilizer, instead of overcoming this condition, as was at one time supposed, may even aggravate it if the application is made at the wrong time of the year. Surely it would seem illogical under such conditions to make heavy applications of readily available nitrogen fertilizers in the late fall, winter or early spring.

In orchards where legumes are grown to supply the nitrogen, the situation is different. The conditions that are conducive to the bacterial activity essential for nitrogen fixation by legumes and for the decay of soil organic matter necessary to release nitrogen for plant use, are the same conditions that promote best tree growth. There should be little danger, therefore, of the accumulation of an abnormal supply of available nitrogen, under conditions where that element of plant food is supplied by legumes or by slow acting organic fertilizers. That this is borne out where legumes are grown has been shown and it is also known that the roseatted condition does not develop but can be overcome when animal manures are used to supply the nitrogen. The property of manure to supply regular and normal amounts of available nitrogen in the proportion that the growing plant demands them has caused this fertilizer to become known as being "fool proof." When plants are fed with artificially prepared fertilizers of high availability an attempt should be made to apply such fertilizers at the time and in the proportion that they are required if best results are to be obtained, and this is especially true where perennial plants are grown and when the quality of the product is a factor. If these relationships are once properly understood many malnutrition problems can be controlled and commercial fertilizers may be used to exert influences on yield and quality never before credited to or claimed for animal manures.

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SCIENTIFIC EVENTS

BUDGET OF THE BUREAU OF CHEMISTRY AND THE BUREAU OF BIOLOGICAL SURVEY

THE budget of the U. S. Department of Agriculture for the fiscal year 1929 (see SCIENCE, LXVII, page 186), which has been transmitted to congress by the president, includes the following recommendations for the work of the Bureau of Chemistry and Soils and for the Bureau of the Biological Survey:

Bureau of Chemistry and Soils, $1,244,963, which includes increases of $15,000 for studying methods for diversifying products made from sugar-cane and originating new products; $10,000 for food research, including a study of the deterioration of foods due to micro-organisms, chemical agencies, etc.; $10,000 for a study of the commercial utilization of citrus fruits, pomegranates, avocados, pears, prunes and other fruits; $10,053 for experiments and demonstrations in proper methods of removing and curing hides and skins, and study of little-used native tanning material and of foreign tannin-bearing plants; $5,000 for fundamental investigation of the chemical properties and utilization of lignin; $3,000 for extension of studies on the composition and utilization of vegetable oils and fats; $10,000 for investigating the possibilities of utilizing sweet-potato culls for the production of starch and conversion products; $10,000 for the development of new insecticides and fungicides; $10,000 for enlargement of research work on the causes and methods of control of farm fires; $5,000 for inaugurating studies of new processes and equipment for the production of naval stores, in cooperation with producers and the Forest Service, as well as a study of the adaptability of naval stores for various uses; $5,000 for expanding the work necessary to properly coordinate the chemical investigation of soils with the classification and mapping of soil types; $6,060 for investigation of methods of producing nitrogen fertilizer; $5,000 for a study of the production of phosphoric acid in a more desirable form than acid phosphates, and for potash investigations; $6,000 for bringing up to date the soil-survey map drafting work; $9,485 for studying the causes and developing methods for remedying destructive soil erosion; $4,650 for further crop experiments with air-derived nitrogen and other concentrated fertilizers; $2,350 for soil fertility and fertilizer studies on sugar-cane soils in Louisiana, Florida and other southern states, and $3,360 for additional editorial assistance and other general administrative work.

Bureau of Biological Survey, $1,078,500, which includes