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The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

REASONS FOR SOME "AILMENTS" IN BIOLOGY.

By Carleton R. Ball

See correspondence: Steinbach, H. B. Oct. 9, 1952

unpublished

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The writer was born a "naturalist" on the western frontier. From early childhood, he was intensely interested in the birds, mammals, plants, insects, reptiles, crustaceans, and fishes in that area. Of equal interest were the ever-changing aspects of land and water, climate and weather, and sun and stars, and the equally shifting response of animate creation to these influences. His first love was the birds and his first paper, on "he Cuckoos of Northwestern Iowa", was published in 1891, two years before he entered Iowa State College.

Working one's way through college during the depression of the '90s was not easy. Failing to find paid work under Dr. Herbert Osborn in the Zoology Dept., where his brother was majoring in entomology, he got a job as janitor in the Dept. of Botany, under Dr. L. H. Pammel. As a result, he graduated in botany, specializing in taxonomic agrostology. In the following seven years of work in forage plants for the U.S. Dept. of Agriculture, he soon went over to the agronomic side of the problems. After that, 24 more years were spent in cereal agronomy (where the grasses dominate). The final 13 years were spent in public administration, in the field of developing and using full cooperation between Federal, State, and local governmental agencies in solving their mutual problems in the entire United States.



It is from these backgrounds that the writer ventured to suggest the apparent reasons for some of the "ailments" of biology, noted in recent "letters to the Editor" and in Marston Bates' paper, "Where Is Biology", in the July issue of the A.I.B.S Bulletin (capital B).

1. Physical and Biological Sciences Compared.

The physical sciences are more abstract and symbolized. The biological sciences are more concrete and objective. In the physical sciences, especially the mathematical group, only the symbols can be seen. The rest must be imagined until wrought into the form of evidence by patient and painful labor of the mind. The immediate results obtained are mental, not physical.. In applied mathematics, the construction engineer, for example, must study and evaluate existing instruments, machines, and structures before he can imagine and design improvements. He then must finance their construction and testing before he can be certain of their usefulness and so obtain credit for any improvement.

In the biological sciences, the objects already exist, and most of them can be seen, either wild or domesticated, in their varying habitats on land or in water or the air. Preserved specimens of many kinds may be studied as dried plants in herbariums, mounted skins or skeletons in museums, or bodies and organs visible in preservative liquids in glass containers. Minute organisms are enlarged under the microscope. Form and substance, color and beauty, are had for the looking. Hybrids are produced in nature or artificially and the progenies selected to obtain desirable new organisms.



Because of these differences, biology will attract those with love for the living things in nature. It also may attract many with less aptitude or inclination for the more exacting requirements of computation and reasoning so basic to the physical sciences. Yet these very differences, if appreciated and properly used, give the teachers of biology an outstanding advantage in arousing the interest and enthusiasm of their pupils. Its teachers must be inspired to make full use of this advantage. 81

2. Failure to Produce Nature Lovers and Conservationists.

Biology in some form is taught in practically all high schools, colleges, and universities. Tens of thousands of our boys and girls are enrolled in biology classes each year. Only a minute fraction of these will become professional biologists, or ever should be expected to do so. What, then, should be the prime object in teaching general biology to these comparative beginners? The object should be to produce

ardent nature lovers and informed and effective conservationists. Just that. The necessary fraction of those so taught will become immensely more effective professional biologists.

There is desperate need for an increasing conservation of our natural resources, especially of the so easily destroyed plant and animal life. Already, in the brief span of our national existence, several species of birds and animals have become extinct, including the great auk and , quite recently, the heath hen of New England. Others are being rapidly reduced in numbers and soon will disappear. It is a tragedy that, as the ability for personal travel increases, some of the most interesting objects of sight-seeing disappear forever. Only the complete protection of certain wildlife areas from commercial exploitation can save the present remnants of other species from extinction. Our splendid series of national, State, and city parks and forests is doing much to provide areas where those animals and birds able to endure the proximity of man may continue to live and reproduce normally. These areas also enable our increasingly urban population to become acquained with our varied forms of wildlife under fairly natural conditions. But such parks cannot save the more timid creatures of the wild now verging on extinction.



The student of elementary biology should be taken into the out-of-doors to study the habitats and habits of plant and animal life. This would be supplemented by textbooks and lectures, and rounded out by discussions of the usefulness or harmfulness of each group to other groups in nature and to mankind under varying conditions. Such teaching would produce enthusiastic nature lovers, who would become effective conservationists. Only this will counteract the common slogan of our day: "It's alive,- kill it". Only such nature lovers and conservationists can create that extensive public sentiment which alone can insure the preservation of our natural resources of plant and animal life. Laws alone, if existent, cannot do it. Effective citizen cooperation is required to obtain laws and make their enforcement possible. Biologists must consider seriously whether present teaching ir directed toward, and is accomplishing, these ends. Only yesterday, two game wardens were shot by a hunter whom they were trying to prevent from killing animals during the closed season.

Do non-biologists ever disparage and cripple biology? Some 50 years ago, the writer discovered that, in the botanical and zoological laboratories of a college in a large eastern city, there was not a single microscope and very little equipment of any kind. Amazed, he discussed the matter with the dean, who admitted the fact and explained the reasons. Their School of Pharmacy must have high efficiency or its graduates could not pass the State examination for licenses to practice. Pharmacy depends greatly on chemistry. The fees of the chemistry students were not sufficient to maintain that Department at the high level required, so the fees paid by students in botany and zoology were used to strengthen Chemistry. The inference of the inferior status of biology is obvious, and that dean remained in control for many years thereafter. Had AIBS been existent then, it would have protested this unfair discrimination against biology students and this unjust diversion of their fees.

Do biology teachers ever arouse hatred of biological science? Some almost incredible happenings in biology classes have been reported to the writer in the past 25 years. In several cases, young biology students were ordered to extract pickled carcasses of animals from bottles and dissect them, allegedly to trace out the nervous and/or circulatory systems and the skeleton. A pickled rat is not an attractive animal at best. The immediate result was violent nausea. The permanent result was a deep abhorrence of biology, carried on into their adult lives. The writer submits that the dissection of carcasses has no part in beginners biology. Any knowledge of internal anatomy needed then can be taught better and more quickly by diagrams, photographs, and mounted skeletons. Dissections belong only in the training of advanced students with professional intent. In the cases mentioned, many other students and students-to-be heard of what happened abd decided not to elect biology, if they had a choice.

3. Using Unneeded Foreign Words in English Writing.

Language is the one universal tool of humanity, and the most useful. Its ready and accurate use is tremendously important as our world grows steadily smaller. Our English is a puzzling conglomerate, derived from most of the languages and dialects of the entire world. Because of the history of exploration, conquest, and settlement, it probably is more nearly a world language than any other. But, because of its diverse and polyglot origin and long period of evolution, it is probably the most confusing in pronounciation and spelling of any language on earth. Action which would simplify and improve it is quite possible. And we should be exceedingly careful not to increase the present evil confusion. Yet exactly that is being done.

A common temptation is to sprinkle our scientific writing with latin words or phrases which could have been better expressed in English, if needed at all. The writer once counted 19 latin phrases in one scientific paper, written in English. The meanings of all of them could have been expressed perfectly in English, and would have been understood by more of the readers. Another writer of English used the latin phrase, ad hoc, some 25 times in a single paper. It is a fair guess that he had just become acquainted with it and was "showing off". Biologists must accept a fair share of the blame for such extravagances.



Where introduced foreign words add new ideas to our language, they may be truly helpful. At first they are recognized as foreign and italicized when written. But, when we adopt them as English, if we retain a foreign pronounciation different from that of English words similarly spelled, we do great harm to our language and to our children who have to learn it. But many of the foreign words, especially French, now regarded as "English" do not represent new ideas at all. Many of them seem to have been adopted and used primarily because they are assumed to add elegance to our speech and to indicate a superior "culture " of the user.

Some such words commonly used, and having a non-English pronounciation, are ballet, blase', bouquet, chauffeur, coiffeur, coupé, corsage, ennui, entre', entrepreneur, garage, massage, melee, menage, mirage, penchant, and sabotage. Compare them with our banquet, bonnet, bullet, cartage, courage, damage, dosage, entry, manage, message, salvage, tonnage, vantage, and wastage.

4. Continued Use of Confusing Latin Plurals for Anglicized Latin Nouns.

The English language has a comparatively simple system for forming the plurals of nouns by adding s or es, There are a few confusing variations, as the en in oxen, and both es and s for words ending in o. A third and most numerous variation is in the plurals of words ending in y. In such words of more than one syllable, we form the plural by changing the y to i and adding es, as in dairies, ferries, dictionaries, ponies, and juries. This is wholly unnecessary. It is not done with most nouns of one syllable which end in y, as bay, clay, day, fay, jay, lay, may, play, quay, spray, tray, way, bey, key, trey, boy, joy, soy, toy, buy, guy, and many others, where the simple s is added. In a few other similar nouns like cry, dry, fly, fry, spy, sty, try, etc., the y is deleted and ies added. A few others are not discussed here.

There is no reason whatever, other than accepted habit, why all singular nouns ending in y should not form the plural by simply adding s. Sports writers in baseball already are rebelling and writing "flys" and "trys". If biology teachers, writers, and editors would agree to sanction and advocate this practice of adding s to pluralize all nouns ending in y, it quickly would be adopted by a grateful public. Let us always remember that dictionarys do not create language practices but merely record the practices adopted by users of words.



But there is one serious and wholly unnecessary confusion in plural nouns for which science is chiefly responsible, and biology must accept the larger share of that responsibility. That evil is the using of the exceedingly variable and difficult system of Latin plurals for those thousands of Latin (and Greek) singular nouns commonly used in scientific writing. For many similar words, of course, the singular has been anglicized and the plural now is formed in the English manner. But such words are greatly outnumbered by those for which the Latin plurals still are used, even though our dictionarys record the accepted use of the English plural form for many of them. The writer discussed this problem some 25 years ago, illustrated it by numerous tables, and cited several earlier papers on the subject.*

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* Ball, Carleton R. English or Latin Plurals for Anglicized Latin Nouns. American Speech 3:291-325. 1928. (reprinted for the American Society of Agronomy).

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Below is a table which summarizes very briefly the data in the extensive tables of that paper. For most of the words used below to typify the various groups, Standard and Webster's dictionarys recorded only latin plurals as then in accepted use, or at least in preferred use. The table lists the various confusing endings of both singular and plural nouns in these 17 Latin groups. One noun used commonly in biology is given in both singular and plural forms, followed by a second word used more commonly in other professions. The final column shows the approximate number of latin nouns in eacg group, and their grand total. In two of these groups the singular and plural forms are the same.

Singular and Plural Endings in 17 Latin Noun Groups.

| Endings | | Nouns Typical Of Each Group | | | | No.of |
|---|---|---|---|---|---|---|
| Sing. | Plur. | Biological | | Non-biological | | Words |
| a | ae | larva | larvae | nebula | nebulae | 500 |
| a | ata | stoma | stomata | thema | themata | 175 |
| en | ina | stamen | stamina | nomen | nomina | 25 |
| is | es | pelvis | pelves | analysis | analyses | 250 |
| is | ides | iris | irides | apsis | apsides | 35 |
| x | ces | Salix | Salices | aviatrix | aviatrices | 130 |
| nx | nges | larynx | larynges | sphinx | sphinges | 20 |
| | | | | | | |
| um | a | museum | musea | lyceum | lycea | 40 |
| ium | ia | mycelium | mycelia | symposium | symposia | 470 |
| um | a | datum | data | agendum | agenda | 340 |
| eus | ei | pileus | pilei | nucleus | nuclei | 30 |
| ius | ii | genius | genii | radius | radii | 30 |
| us | i | sorus | sori | calculus | calculi | 350 |
| us | us | simus | simus | apparatus | apparatus | 40 |
| us | era | genus | genera | opus | opera | 10 |
| us | ora | pectus | pectora | corpus | corpora | 5 |
| ies | ies | species | species | series | series | 3 |
| | | | | | | 2453 |

In addition to those in the table, there are nearly as many more small groups, having from one to several words in each, and a total of some 15 different ways of forming their plurals. Not many of these words are seen in English writing. A few examples, with singular and plural forms, are: icon, icones; halo, halones, caput, capita; generale, generalia; and vas, vasa. These serve to expose further the vicious variation in the forming of latin plurals.

It is a tragedy that the groups listed in the table, plus those mentioned above, show a combined total of about 30 different ways of forming the plurals. In every case the relatively simple English system can be used. Not the least of the tragedy lies in the fact that the singular ending of some groups is exactly the plural ending of other groups, and vice versa. Only a thoroughly grounded Latin scholar can be sure whether he has a singular or plural noun before him, if the word is unfamiliar.

Two examples of the evil of using these Latin plurals are our current use of the nouns "data" and "agenda". Both are plural, but the singular forms, "datum" and "agendum", never have come into common use in English. As a result, many scientists are using them as singular forms. From his own experience in editing scientific journals, and from discussions with present editors, it seems that these words are used as singulars in about half of the papers submitted for publication, as well as in the programs of our meetings. Worse still, some editors are letting them get by, and we see such expressions as "This data" and "The data is" in printed papers. Biologists should lead the way in a concerted and determined effort to do away with the use of this wholly unnecessary and completely confusing system of Latin plurals where they differ from accepted English forms.



5. The Lure of Taxonomic Opportunity.

The naming and description of new entities (genuses, species, varieties) of animals and plants is necessary and legitimate. But it affects every worker and student in biology, whether taxonomist or not. That should obligate the taxonomist to careful and extensive study of the supposed novelties and all closely related entities. This should produce conservative results and prove helpful to all concerned. If hastily and carelessly done, it may be very harmful. There are certain weaknesses in taxonomy, as now organized, which offer temptations to hasty, careless, unproved, and sometimes intentionally fraudulent work. These weaknesses, mostly set forth previously by other workers, are discussed here for consideration and action by all biologists.

a. The Rule for Priority of Publication. The rule that the earliest published name applied to a taxonomic entity (genus, species, variety) shall have priority over all names published later for the same entity is a fair rule and desirable, if only provision is made for conserving names long and widely known before the earlier name was discovered. No such provision was made at the beginning and none conserving names of species yet exists in taxonomic botany. Science is for the increase of knowledge, not the rewarding of individuals. This condition has had two bad effects.

The first evil is the continued displacement of names which have been widely used for 100 or 150 years or more and are well known to workers in the science. A recent example is Fernald's action in 1946, stating that Michaux's Salix cordata of 1803 antedated Muhlenberg's Salix cordata by a few months. As Michaux had applied that name to the species long and widely known as S. adenophylla Hooker, the rule required that both Muhlenberg's and Hooker's species must be known henceforth under new names. Instead of stability, we have continued changes and all students are compelled to learn them. That increases labor, not knowledge. If Michaux and Hooker could be polled, they almost certainly would have advised against the changing of well-known names in wide use for more than 100 years. The early explorers were seeking to increase knowledge for others, not to get personal honor for naming new entities. But we provide no rule for the automatic conservation of long-known and widely used names, which is true stability.



A second disturbing possibility is that, a few years later, another taxonomist will claim to have discovered a still earlier name applied to the entity discussed. This requires another change before students have become accustomed to the first. Or sometimes a second writer asserts that the first change was unnecessary because that earlier published name really had been applied to a different species than the one suggested by the first writer. Unless all can agree on the facts, two schools with different beliefs and usage will further amplify the confusion.

b. The Rewards of Taxonomy Tempt The Weak. Taxonomy, as now organized, offers too many tempting rewards, with little regard for the quality of the work. Among them are the frequent and permanent displaying of the namer's name, complete freedom from supervision, and no penalties for poor or even intentionally fraudulent work.

The surname of persons who name new entities will forever appear when these entities are cited by any one, whether they are listed as valid or merely as burdensome synonyms. There probably are some 10 times as many synonyms as actual entities, but there is no stigma or reproach attached to the creation of countless synonyms, even by intentional fraud, although these will burden honest workers for a million years.

The taxonomic slogan followed by many says: "It looks different. Name it" (before anyone else does). Taxonomy actually obligates to careful and exhaustive study. There is additional temptation presented to the strong-minded but weak-moraled taxonomists. Their rule seems to be: Name everything you see. Let the other fellow do the work" (of finding out what the thigs really are). One gets the credit for production, the other does the honest and much harder work of determination. One taxonomist, who published hundreds of "new" species, seldom compared them with the others to which they were most nearly related, or actually were, but usually only with some distant relative. Three men, in 10 years, jumped the number of named "species" of hawthorns (Crataegus) from about 25 to more than 1200. Now there is utter confusion. The only real remedy is to declare the published results of that debauch to be illegitimate. Another man, without explanation or reason, changed the name of a long-known species and thus achieved one more novelty in a forthcoming manual.



If biologists are to restore and maintain the ancient respect for this science they must speak out against such actions and provide means for preventing and undoing such wrongs. The only species-maker whose countless "new" species have been denied recognition, in the writer's knowledge, was Gandoger. In his case, the refusal was based on a claim that they were not legitimately published. A scientific worker here, when refused permission, by his employing agency, to publish certain taxonomic assertions, had them published under the name of his non-scientific wife. By both action and inaction, biology has lost respect. Let us act to regain and maintain that respect.

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# No. Amer. Crataegus "Species"
## from New Index Supplements

| Suppl. No. | Period | New Species |
|---|---|---|
| 1 | 1886-1895 | 2 |
| 2 | 1896-1900 (in 1899-1900) | 56 |
| 3 | 1901-1905 | 472 |
| 4 | 1906-1910 | 388 |
| 5 | 1911-1915 | 74 |
| 6 | 1916-1920 | 10 |
| 7 | 1921-1925 | 84 |
| 8 | 1926-1930 | 1 |
| 9 | 1931-1935 | 3 |
| | In 50 years | 1090 |
| | In 12 years (1899-1910) | 916 |

Murrill published 13 from Florida in 1942

American Institute of Biological Sciences
ASSOCIATED WITH THE NATIONAL RESEARCH COUNCIL



October 9, 1952.

Dr. Carleton R. Ball,
3814 Jocelyn St. N.W.,
Washington 15, D.C.

Dear Dr. Ball:

Dr. Meyer of the AIBS office forwarded to me your manuscript "Reasons for some Ailments in Biology". I have read the manuscript with great interest and appreciation. You say many things which should be said but, unfortunately, at the moment the BULLETIN cannot undertake to publish the paper. As you probably know, the BULLETIN is limited in space, since we can publish only to the extent the advertising revenue will allow. Perhaps an even more critical limitation is that decided upon by the Editorial Committee when we met recently at Ithaca, New York. At that time we more or less committed ourselves to a unified plan for about the next year, of such a nature as to commit most of the space that will be available.



I have taken notes on your interesting paper and am keeping them on file with the hope that later on space will become available. We wish to thank you sincerely for the support you have offered the BULLETIN.

Yours truly,

H. B. Steinbach,
per. HBS

H.B. Steinbach, Chairman,
Editorial Committee.

HBS/VW