

[For the Scientific American.]

THE LEAF-CUTTER BEE.

[By Edward C.H. Day, of the School of Mines, Columbia College.]

Would you enjoy sensations of genuine, worthy pleasure, such as are not to be obtained in a stroll on Broadway, or even amidst the artistic luxuries of a wealthy mansion—of pleasure unaccompanied by feelings of envy and jealousy, and unalloyed by the thousands of petty cares, and the follies and vices, that, amongst your fellow men, jostle you at every corner? Do but have recourse to Nature, and watch her operations. No knowledge of hard words is required for this—a pair of willing and patient eyes is all that is needful; the name of the creature you are watching is immaterial to you—its habits, its history, and itself are before you—note accurately in your mind what you observe, and when opportunity offers, you will be able to find out all that is recorded about it in books. There are but few persons, we trust (though, alas! we have our doubts on the point of number), who do not pay some attention to the truths of Nature that surround us; but many things that are the most interesting we only half comprehend, because their salient features are so familiar that we do not think it worth while to inquire further. We thus wander through the world, unconscious of its wonders, failing to discern its half-hidden beauties, and ignorant of the lessons of wisdom that it is ever willing to teach to those who are not too self-satisfied to learn.

Every child in its first reading lessons is taught something in words of the habits of the honey bee; and there are few children that have not, with childhood's yearning after natural knowledge, endeavored to learn more by their own observation, watching the little gatherers collecting honey, or wearily struggling homewards with overladen thighs. They have been told of the waxen cells these insects make, and "honey-comb," in the course of years, becomes a familiar idea in their minds, and a useful term in their stock of words. If, by chance, they have seen a swarm, they may have realized the multitudes that make up a society of bees; and if happy enough to have been able to watch a hive in summer, they have probably learnt what a busy community it is. The result of all this is that they come to think of bees as only social creatures, and many of their teachers, we fear could scarcely enlighten them by telling them of bees that are solitary in their habits. "Who ever heard of one bee making honey?" was the sally uttered by the wit of a party on the cars one day, and due appreciation of the joke was manifested by the laughter that greeted it. For our part, it reminded us of Lord Dundreary, but it was a Dundrearyism without a Dundreary point—a bird with only one feather is really a ludicrous idea, but a solitary bee making honey is an every-day fact.

So much of an every-day fact is it, that the bees are divisible into social and solitary species; and these groups differ in one very important feature. As the neuter bees—the workers of the hives—are an "institution" having its origin in the necessities of the societies of the social bees, we do not find such forms among the solitary species.

There is no need here that any female should have their natural course of development arrested in order to promote a division of labor; among these each female has to perform all the labors preliminary to the deposition of her eggs; she has herself to build the nest and store it with food for her future progeny: nor does she accomplish the latter by easy rapine, as do the wasps, but by patiently collecting and garnering with many a toilsome journey. These solitary bees abound under our eyes in the garden and the field, and as industrious and laborious in their tasks and as ingenious in their unassisted constructions. They are, in one respect, even more instructive than their sisters of the hive; for in a study of their simpler habits lies our first step towards even comprehending the mysterious instincts that govern the social species.

Some of these solitary forms are sufficiently well known, as the carpenter-bee, for instance, which labors steadily for days boring a hole into the wood-work of a trellis or into a beam, until it perfects a tunnel often eighteen inches in length, and as truly and as neatly finished as it drilled by the most skilled carpenter. Within this tube she makes her cells, depositing in each a mass of pollen and honey, inclosing an egg, and closing each cell by a partition of agglutinated sawdust—if we may give that name to the results of her rasping.

Again, there are many kinds of mason-bees that build their cells of clay or sand, cementing the particles together, and smoothing the inside with the most exact nicety. One species of these makes its cells and an extra edifice, inclosing them as hard as the most durable cement work of mankind, and lest such solid walls should altogether immure the forthcoming brood, she leaves a means of egress at the point next to the cell from which the first bee is to escape. By what wonderful instinct does she know which is to be the first? Extraordinary as such instincts are, they are less bewildering to our comprehension than those of the upholders, and leaf-

cutting bees. Why should these creatures hang the walls of the cells they excavate with the finest silk or with the tenderest rose leaves, or choose the gaudy red-poppet petals as the material for furnishing these little "homes of taste?" These small species do not so frequently attract attention as the larger carpenter-bees, for their nests are generally more concealed; but the traces of the operations of the *Megachile centuncularis*, or the "leaf-cutter" bee, must often be noticed. The observer may frequently find upon a rose bush leaves out of which a portion of a circle has been cut with remarkable accuracy. If he succeed in seeing the worker in the act, he will observe that the feat is accomplished rapidly as well as dexterously by the little creature's jaws; and should he discover her nest, he will learn that she disposes of the fragments with equal skill. The reader may best understand this by a glance at the accompanying engraving, and by the following extract from Kirby and Spence; we merely premising that these bees hollow out the tunnel, they afterwards tapes-

pleted the six or seven cells which compose her cylinder. "What other architect could carry impressed upon the tablets of his memory the entire idea of the edifice which he has to erect and, destitute of square or plumb-line, cut out his materials in their exact dimensions without making a single mistake?"

When such are the marvelous works of an insect, are we wrong in inviting you to give a little of your spare time to the observation of Nature? And would it not be better for ourselves and ours had we but a wider knowledge of her material ways?

Gymnastics as a Remedy for Physical Debility.

The following extract from a paper by Archibald McLaren, of the Oxford Gymnasium, published in the last number of the *Herald of Health*, shows in a striking manner the power of properly directed exercise to restore muscular power and to develop that of persons naturally weak:

"The first detachment of non-commissioned officers, twelve in number, sent to me to qualify as instructors for the army, were selected from all branches of the service. They ranged between nineteen and twenty-nine years of age, between five feet five inches and six feet in height, between nine stone two pounds and twelve stone six pounds in weight, and had seen from two to twelve years' service. I confess I felt greatly discomfited at the appearance of this detachment, so different in every physical attribute; I perceived the difficulty, the very great difficulty of working them in the same squad at the same exercises; and the unfitness of some of them for a duty so special as the instruction of beginners in a new system of bodily exercise—a system in which I have found it necessary to lay down as an absolute rule, that every exercise in every lesson shall be executed in its perfect form by the instructor previous to the attempt of the learner; knowing from experience how important is example in the acquisition of all physical movements, and how widely the exercises might miss of their object if unworthily represented by an inferior instructor. But I also saw that the detachment presented perhaps as fair a sample of the army as it was possible to obtain in the same number of men, and that if I closely observed the results of the system upon these men, the weak and the strong, the short and the tall, the robust and the delicate, I should be furnished with a fair idea of what would be the results of the system upon the army at large. I therefore received the detachment just as it stood, and following my method of periodic measurements, I carefully ascertained and registered the developments of each at the commencement of his course of instruction, and at certain intervals throughout its progress.

"The muscular additions to the arms and shoulders and the expansion of the chest were so great as to have absolutely a ludicrous and embarrassing result; for before the fourth month several of the men could not get into their uniforms, jackets, and tunics, without assistance, and when they had got them on they could not get them to meet down the middle by a hand's breadth. In a month more they could not get into them at all, and new clothing had to be procured, pending the arrival of which the men had to

go to and from the gymnasium in their great-coats. One of these men had gained five inches in actual girth of chest. Now, who shall tell the value of these five inches of chest, five inches of additional space for the heart and lungs to work in? There is no computing its value, no power of computing it at all; and before such an addition as this could be made to this part of the body, the whole frame must have received a proportionate gain. For the exercises of the system are addressed to the whole body, and to the whole body equally, and before this addition could be made to the chest every spot and point of the frame must have been improved also—every organ within the body must have been proportionably strengthened.

"But I tried another method of recording the results of the exercises. I had these men photographed naked to the waist shortly after the beginning of the course and again at its close; and the change in all, even in these small portraits, is very distinct and most notably so in the youngest, a youth of nineteen, and as I had anticipated in him, not merely in the acquisition of muscle, but in a re-adjustment and expansion of the osseous framework upon which the muscles are distributed.

"But there was one change—the greatest of all—and to which all other changes are but means to an end—are but evidences more or less distinct, that this end has been accomplished, a change which I could not record, which can never be recorded, but which was to me, and to all who had ever seen the men, most impressively evident; and that was the change in bodily activity, dexterity, presence of mind, and endurance of fatigue; a change a hundredfold more impressive than any thing the tape measure or the weighing chair can ever reveal."

THE INVENTOR IS AS MUCH A CREATOR AS THE SCULPTOR.

THE LEAF-CUTTER BEE (*Megachile centuncularis*) AND ITS NEST.

try, sometimes in decayed wood, or in the pith of a stem, or in the ground, or, as recorded by Putnam, under a board in a roof:

"This cavity she fills with six or seven cells, wholly composed of portions of leaf, or the shape of a thimble, the convex end of one closely fitting into the open end of another. Her first process is to form the exterior coating which is composed of three or four pieces of larger dimensions than the rest and of an oval form. The second coating is formed of portions of equal size, narrow at one end, but gradually widening towards the other, where the width equals half the length. One side of these pieces is the serrate margin of the leaf from which it was taken, which, as the pieces are made to lap one over the other, is kept on the outside, and that which has been cut within. The little animal now forms a third coating of similar materials, the middle of which, as the most skillful workman would do under similar circumstances, she places over the margins of those that form the first tube, thus covering and strengthening the junctures. Repeating the same process, she gives a fourth and sometimes a fifth coating to her nest, taking care, at the closed end or narrow extremity of the cell, to bend the leaves, so as to form a convex termination. Having thus finished a cell, her next business is to fill it within half a line of the orifice with a rose-colored conserve composed of honey and pollen usually collected from the flowers of thistles; and then, having deposited her egg, she closes the orifice with three pieces of leaf so exactly circular, that a pair of compasses could not define their margin with more truth; and coinciding so precisely with the walls of the cell as to be retained in their situation merely by the nicety of their adaptation. After this covering is fitted in, there remains still a concavity which receives the convex end of the succeeding cell; and in this manner the indefatigable little animal proceeds until she has com-