coast along the Channel of Tartary as far as Okhotsk Sea. No evidence whatever could be found to indicate a former population different from the present. The swift current and high waves keep the gravel and sand of the beach continually shifting. It was possibly for this reason that so little was found on the shores. Not a worked flint was seen. There were hundreds of fragments of pottery, about thirty polished stone hatchets or scrapers, some notched sinkers and a few other stones, showing marks of use or attempts at shaping. Above the water-line, grass and weeds grow so abundantly that the ground is hidden. In the few places, where vertical exposures of the banks occurred, every foot was carefully examined; but there was not a fragment of pottery, a piece of charcoal, or any other evidence of human occupation, to be seen below the sod. This is true of all terraces, whether subject to overflow or not. The natives say the 'old people' (meaning thereby their predecessors, without regard to time) used the polished stone implements. Now better utensils can be had from the Russians. Most of the pottery is Manchurian, as is proved by its marking or decoration. The remains of a Chinese town may be seen in the woods at Tyr; three inscribed monuments formerly stood near here. The inscriptions have been deciphered, and prove to be Manchurian.

There are no shell-heaps, of course, because no shells; no mounds; no stone graves; no graves, except modern ones, with any mark to show their existence.

When a Gilyak house is abandoned, it soon goes to decay. The earth piled around the base is increased in amount by that falling upon it from the walls, and when the wood all decays there is left an embankment surrounding a depression. If the roof-timbers hold for a year or two, the earth is washed off and adds to the embankment; if this dirt falls directly downward, it lessens the depth of the depression.

In the entire region examined, these abandoned house-pits was found. In some, part of the timbers were still in their proper position. In others the timbers were all more or less decayed. In still others no trace of wood remained. Step by step could be traced the gradation from the house just deserted to the house-pit covered with moss and turf to an equal thickness with that on every side, and overgrown with pine trees up to thirty inches in diameter—as large as any observed along the river. All are constructed in the same way, and several which were trenched across showed the stone flues just as they are made at present.

There may be ancient remains here yet to be discovered; but so far none have been found which may not be properly attributed to the present native tribes, or to the Manchurians, who until recently owned this territory.

GERARD FOWKE.

ON BIOLOGICAL TEXT-BOOKS AND TEACHERS

A GENERAL indictment against text-books may be drawn, to the effect that, like the teachers who are usually their authors, they proceed on the assumption that all who pass through their sphere of influence are to become specialists in that particular department of knowledge. This tendency carries its own *reductio ad absurdum* and is the cause of frequent revolutions in 'methods of teaching.' A new phase of the subject, a new standpoint from which to present it, is at first tentatively added or partially substituted for the old course of study, with noticeably excellent results. Not realizing that the improvement is secured by the introduction of moderation, balance and sanity into the work of instruction, the inference is at once drawn that still more startling effects are possible through further progress in the direction whence the light

came. Very soon, however, the mean is passed, the new has become the old, the simple the complex, and another advance, return, or deflection, is in order.

The history of biological instruction in schools furnishes a good illustration of these phenomena. The systematists had the first botanical opportunity, which they proceeded to abuse. Not content with the original practice of giving beginners a slight acquaintance with the names and properties of the more prominent local plants, they arranged for the laying of broader foundations for systematic work; manuals containing thousands of species and requiring extended experience for their profitable use were put into the hands of academic pupils prepared only by a brief course in definitions. The vital activities of plants went unnoticed; they were not organisms to be understood, but objects to be named. Such a one-sided and sterile method could not be perpetuated in the treatment of a subject having any practical bearings, and the necessary revolt followed. Numberless facts of internal structure and organic functions, problems in physics, chemistry and electricity were then brought to light and put before the budding mind as containing the essence of botany, and now the extreme of development in this direction is being reached.

That the training of specialists is not the primary object of instruction in biology, in primary and secondary schools, or even in the college, will be admitted by all. The available time is limited, more commonly painfully short. The interest of pupils is necessarily divided and fragmentary on account of the numerous subjects they are obliged to follow simultaneously; originality and the power of clear insight are in process of destruction by a continuous surfeit of educational provender. Biology cannot hope to monopolize time or attention, and hence the first problem of instruction is to employ the meager opportunities to the greatest good of the student. The course which will obtain the maximum of pleasurable interest is also that which will produce the most lasting and satisfactory results. The teacher is the mentor and guide in the fields of knowledge. If he were in charge of a party of his pupils who were visiting England, and had a week to see London, the systematist would advise that six days be spent with the maps and guide books, so that his students might be able to call the principal buildings and streets by name while driving to Westminster on Sunday; the laboratory instructor would consistently employ the week at the Tower, mostly in careful examination of the foundations, Both suggestions would have advantages if the visitors were to remain in London six months or a year, but with the sojourn limited to a week the young people would in each case come back disappointed at not having seen the city, and this may properly be the state of mind of thousands of students of biology and its departments. They have a right to see as many and learn as much about living creatures as time and opportunity will permit; to proceed as though they were to spend a lifetime in pursuit of some biologic speciality is a piece of criminal stupidity not unfrequently alloyed with a considerable amount of laziness, since both the extreme methods are reducible to a definite class-room or laboratory routine capable of comparatively easy management, while to maintain a well-balanced middle course, giving a maximum of knowledge in logical and orderly arrangement, requires alert and sympathetic comprehension, both of facts and of persons.

But of what should general tuition in biological subjects consist? The answer must vary with the pupils, the facilities and the time. To specify any method, standpoint or sequence as the unqualified 'best' is to lose sight of the differences and

limitations which must be considered in particular cases. There are, however, some simple and universal demands which all general courses in biological subjects may be expected to meet, but which are frequently neglected in favor of the special instruction deprecated above.

1. *Formal instruction should not fall behind general knowledge in dealing with familiar things.* This does not mean that students of zoology should all become veterinarians, but it does mean that they should know something more about horses than the average of uninstructed humanity. It is no special credit to the educated man who 'had a course in botany' to be badly poisoned by contact with a weed which thousands who never heard of botany have learned to avoid. To be able to recognize the more common edible fungi is an accomplishment which none would be likely to regret. In fine, the educated man is a man none the less, and a part of nature throughout his mortal life, and any so-called instruction which does not, within its particular province, increase his efficiency in contact with his environment lacks prime elements of interest and importance.

2. *Literary development requires the command of a reasonable scientific vocabulary.* It is too late in the age of the world for whales and porpoises to be called 'fish,' for corals to be called 'insects,' for lichens to be called 'moss.' For literary purposes, if for no other, a man should know an elm from a hickory or a woodbine. The ignoramus is no longer at a premium on account of any supposed profundity. The poet who has his crows' nest in the fence corner will surely come to grief and derision, likewise he who puts the swallows' nest in the tree.

3. *To insure familiarity and subsequent recognition, natural objects should, as far as possible, be seen in nature.* The graduate from school or college who has not gained a larger insight and a deeper interest in surrounding nature and natural objects may know, without peradventure, that he has suffered a grievous loss through the incompetence of the biological contingent of the faculty. The teacher who is accustomed to carry his classes 'through' botany and zoology without taking them into the field is a dangerous fraud whose 'course' consists in some routine work or specialized sawdust which the general student can safely neglect as likely to be of minimum utility or bearing on culture.

4. *Every science should give its students a general view of its subject-matter.* At some time in the course of their biological education students should see and examine, if possible, representatives of the principal groups of animals and plants. It may or may not be desirable to go into great detail in the study of these 'types,' certainly not if thereby the other numbers of this enumeration are to be neglected. It is far better to show the general student forty different sorts of crustaceans and point out their general agreement in structure than to have him spend the time in cutting up one particular form and in learning the names of parts and organs which he never saw before and will never see again.

In the botanical text-books used in the secondary schools ten years ago only the barest mention of the lower plants was made, ferns, mosses, fungi and sea-weeds being summarily dismissed as 'Cryptogams.' In a recently published work of secondary grade the structure, organs and functions of mosses, for instance, are explained or discussed in nine different places. It is safe to say that the information furnished in this form serves to obscure already confused ideas of physiology and morphology rather than to widen and clarify the student's botanical horizon by giving him a modicum of elementary knowledge concerning an interesting group of organisms.

5. *Every science should give its students an*

introductory acquaintance with its methods of investigation. How has the science been built up? What extent of work has been accomplished and what remains to be done? What important problems are now receiving attention, and how is the work being carried on? What are the possible bearings on utility or culture of such investigations? These and numerous others are legitimate and pertinent questions being constantly asked by those inside as well as outside of scientific lines. Under this head it is desirable to make a careful dissection and thorough microscopic examination of at least one animal or plant. It is something to know how an eclipse is calculated or how a plant is 'analyzed,' even if we never attempt either feat after having 'passed up.' Together with a reasonably thorough investigation of the structure of some one form, the student should collect and learn to know the local flora or fauna in some natural group, even though a very small one. Instead of manuals of extensive regions, school purposes would be far better served by carefully written local monographs which could be made really adequate for purposes of determination in the hands of the inexperienced. By being less formidable such works need not be less scientific. Greater simplicity would also make easier the comprehension of the principles of classification and the meanings of its various categories. Repetitions and demonstrations of interesting or famous experiments are also valuable, but to confine a class in the laboratory and hurry it through a long series of such may result merely in intellectual nausea on the part of the victims.

These limited specializations are desirable as part of every general course, but the field or the problem should in each case be so narrowed that the student may reasonably be expected to gain some insight in the time available. To say that all work must be experimental or all histological or all systematic is merely to commit the same mistake in three different ways. Biology has an advantage over many parts of school curricula in that its subject-matter contains much of daily interest and permanent value. Although other departments commonly justify their existence by appeal to the fallacy that mental training can be successfully divorced from instruction, biology has less need of such an admission. The gymnasium may be theoretically the best place to secure symmetrical muscular development, but the stronger attraction is exerted by foot-ball or boat-racing, and college faculties have themselves largely to thank for the fact that these subjects monopolize so extensively the attention of undergraduates. The growing mind demands some object of tangible, contemporary, individual interest, and if this is not found in the curriculum it will be sought outside. A knowledge of foot-ball relieves many a college graduate from the charge of being a complete ignoramus. Interest in nature for its own sake is, however, also a normal and very common characteristic of younger individuals of the human species, and while the rountine of school life tends to an early eradication of this quality, its extinction is seldom complete, and the competent teacher knows how to utilize it as a most pleasant and important adjunct to the work of instruction. The popularity of the weekly excursion of classes in botany and zoology has even caused resignations from the foot-ball team.

While the training of specialists is not the object of any schools except the universities, the importance of investigators in modern civilization is too great to justify the neglect of the interests of such during the educational period. Investigators, however, of all others, need to acquire this more popular and more general knowledge of their own specialty. To be drilled from their earliest days only in methods of in-

vestigation, either systematic, structural or physiological, is to destroy originality and keep narrow the ground on which future generalizations must be built. It is accordingly plain that to limit a student's opportunities for biological instruction to a specialized course along some one line has not even the single justification it at first seemed to possess. The present extreme tendency toward 'laboratory work' and away from actual contact with nature on the part of beginners in biology is without doubt a temporary condition. Not every one who sits behind a battery of reagents in a laboratory is an investigator, and not all investigators are thus equipped.

At the cost of an equal amount of labor, which would command the general preference, an acquaintance with the more common plants of one's neighborhood or a mass of facts about plants in general, but applicable as a whole to no plant in particular? Organs, tissues and functions have been named and classified; knowledge in these directions is becoming extensive and complex, and the specialists are zealously trying to keep the beginners up with the times. Recent text-books written from structural and physiological standpoints contain a mass of definitions and an amount of classification equalling or exceeding that of the other extreme in systematic works. This classification is, indeed, not what prominently bears that name, but it is classification none the less, though artificial and based on abstractions instead of affinity or phylogeny. The details of structure and life history are arranged under such heads as 'Growth,' 'Reproduction,' 'Nutrition,' 'Irritability' and 'Symbiosis,' and the emphasis is not upon the facts in nature, but upon the mechanical or chemical considerations which must be invoked to explain the various special problems.

A complaint has been voiced that these so-called modern methods of instruction are atal to the interest and spirit which actuated the naturalists of former days, and this is not difficult to understand. Such work is preparatory only for chemists, physicists and physiologists. Its interest is not in nature, primarily, but in matter and mechanisms. Under the extreme systematic method we had introductions to plants of which we knew nothing; by the avowedly unsystematic method we learn facts about plants which we do not know.

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SCIENTIFIC BOOKS.

Text-Book of General Physics for the Use of Colleges and Scientific Schools. By CHARLES S. HASTINGS, PH.D., and FREDERICK E. BEACH, PH.D., of Yale University. Boston, U. S. A., Ginn & Co.

Apart from the obvious distinction between good and bad, text-books in Physics may be divided into two well-marked classes. In the one the main point of view is to consider the study of Physics as a training of the mind; as a subject which requires the use of logical processes and which ought to develop mental accuracy and habits of thought better than any other science.

The other class of text-books does not lay so much stress upon logical methods, but calls attention rather to the phenomena of Nature which are illustrations of the great fundamental laws, and to the experimental methods by which these laws have been discovered.

The continued success of such text-books as those of Ganot and Deschanel shows that there is a great need in American colleges and schools for the class of text-book which comes under the second head, just mentioned. The most recent text-book, this by Hastings and Beach, is distinctly one of the same order. It treats the subject, however, in a thoroughly modern manner and is free from the inaccuracies of the earlier treatises. One's first impression on opening the book is of great satisfaction. The paper, type, illustrations, arrangement of matter, everything which per-