so unusual, but nothing so desirable in education, whose purpose is, not to make things easy, but to strengthen ability to master difficult ones. It is just this training which zoölogy should furnish.

It may be set down as certain that in the brief time usually allotted to zoölogy in college no student can master both the technique of zoölogy and a complete survey of the classification. It is also certain that he cannot acquire without laboratory work a zoölogist's conception of, we will say, a crustacean. He may dissect a cray-fish and then be informed that it is a crustacean, in which case he merely understands the terms 'cray-fish' and 'crustacean' to be synonymous. But let him take a cray-fish or lobster for his first study; let him dissect it and study its cellular structure; let him study its larval stages. From it let him go to other macrourans and compare their forms, all the way from *Gebia* to *Hippa*. Let him have access to the systematic treatise, and hunt out the genus and species. Let him compare it with the schizopod and the crab, and with the megalops of the crab, and he will then form some adequate conception of the zoölogist's meaning of a crustacean.

We believe this to be the true way to teach zoölogy, for we doubt the value to a man of a mass of indefinite ill-digested text-book information. Occasionally an omnivore can take in every thing, and digest and so metabolize it as to organize it into healthy mental tissue. They are, however, the few.

If the requirement of zoölogy from a text-book be such as this outline would indicate, obviously no text-book can ever fully meet it. For the systematic work no smattering key but the original description should be consulted if possible. Upon the anatomy and histology the student should have the use of original articles, monographs, etc. This is, however, not always possible, but the nearest approach to it should be the chosen course. Sedgwick and Wilson's work comes the nearest to being such a text-book of any with which we are familiar. We should have preferred the selection of some animal with a larger circle of cousins and other relatives, both near and distant, and think that a crustacean or a coelenterate might be taken to exhibit better the science.

It will mark a long stride of improvement for the science of zoölogy when teachers and examiners will be content to allow the student to become broad only after he has been narrow, in place of exacting of him a large amount of varied information which is only skin deep, will foster and encourage methods of work which will make him the master of the facts. The real test of the merit of a zoölogical student should be made to lie in what he can do, how much he can see, — his ability to demonstrate facts in zoölogical science, and not merely or chiefly, as at present too largely, in how much he knows.

L. H.

Elementary instruction in zoology.

Seldom have I read an article, among the many that have been recently published dealing with that all-important question as to why biology should constitute one of the leading educational branches in the schools and universities, with more interest than I did the one contributed by Prof. H. W. Conn, and published in the issue of *Science* which appeared upon the 18th of last month.

To my mind, it not only presents in the most masterly manner why biology should be introduced into the curriculum of every grade of school, from the primary classes to the university, but how, within the near future, such a happy result will with great certainty come about.

I can remember very well how, a number of years ago, I read with the keenest interest all of Huxley's now classical essays upon this subject, and watched the untiring efforts of his to force upon the attention of those in authority in educational matters in England the prime importance of an early introduction of the biological studies not only into the graded schools, but into the curriculum of every university.

There are many, many teachers and educators in this country to-day that now hold the views of Huxley in nearly all essential particulars; and those who have thoughtfully followed, step by step, the growth of the natural sciences with us, since the early days of this century to the present hour, know full well that the time is not far distant when the education of the individual will by no means be considered a liberal one, unless it comprehends a very clear understanding of the principles of biology in their widest sense.

For more than a quarter of a century it has been my good fortune to have been able, in common with others of my date in the fields of science, to watch and study the several highly interesting phases through which the natural sciences have successively passed. These phases seem to divide themselves naturally into three quite well-marked stages; and these stages may be characterized by comparing them with the way in which any animal or group of animals has been studied. In times gone by, naturalists dealt first with the mere description of animals, — the narrative stage, as it were, — and the literature of the subject partook almost exclusively of this style of treatment. But as the knowledge of animals became more accurate, and freed of its mythical taint, why, then the needs of the minds of men demanded more than this, and the subject naturally passed into its second stage, and the study became highly classificatory. Classification reduced the enormous amount of almost chaotic descriptive literature to order and system. Next the study of the natural sciences gradually passed into its third and present stage, wherein classification is being checked and corrected by the wide-spread attention that is being devoted to the subject of structure, — the morphology of animals. It is needless for me to add here that the outcome of the present phase is slowly bringing to light a knowledge of the fundamental life-principles of organized nature, and an understanding of the universal laws that apply to the whole.

As the pressure of the necessity for the teaching of biology in the schools became greater and greater in recent times, it was soon followed by the outcropping of the text-books to be used for the purpose; and it has been with the very deepest interest possible that I have studied the casting of these very volumes. Some of them have still clinging to their pages many of the traces of the 'narrative' phase of the science; others are largely classificatory; while still others, intended even for the youngest minds, deal chiefly with morphology, — with healthy hints of a juvenile calibre, at the underlying principles of life, judiciously introduced.

From this point, space now demands that I be brief in my remarks; and I will, in concluding, simply present my matured views upon the subject of elementary teaching in biology, irrespective of any of

my reasons for holding them, or any defence of my convictions in the premises.

As to the age at which children should first take up the study of biology, I contend that it largely depends upon the aptness of the individual child, and the capacity for teaching of the instructor. My oldest son is not yet quite ten, and he can pass a stiff examination upon Morse's 'First book in zoölogy,' name the bones of the vertebrate skeleton, comprehends the general principles of a natural classification, reads well, and has his other studies fully up to those in biology, and, finally, makes an unusually creditable drawing *direct* from any natural object. I would say, then, to those children to whom all the advantages of the schools are open, that they may safely begin with their first steps in zoölogy and biology at nine years of age.

As to the methods, I would say, then, for a child of nine years of age, that mere descriptive zoölogy be simply considered a part of his general reading; that such training as comes from the study of the naming of animals I would surely confine to a very limited list of the commonest forms of the several groups, but let these be thoroughly understood; and I would say right here, that, even at this age, it is truly wonderful how well a child can comprehend the general principles of nomenclature, if they be properly presented to him. Even clear through the university course, I am by no means an advocate of the student putting forth the effort to commit to memory the names of animate objects, even so far as they apply to the fauna of his own country. Coming next to classification, I would say that this, too, be borne upon but lightly at first, though *its principles* can be introduced at a very early stage in the programme of biological education. What I object to, is the early course of zoölogical studies being based upon any system of classification. I agree with Professor Conn when he says that "classifications have, by reason of recent discoveries, grown so intricate and complicated that they no longer can be taught to the general student with any degree of satisfaction." But the principles of classification, as I say, can be easily made clear to the child; and it soon learns to grasp these, and prattles quite learnedly as to why bats are grouped with the mammals, and whales are not fishes!

By this time I expect my views upon this part of the subject have been anticipated; and I hasten to say that my firm convictions are, that the principle upon which biology should be taught to children, is to begin with the study of TYPES. Not only that, but I contend that it is the question of a study of types that should be held to, all the way through the entire course of study, until the day of graduation at the university.

And, figuratively speaking, at all ages these studies must be pursued with text-book in one hand and the actual specimen in the other, with the lens and scalpel constantly at work.

If we start in with a child nine years of age, and commence to carefully point out to it, constantly using fresh specimens, all that can be learned from the body of any *one kind* of small animal, appropriately illustrating it as we proceed with a sufficient number of the proper kind for comparisons, and introducing at the same time the simpler laws of chemistry and physiology, it is absolutely marvellous the interest that can be aroused, and the progress that is the outcome of it all. Children soon learn, too, to make wonderfully good sketches of their work, and may be easily taught to compare them, and lay them aside for future use.

The text-book for this purpose, treating, as it ought to, of a few types, should be thoroughly and carefully illustrated; and none of the systems should be in any way neglected or hastily passed over. Take the muscular system, for example. For children nine years of age, it will only be necessary to illustrate the larger and more important muscles of the trunk and extremities, but good figures of them must be given in the text-book; and, say the instructor has before him as his type some such an animal as a squirrel, he can easily lay bare the biceps in the fore-limb, and, in an attractive way for children, speak of the composition of a muscle, show the physics involved in its leverage, and say how it is found in most all vertebrates with fore-limbs, how in mammals it is inserted into the radius, and in many birds into the ulna; its presence in ourselves can at once be demonstrated upon any child present; and so on. Lessons of this kind, I know from personal experience, are entered into with a growing interest, and are pursued with an ever-increasing profit.

So far as I know, to my mind, the text-book in zoölogy and biology, for the use of our children from nine to fifteen years of age, remains yet to be written.

R. W. SHUFELDT.

Fort Wingate, N. Mex., March 5.

Thought-transferrence.

I read with much surprise Mr. Edmund Gurney's letter on the article of which I gave an account in *Science* of Feb. 4. I thought I had made it quite clear that I was simply saying, in part in my words but mostly in their own, what two ladies had written on an overlooked factor in thought-transferrence. As these ladies have so clearly proved their ability to speak for themselves, I will take the liberty of forwarding them a copy of Mr. Gurney's letter, and, if they think it advisable, they may answer it.

The reason why I consider the article important is because it tells us something new and interesting about the 'number-habit,' not on account of its bearings on thought-transferrence. The latter point of view, however, was that which interested the authors of the article, and I thought it better to adopt their form of statement. The bearing of this fact on psychic research is to me of rather trivial interest compared to the psychological value of the fact itself. I fear there is great danger of magnifying the importance of psychic research in general, and of forgetting that it forms only a small and that rather an unimportant part of psychology.

It seems to me perfectly fair for the writers of the article in question to omit any detailed reference to the work of the English society; and I, for one, did not draw from it the inference which Mr. Gurney draws, — that they suppose the argument to apply to *all* the work of the English society. I do believe, however, that the principle has a very much wider application than Mr. Gurney supposes. The writers of the article in question took for granted some acquaintance with the work of the English society; and the charge of misrepresentation seems to me unfair against them, as I hope it is also unfair against my account of their article.

It can hardly be of interest to any one but myself to know that Mr. Gurney's own attempt at 'thought-