The second Shaler Memorial Research, supported by the Shaler Memorial Fund of Harvard University, will consist of a study of shoreline changes along the Atlantic coast by Professor D. W. Johnson and two or three assistants. Special attention will be given to changes in the form of beaches within recent geological time, and to supposed evidences of recent coastal subsidence. Since the problem of coastal subsidence is affected by the relative heights of high tides on the outer and inner sides of barrier beaches, lines of levels will be run between the ocean and lagoons, upon which tidal observations will be based. The most important localities from the Bay of Fundy to southern Florida will be examined during the spring and early summer. During the latter part of the summer Professor Johnson will visit localities on the coasts of England, Holland and Sweden, for the purpose of making comparisons with similar localities on the Atlantic coast of North America.

UNIVERSITY AND EDUCATIONAL NEWS

M. Auguste Loutrefil has bequeathed $700,000 to the Paris Academy of Sciences, $500,000 to the University of Paris and $20,000 to the Pasteur Institute.

The University of Michigan has received a gift of $10,000 from William J. Cook, now of New York, and formerly of Hillsdale, Mich., to be used toward the erection of a residential hall for women.

By the will of Miss Susan G. Lansing, of Albany, N. Y., Rutgers College receives the sum of $5,000, together with one third of the residuary estate, which, it is estimated, will bring about $10,000 additional.

The residue under Sir Francis Galton's will is bequeathed to the University of London for the encouragement of the study of eugenics.

The technique of printing and publishing is a new course of study at the University of Wisconsin in connection with the course in journalism. It is designed for students of agriculture, engineering and commerce, who are preparing to enter technical and trade journalism. A class in technical and trade journalism has been organized to give further training in this field.

The University of Illinois special train to rural schools started out for a two weeks' trip over the Illinois Traction system on February 27. The special consists of two cars fitted up with illustrative material for the use of the speakers who accompany the train. About one thousand children are visiting this special every day. The county superintendent of schools of each county that the special visits accompanies the party and acts as guide and director.

Professor V. H. Blackman, of Leeds, has been appointed to the professorship of plant physiology and pathology at the Imperial College of Science and Technology, London.

DISCUSSION AND CORRESPONDENCE

THE USE OF NUMERALS FOR SPECIFIC NAMES IN SYSTEMATIC ZOOLOGY

In a recent number of Science, Dr. Needham has suggested the use of a numerical system of naming species, in addition to the present binomial system devised by Linnæus.

To this suggestion there are several objections, which to the practical worker in taxonomy seem wholly insuperable. In the first place, the name of an animal is not the main element concerned. The specific name covers our conception of the species, a conception likely to be greatly modified by thorough study. The generic name indicates our conception of where it belongs. This conception, of necessity, changes with the progress of knowledge. The changes in name mark such progress. To the taxonomist, certain changes of name are as real and as important as any other forward step in science. It is of course unfortunate that some species have had many different names. So have many genera also. This is due primarily to the inherent difficulties of the subject, as few branches of knowledge are more intricate than the study of the genetic derivation of forms, and their exact geographical distribution. These two branches of science, taxonomy and zoogeography, must

depend for their existence on exactness in nomenclature. Besides this, it often happens that a publication in one nation may be unknown in another, that different writers reach the same results almost simultaneously and independently, and still worse, that some writers are careless or ignorant of the literature, or have felt free to improve on the work of their predecessors by changing, not their conceptions, but the names they have given.

This condition in which anybody called any animal or plant what he pleased went on for more than eighty years after the publication of the "Systema Naturæ." It was evident that all exactness in nomenclature was being lost and that the only way out was through the law of priority and through considering systematic zoology as a democracy in which there was no respecting of persons. Since the first attempt at the recognition of the law of priority in nomenclature, we have come by degrees to relative stability. So far as the first name given to species or a genus was concerned, this name, unless already in use, is right. All the others are wrong. To those who regard rules, the number of names doubtful from the standpoint of nomenclature is now but a very small proportion of the total number. Those zoologically doubtful are naturally far more numerous.

The many zoological problems involved must be settled by observation of the facts in nature, not by rule. There is scarcely a species of which we finally and completely know the actual boundaries. The value and limitation of generic groups changes with every increase of knowledge. Forms once placed side by side are shown to belong far apart. Those far apart are often brought together. In this regard, there can be no stability until the facts are all in. A nomenclature absolutely stable would represent intellectual stagnation.

But to the systematic worker in any field, the actual changes bring no great inconvenience. Names are nothing without ideas. His difficulties do not lie in the remembering of names, but in getting the facts to which names are the handles. The postman is not worried over the fact that each town has a name, and that it belongs to some county, and that there are many counties in many states. If he has troubles, it is not because there are so many names, but because there are so many towns and so many people to be named. So with the taxonomist in any field.

To the worker in other lines in biology, who asks of taxonomy nothing save the name of the animal he is working on, all suspense is aggravating. He wants the scientific name once for all, and he doesn't want it changed. We are sorry that we can not accommodate him, but a name as such is not the main question with the taxonomist. We may let the anatomist keep for his own purposes such names as *Amphioxus,* although the taxonomist can not use it, because the group had a name before *Amphioxus* was invented. The anatomist may in time get used to *Branchiostoma* just as he has become reconciled to *Necturus,* in place of the much later *Menobranchus* once sacred to his purposes.

The fact that a name seems to be in common use just now is no argument for its permanence. The next generation realizing more and more the value of law and order, will discard the name that should not legitimately be used. It is just as necessary in taxonomy and in zoogeography to have a clear-cut nomenclature—above all whim or personal preference—as it is in anatomy to have clean knives, or in histology to have trustworthy staining fluids.

As to the substitution of numbers for specific names or their use in place of such names, we have first the minor objection, of inaccuracy. There will be a dozen errors in a column of figures to one in a column of names, because with the numerals the memory has nothing to hold to. If you live at No. 163 West 135th St. half your letters will be misdirected. This can be easily tested. The dead-letter office is sending back to me letters I directed to 916 East 19th St., and to 919 East 14th St., which should have gone to 914 East 19th, and I have now to write these figures twice to be sure that they are right. No. 256 Knickerbocker Avenue does not have this trouble. Besides, misprints in names correct

themselves. Slips in numbers can not do so.

But waiving all this, the plan seems utopian. Let us look at its application to the group of fishes. There are about 12,500 known species of fishes, arranged in about 2,500 genera. Over 4,000 genera have been named and upwards of 30,000 to 40,000 species. Of these names, perhaps 10,000 are known to be synonyms, the result of some one's misfortune or carelessness. The majority of the supposed species have not been tested. The seas are large, there are many rivers, and but few men who study these animals thoroughly. In our system of numbers shall we count real species or merely count names? Manifestly it is only the names which we can use, for we do not know half the species well enough to assign them a final place. Again, shall we number all species of fishes from 1 to 40,000—or shall we number them by groups or by genera? In any case, a single man or bureau must do all the numbering for all the world, else we should have a crossing of numbers. I might use 38,927 for my cat-fish, while my Russian friend might claim it for a sturgeon. If we number by genera, my *Ameiurus* 36 may not be the same as my friend's *Ameiurus* 36 issued at about the same time. Or one or the other might make an error, or misprint, duplicating what is already numbered.

We must then have in each group a central numbering bureau, a bureau which shall have the means to go back and number all the forgotten species already in literature. We would have to do this before the work could begin. Our American channel cat, *Ictalurus punctatus,* has received some 27 specific names after it was called *Silurus punctatus.* To do it justice, we must refer to it as *Ictalurus,* 5, 27, 36, 38, etc., thus including the whole list of synonyms, any one of which some one some time may show to be valid. But the channel cat was not originally called *Ictalurus.* This raises the question as to whether you would list it as *Silurus,* which it is not, or as *Ictalurus,* which it is, or as *Ameiurus, Elliops, Synechoglanis, Pimelodus* or other generic names under which synonyms its species have been recorded.

Manifestly they must be listed under the original generic name, for no one yet knows the final boundaries of the modern genus. The modern genus consists of a group of species clustering round its original type. The boundaries between *Ictalurus,* the channel cat, and *Ameiurus,* the ordinary cat fish, are still uncertain. There are species intermediate, with the head of *Ameiurus* and the tail of *Ictalurus,* and it may be that the two must coalesce. So the same channel cat may be *Silurus* 25, *Ameiurus* 29, *Pimelodus* 75, *Synechoglanis* 1. Under the law of priority, it can have but one right name. This is *punctatus,* the oldest specific name attached to its right genus, which, as we now understand it, is *Ictalurus.*

But let us start the numbering and see where we come out. Shall we begin with the lowest fish or with the fish first made known? Our system of nomenclature begins on January 1, 1758. The first fish named is the common lamprey, *Petromyzon marinus. Petromyzon* offers no difficulty, except that according to Linnæus, *Petromyzon* is not a fish, but an amphibian. His *Amphibia nantes,* or swimming amphibians, in his mind are not real fishes.

Passing on to the first species actually called a fish by Linnæus, *Muræna helena,* the European moray, we have then *Muræna* 1. But this Linnæus *helena* obviously is not a species. It is a compound of what is now called *Muræna helena,* identifiable from its use at the suppers in honor of Helen in Rome, to which Linnæus refers, and of two other species, one of the old world, one American. *Muræna* 1, therefore includes *Muræna* 50 (—*Gymnothorax moringa*) and *Muræna* 90 (*polyzonia*). But we will use the name *helena* for the Roman moray *Muræna. Muræna* 2 (*ophis*) is—no one can tell what—a species of *Ophichthus,* and *Muræna* 3 (*serpens*) is the type of the later genus called *Ophisurus* or *Oxystomus.* It has very little in common with the morays. Have we gained much by substituting *Muræna* 1, *Muræna* 2 and *Muræna* 3, for *Muræna helena, Ophichthus ophis* and *Ophisurus serpens?*

But perhaps it will be best to begin at the bottom of the series. The lancelet is the lowest fish, if (1) it is a fish, and (2) if the *Tunicates,* and the *Balanoglossi* are not also fishes. If we number the fishes from 1 to 40,000, we shall have to decide beforehand as to the nature of tunicates, lancelets, lampreys, chimæras and sharks as well as that of their various extinct relatives. Apparently the only safe way will be to number the species after another, each in the genus in which it was originally placed. In that case, the genus may go where it will, the species will hold their numbers.

In 1774, Pallas named the lancelet, *Limax lanceolatus.* But it is not a *Limax. Limax* is a land-slug. Must we wait till other shellless snails or *Limax* are numbered, before we can list our first fish. Let us chance it as *Limax* 75 and keep it with the fishes if we can.

In 1834, Costa named this same lancelet *Branchiostoma lubricum. Branchiostoma* 1 is therefore equivalent to *Limax* 75. But the species should not be called *lubricum,* but *lanceolatum.* This Yarrell recognized in 1836, calling it *Amphioxus lanceolatus,* bringing up the old specific name. But his generic name, new and useless, has been the source of much subsequent trouble. In any case the species is not *Amphioxus* 1, because it does not start with *Amphioxus.* It was known sixty years before the time of Yarrell.

Our next fish is *Branchiostoma caribæum* of Sundevall in 1853. This is a doubtful species, most likely the same as *B. lanceolatum,* but it may stand as *Branchiostoma* 2. *Branchiostoma Californiense* Gill 1893 may be *Branchiostoma* 3, and the remaining lancelets are scattered over the world, some recorded as *Amphioxus,* most as *Branchiostoma.*

It is not necessary to follow this further. The same conditions prevail throughout zoology. The fact is that our present Linnæan system of naming species and groups in zoology or botany is still the best which has been devised or suggested. It has the right of way through one hundred and fifty years of usage. All present taxonomy is based upon it. Its embarrassments are due chiefly to the difficulties inherent in the subject, and to the limitations of human nature.

The changes in names of the last thirty years have been, on the whole, in the direction of final stability. The zoologists of the world have devised machinery which will steadily make for permanence, and the necessary period of transition is one from lawlessness to law, from confusion to science. In so far as we have confusion this has arisen through neglect or ignorance of law. It can not be remedied by further neglect. A writer dealing with scientific names must either call an animal or plant whatever he pleases, or else he must conform to regulations inherent in the nature of his work. Arbitrary rules will soon be disregarded. The necessary regulations are those which future workers will approve, and we, who are still working in the infancy of taxonomy, must lay foundations on which the future can build.

In view of the great issues which depend on accuracy of method, such minor issues as that we rather say *Amphioxus* than *Branchiostoma,* or that it suits us better to call the common eel *Anguilla vulgaris* rather than *Anguilla anguilla,* or that our collection is labeled according to the method of Cuvier, sink into insignificance. You can say *Amphioxus* if you like—or *Bdellostoma.* We shall know what you mean, but we shall not try to force these names back into nomenclature, replacing older and legitimate names already becoming better known to the actual worker in taxonomy than these names of temporary convenience ever were or ever will be.

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THE USE OF SYMBOLS IN ZOOLOGICAL NOMENCLATURE

AT first thought, Dr. Needham's suggestion[1] that in substance we designate what are practically subgenera, species and so on, by symbols does give more or less of a shock. Never-

[1] SCIENCE, N. S., XXXII., pp. 295–300, September 2, 1910; see also *ib.*, pp. 428–429, September 30, 1910, and XXXIII., pp. 25–29, January 6, 1911.