The establishment of the permanent camp has made possible much more efficient class work. The region available for study exhibits a remarkable variety of geological phenomena in a small area. The whole district studied is about five or six miles long and less than three miles wide, and the permanent camp is situated near the center. Within this area more than twenty-five distinct geological formations are outcropping, ranging in age from the Cambrian to the Mississippian, most of them being more or less abundantly fossiliferous. In addition, unusual fault phenomena provide problems of great interest for class work, while there is a remarkable opportunity for the collection of fossils from numerous Paleozoic horizons. It is proposed in the near future to expand the work at the Field Station into a real Field School of Geology and to continue it throughout the summer quarter, with a number of distinct courses and the proper instructors for each.

EMPLOYING the methods of engineering, research in eye conservation on a nationwide scale has been undertaken by the Eyesight Conservation Council of America. The work is in charge of J. E. Hannum, a former member of the teaching staff of Purdue University and a member of the American Society of Mechanical Engineers. The plan, which follows revelations of human and industrial waste in industry, made by the Hoover Committee on the elimination of waste in industry of the Federated American Engineering Societies, of which J. Parke Channing of New York is chairman, aims to determine the extent to which attention is being given to the conservation of vision in the educational, commercial and industrial activities of the United States. A study of statutory provisions now in force and affecting eyesight will be carried on. Experiments to determine the true economic value of perfect vision will be made. It is proposed to measure the improvement in health, increase in quality and quantity of production, advancement of individual performance and decrease in losses due to waste and accident. Factory, home and school lighting, now a subject of scientific research here and abroad, will be studied. Mr. Hannum, a former Indianapolis engineer, is a graduate of Pennsylvania State College, and was formerly connected with the Red Cross Institute for the Blind in Baltimore.

UNIVERSITY AND EDUCATIONAL NOTES

THE committee of the Associated Harvard Clubs which is raising $250,000 to endow five professorships at Berea College, Kentucky, in memory of Professor N. S. Shaler, the Harvard geologist, has been continued for another year to go on with its campaign, which has already secured more than $50,000.

WINTHROP MORE DANIELS, a member of the Interstate Commerce Commission, has been appointed to the newly established chair of transportation at Yale University.

DR. B. B. BRACKETT, who has for the past fourteen years been the head of the electrical engineering department at the South Dakota State College, has accepted a professorship of electrical engineering in the college of engineering of the University of South Dakota.

DR. H. M. DADOURIAN, associate professor of physics at Trinity College, Hartford, Connecticut, has been appointed Seabury professor of mathematics.

DR. R. W. WHYTLAW-GRAY, science master at Eton College, has been appointed professor of chemistry at University College, London, in succession to Professor Arthur Smithells.

We learn from *Nature* that Dr. S. P. Smith, assistant professor in the City Guilds (Engineering) College, Imperial College of Science and Technology, London, has been appointed professor of electrical engineering at the Royal Technical College, Glasgow, in succession to Professor Magnus Maclean, who is about to retire after occupying the chair for twenty-four years.

DISCUSSION AND CORRESPONDENCE

AS TO THE CAUSES OF EVOLUTION

ABOUT a year ago I published a note (SCIENCE, April 14, 1922) on the evolution controversy. In this I spoke of the causes of evolution. It has come to my attention that my remarks on this subject have been considerably misunderstood. And it now appears

that one of these misunderstandings is likely to be used in a way I should not like. Consequently, another note seems to be in order, this one dealing with the subject not incidentally as the other did, but directly.

A cardinal element in my theory of causality as applied to evolution is indicated by the fact that I always speak of the *causes* and never the *cause* of evolution. A multiplicity of causes is the point. Probably few biologists now fail to recognize that more than one cause has always been and still is operative in producing the living world. Nevertheless, it strikes me that few there are who accept the principle of cooperating causes, not in organic production merely, but in all natural processes, as wholeheartedly as by right it should be accepted.

While many evolutionists show a sort of grudging assent to the idea by speaking of "causal factors" or just "factors," they appear to harbor the notion that after all there must be one King Cause, as we may say. This, some stoutly maintain, or did until recently, has been discovered. Instances: Some of the polemics in favor of natural selection, or mutation, or the inheritance of acquired characters. But such discussions are becoming less frequent than they were and this is a real gain.

Such a state of mind on the subject is, I strongly suspect, a hold-over of the old theological idea of one Great Primal Cause. The later doctrine of "first" causes and "second" causes appears to have been a compromise forced upon the original idea by progress in natural science.

As concerns the origin of species, I wonder if the causal difficulties, great though they unquestionably are, have not been magnified by a mere verbal accident, as it may be called. Has not the substitution of the word evolution for that of development been a great misfortune in this matter? It seems to me so.

I do not believe there is a thing in the phenomena of origination in living nature that justifies any distinction between the two words as applied to those phenomena. Dictionary definitions certainly warrant this view. But much more convincing is the fact that neither Lamarck nor Darwin, the two major prophets of modern transformism, hardly used the term evolution at all, though both made much use of development. In later practice, however, a very sharp distinction between the words has undoubtedly grown up. And one result of this seems to have been to make us hope and strive for causal explanation when we use the term evolution in a sense in which we do not any longer when we use the term development. So marvelous is the beguiling power of words!

Do working horticulturalists, stock-raisers or embryologists nowadays think of such a thing as some one cause or even of just a few completely discoverable causes of development of the individual plants and animals and embryos with which they work? Certainly not. And, it should be noticed, the case is not different when they think of the varieties and races with which they work.

Unquestionably the problem of what causes that crucial step in the origin of species which makes them sexually incompatible with all other species is one on which we have little light as yet.

But how justify, either by fact or logic, the widely prevalent seeming assumption that whatever causes this particular step is the cause of the origin of species and hence of organic evolution, par excellence?

Certain is it that the races, varieties, subspecies, etc., with which we are familiar are naturally caused somehow. And if these may become true species, as Darwin believed and most naturalists believe, by what hocus pocus of reasoning can we exclude variety-producing causes from being also species-producing causes, the moment the varieties become species? Reasoning of this kind would require us to say that the causes which produce the sapling can not be included among those which produce the tree.

What I am standing for is the factual truth, and the scientific importance of the principle of many cooperating causes in organic development. Whether the development be of individuals, of varieties, in nature or under cultivation, of subspecies, of full-fledged species, of genera, or what not, matters not at all.

And I would insist that if in formal biology the principle could be viewed and discussed in this common sense way much of the futile or worse controversy within the biological realm, and the bewilderment among intelligent people

outside of that realm, would disappear. For it would be recognized on all hands that very much is known about the causes of all development even though certain steps, notably that by which species become differentiated sexually from other species, are still very obscure as to causation. No sane person could then make the charge, now being made by persons who undoubtedly are sane, that biologists "know absolutely nothing at all about the cause of evolution." Nor would even a fundamentalist Bishop be likely to announce himself (as one has recently been reported to have done) as standing four square against evolution, if evolution and development were everywhere recognized as being one and the same thing.

And the gain to clear thinking in biology itself would also be great in that the idea, often as vehemently defended as it is vaguely held, would vanish, that certain supposed causes of evolution must necessarily exclude one another.

What real justification is there, to illustrate, for assuming that if natural selection is a true cause of evolution, the inheritance of acquired characters must be denied—or vice versa? Darwin's position on this was beyond question logically sound. For him there was no *a priori* exclusiveness as between the two. It was solely a matter of evidence—of objective evidence. And so in the nature of the case is it to-day and so it will remain. Does anybody really believe that should one or more of the strong indications recently brought to light of the heritability of somatic modification be fully proved, natural selection would thereby be disproved?

It will be a great day for science when she shall have gained such a mastery over her mental technique that while speculative thinking shall continue to supplement and extend common sense thinking, it shall no longer destroy it.

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MARINE PLEISTOCENE FOSSILS FROM NEW YORK CITY

RECENTLY a fossil bivalve was sent by Stanley N. Shaw, editor-in-chief of the *Federal Reserve Club Magazine,* of New York City, to the geology department of Cornell University for the determination of its character and history.

The shell was uncovered on September 30, 1922, by the workmen in excavating for the foundation of the new Federal Reserve Bank which occupies the block between Nassau, Liberty, William Streets and Maiden Lane; the specimen excited the interest of the officials and consequently was sent to Cornell. Three other shells and a piece of wood were also discovered at the same locality and later sent. These fossils prove to be of Pleistocene age and belong to the following species:

Venus mercenaria Linnæus cf. *antiqua* Verrill—right and left valve.

Alectrion (Ilyanassa) obsoleta Say—2 specimens.

Chamæcyparis (cypress, white cedar) or *Thùja* (arbor vitæ).

The wood has in places a coating of blue clay as well as flakes of mica. The shells are discolored by a bluish clay.

The following is the section as sent with the specimens:

29.8 feet, high curb level.
10.7 feet, old cellar bottom.
0 feet, high water level.
22 feet, sand.
38.7 feet, hardpan.
55.5 feet, hardpan, sand, clay and boulders.
64.5 feet, hardpan, gravel and boulders.
67.8 feet, disintegrated rock.
Base of foundation of Federal Reserve Bank, bed rock—(core sample norite, possibly a phase of the Palisade trap). "This is undulating and varies from a depth as here noted to a depth of 117 feet below curb."

The shells were found 60 feet below the high water level, in the layer of hardpan, gravel and boulders.

The specimens of *Venus mercenaria* are thick, more rounded posteriorly than the recent shells of the same species and vary from the living form in that the concentric ribs are prominent, coarse, lamelliform ridges which extend over the entire surface of the shell, covering the middle region which in the recent shells is characteristically smooth. The characters are like those described by Verrill for forms from the Post-Pliocene of Sankoty Head, Nantucket Island, Massachusetts, to which he gave the varietal name *antiqua. Venus mercenaria,* with