would undoubtedly follow an abstraction of basic elements from the plant compounds by the nutrient solution, and if the change were great enough, the plant would be killed.

In this connection it should be noted that the soil solution of acid soils often contains more calcium than the soil solution of less acid or neutral soils, and yet plants like alfalfa may suffer for lack of calcium in the former case and not in the latter, due to the fact that the acidity makes the calcium less available for certain purposes even though it is in solution. Availability is thus not only a question of solubility. It also depends on the form in which an element exists in solution.

SUMMARY

1. Differences in the feeding power of common agricultural plants for the essential elements of comparatively insoluble minerals are not due primarily to differences in amounts or kinds of acids excreted. The differences are due to several factors, some of which are concerned with external equilibrium conditions around the feeding roots, and others with internal equilibrium conditions inside the plant where the elements are actually used.

2. In case two soluble products are formed in the feeding region of the roots due to the action of carbonic acid on a mineral as is the case with rock phosphate, the feeding power follows the law of mass action and chemical equilibrium, being dependent on the removal of both of the soluble products either by the plant or partly by the plant and partly in other ways; thus plants with a high content of calcium feed strongly on rock phosphate because they remove both the soluble phosphate and soluble calcium bicarbonate in proper proportion.

3. If only one soluble product is formed as is the case with feldspar, the feeding power of the plant for the potassium depends on its ability to utilize potassium from a dilute solution which in turn depends largely on the acidity of the plant sap; the less acid the sap the greater the ability of the plant to utilize potassium from this source due to the fact that potassium is more easily and completely precipitated in the form of plant compounds in the less acid sap.

4. The feeding power of a plant for calcium which is used for the regulation of the reaction of the plant sap and colloidal system, and precipitation of acids, or for other elements used for these purposes, is also dependent upon the reaction of the plant sap but the relation is opposite to that of potassium; the more acid the plant sap the more easily can the plant compete with another acid system—the soil solution of an acid soil, for needed basic material.

5. In the case of base forming elements used for other purposes than regulation of the reaction and precipitation of acids, the relation of the feeding power for these to the plant sap is perhaps the same as for potassium.

6. There are undoubtedly many other factors which affect the feeding power of a plant but it seems that the ones given often exercise a controlling influence.

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THE TEACHING OF EVOLUTION

EVERY student, teacher and research worker in various fields of science must find cause for sincere regret in any attitude or movement that would limit the search for knowledge, or the presentation of scientific fact in the class room. There certainly is such a menace in the suggested limitation or elimination of the teaching of "evolution." It seems rather strange that such a conflict should be staged in a century made notable by outstanding advance in both pure and applied science. At no previous time have all men profited as much by the efforts of scientific workers. Then why such a hubbub about the teaching of what many think a fundamental concept of biological science?

The trouble seemingly was started by a group of conscientious folk who saw a sharp variance between their beliefs, religious or otherwise, and the theories presented and vigorously promulgated by many teachers. Some prominent men, as Mr. W. J. Bryan, made the matter one for public discussion, and the controlling trustees of certain schools requested or demanded that the doctrine of evo-

lution should not be taught in the institutions under their control. The question has been taken to the legislatures of two or three states with a near approach to tragedy to scientific work. In a brief and somewhat generalized form this is the history of the case through the past few months.

As is usual in such cases, as has been true throughout the conflict between scientific and religious men, this difficulty has arisen through gross ignorance, useless misunderstanding and thoughtless intolerance. We have not found any prominent scientists among the opposers of the teaching of evolution. From the vague and inconsistent references to the meaning of evolution and the subject matter of courses in which it is involved it hardly seems possible that the opponents of this teaching have had the most elementary training in the ways of science or have had any sort of open-eyed contact with the world about them. It is always dangerous to take any difficult or abstruse question to any average legislative body —and it becomes especially dangerous when the real issue is hidden in a mist of ignorance and misconception as in the case in review. Legislators must hear the majority of the people —not judge the truth of scientific theory nor establish the rectitude of religious belief. Such misunderstandings with more or less serious disturbance are wholly unnecessary, and would never arise but for unwarranted provocative aggression by one or both parties in the case.

We know one man well, who through twenty years of teaching in high school and college has never had reason to think of his biological training and religious beliefs as conflicting. He has been able to maintain perfectly harmonious relations with different leading Protestant churches, and no question as to his religious uprightness or sincerity has ever been raised. He has had a fair training in biological science and has touched the general field of science enough to understand the lines of harmony and possible variance as touching common or popular beliefs. Doubtless, many other men have had a similar experience of freedom from conflict between their religious, social and scientific work. It is easy to see how all things scientific may seem strange and often unbelievable to the man who has no scientific training or but very meager training and that of doubtful accuracy, and how theories or even facts carelessly or inaccurately stated so as to seemingly conflict with as deep-seated a thing as a religious belief would be cast out as unbelievable or heretical by such sincere folks. It must be remembered as a scientific fact that a great many people, probably a majority of Americans as well as of other folks, actually live and die by their religion, shaping social, financial, political, and moral decisions of each day and year by their religious beliefs. Scientists who will accept at once the newest and most far-fetched theory sometimes fail to take into consideration the fact just mentioned, even though the acceptance of the most important scientific teaching depends upon the attitude of the teacher toward that fact. That the untrained cannot understand the scientist's point of view is taken for granted. Is it asking too much of the scientist to expect him to take such a sympathetic attitude toward churchmen as he expects them to take toward himself? As much of the present difficulty has arisen through a failure of some who call themselves scientists to make themselves fully acquainted with the ideas of the people they would teach as through the "misguided reformers" who do not at all understand the theories they think they must oppose.

There has appeared an alarming amount of bigotry on the part of some who proclaim themselves the champions of science. The really desirable thing, after all, is the freedom for scientists to pursue their lines of research and constructive work, and on the part of others a feeling of trust that our scientific men are really doing something worth while instead of merely spinning useless or even dangerous theories. The attitude of the opponents of evolution does not seem to lead toward this desirable end; and some of the scientific men of the country have not been conciliatory in their remarks when discussing the question.

The chief cause for disagreement was stated clearly by Mr. Bryan (Quoted in SCIENCE,

March 3, 1922, pp. 242, 243.) in these words: "Christians do not dispute the right of any teacher to be agnostic or atheistic, but Christians do deny the right of agnostics and atheists to use the public school as a forum for the teaching of their doctrines." Some scientists through half a century with rapidly increasing boldness have made themselves critics of religious beliefs, holding in complete disdain the opinions of churchmen, without themselves entering experimentally into the merits of the case. There really seems but little reason for a scientist thinking himself fully fitted to discuss at any length the beliefs of a non-scientifically trained man unless the latter is at the same time given full right to discuss the opinions of the former. To put the matter bluntly—both are dealing with subjects entirely out of their field and about which they are, in most cases, essentially ignorant.

The grievance, from the viewpoint of the churchman, has been increased and in some cases made unbearable by the type of biological teaching found in many high schools. The responsibility for the recent difficulties may be largely traced to this cause in all probability. Among the first things impressed upon the college freshmen in natural science courses is the infallibility of a theory of evolution. This is usually made impressive by indefinite, incomplete or inaccurate illustrations with reference to the origin of man. The thorough student of biology soon finds himself facing other theories of evolution, and later forms a proper valuation of these theories with respect to the evidences in fact upon which they are founded. We have met with senior and graduate students, however, in college and university departments of biology, in whose minds the theoretical phases of evolution completely overshadow the basic facts, whose whole conception of Darwinism is included in the descent of man from monkey. Churchmen are not to be blamed for objecting to the promulgation of such ideas. Any right minded man should strenuously oppose such a program, and scientists ought to blush for shame at such a crude presentation of the story of organic development.

The teaching of science, particularly of biology or related subjects, in the high school is the chief area of stress, the place where misunderstandings may most readily occur. Here the teacher is usually to blame, albeit unintentionally so in many instances. Most of the high-school teachers of botany, zoology and biology are drawn from among those students who have spent a year or less in such classes in college and who try to pass on to their students the ideas presented in those elementary courses. It is small reason for wonder that the ideas of evolution caught on the wing in brief lecture periods, unsupported by wide reading and undigested by extensive laboratory work and field observation, should be inaccurate, calculated to rouse protest in any community. It certainly seems that in the interest of public support of true scientific work, such teachers should be kept from service. Under present conditions of school organization this is impossible, but changes in the organization and emphasis in elementary biology courses in colleges would materially lessen the harm from this source.

The elementary courses in college and university courses taken as electives to fulfill general requirements in science are also dangerous, turning out as they do thousands of young folks with but a momentary view of limited phases of biology. But behind all this is a warped view of the relative importance of facts and theories on the part of college and university instructors. After all is said a theory of evolution is but a theory. Which particular line of procedure has produced new forms of life in the past is a basis for discussion and disagreement among the most learned. However much we may respect the theory, however well it may be supported by accumulations of facts, it is subject to adjustment or even serious modification with the presentation of every new fact, and is liable to more or less rough handling by some new Darwin, Lamarck, or DeVries, as some older theories have been shaken by an Einstein. Certainly a theory of evolution suffers violence at the hands of any one who presents it as anything other than a theory. The idea of orderly development, which is all the term evolution may rightly include, will very, very rare-

ly arouse antagonism or even doubt. Danger comes with the presentation and insistence upon the claims of some particular type of evolution.

It should be said plainly that there are abundant unquestioned facts upon which our theories are based, and while we may differ in our opinions as to the significance of those facts, they are generally accepted. Variation of individuals of species or race, reproduction of like forms, the struggle for existence, the adaptation of organism and environment through the cutting off of the unfit, the production of new forms by hybridization, all these are facts of everyday experience, facts that may be taught without raising questions as to the teacher's religious views, facts which if more clearly and consistently taught would tend to develop a better trained group of scientific workers, teachers and general citizenry.

From the standpoint of right and wrong the teacher in college or elsewhere can not more justly force his theories upon an unwilling or unsuspecting public than can a religious enthusiast require all men to subscribe to his beliefs. The quack doctor, the religious fanatic, and the poorly balanced teacher of science are similar in that they are alike dangerous, and the general public should consider all with suspicion. Lampooning earnest religious folks because they refuse to accept all that comes to them in the name of science will not help to develop the very desirable discrimination between the true and the false, but will rather arouse more vigorous antagonism. There is no fundamental basis for conflict between enlightened and sincere churchmen and true scientists. The development of American institutions and ideals and the advancement of the material welfare of the American people have come from the efforts alike of churchmen, statesmen and scientists; and for continued prosperity, it is essential that there be harmony of purpose between these factors. It is the business of the leaders of scientific work and teachers of science to make such a discrimination between fact and theory that all must respect their findings, and to use such care in the presentation of subject matter that no one idea will be given the undue prominence that is provocative of misunderstanding and distrust. Why not make it quite clear that "Darwinism," whatever that may mean to the individual professor, is not all of evolution? Why not spend more time making clear to college students the facts of observation and experiment upon which the "Origin of Species" was founded? We are confident that more teaching of fundamental facts will lead to a better understanding between scientists and the rest of the world, and to a more hearty support of scientific endeavor.

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SCIENTIFIC EVENTS

VITAL STATISTICS OF GERMAN CITIES[1]

ACCORDING to official publications, the population of the 343 larger cities from which reports are accessible had increased one million, being 25,700,000 in 1921, as compared with 24,700,000 in 1920. It is evident, therefore, that 41 per cent. of the total population of the empire resides in these 343 cities. This remarkable growth of the cities is doubtless due, to a considerable extent, to the influx from the smaller towns and to the immigration from foreign countries. The number of living infants born in these cities was 560,000, or 21.8 per thousand of population, which denoted a falling off when contrasted with the record for the previous year, which was 23.8 per thousand. Since it has been found that economic factors exert a great influence on the birth rate, Dr. Roesle, taking the value of the mark in relation to the American dollar as a basis, has been making a critical investigation of the possible effect of economic conditions. In order to discover the influence on the varying birth rate throughout the twelve months of the year, it is quite evidently necessary to date back nine months the birth rate for each month, since in this manner the month in which the children were conceived is ascertained. In 1921, the birth rate of the urban population continued to drop until August, or, taking the

[1] From the *Journal* of the American Medical Association.