BEES AND THEIR INSTITUTIONS.

[We extract from a contemporary magazine, entitled *Home and School*, a most excellent educational monthly, published by J. P. Morton & Co., Louisville, Ky., the following article on the instinct and habits of the bee. It is from the pen of a lady, Sophie B. Herrick, who evidently understands her subject; and it is so well written that we forbear to alter or curtail it.—EDS.]

It is both curious and interesting to study the government, the laws, the political economy of a kingdom which is precisely the same today that it was six thousand years ago; whose antiquity is so great that it enjoyed an ancient rule when China, Assyria, and Persia were still in their infancy. The bees have not only possessed a stable and orderly government through all these centuries, but they have managed to retain their character as models of wisdom, industry, and thrift, while nation after nation has sprung into being, lived its day, and then dwindled away into insignificance.

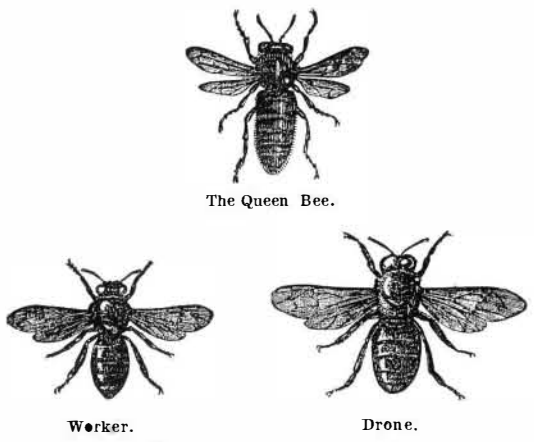

Fig. 1.—DOMESTIC BEES.

Many of the lessons which man learns only by bitter experience a thousand times repeated seem to have been stamped by the divine power upon the very entity of the lower creation; and this, if nothing else, would make their habits, instincts, and life history well worth our study.

In every swarm there are three kinds of bees, which not only differ from each other in form and structure, but whose functions are entirely distinct. These are the queen bee, the workers, and the drones (Fig. 1). The queen, who is the only perfect female in the hive, is the mother of the whole swarm. In shape she is easily distinguished from the other bees: her body is long and slender, her wings small but strong and sinewy, her legs are wanting in the brush and pollen basket which characterize the worker, her head is in form a flattened sphere, and her sting is curved. The workers were supposed to be sexless till the delicate dissections of Mdlle. Jurnie, at the suggestion of Huber, determined them to be imperfectly developed females. These are the smallest bees in the hive; their bodies are shorter than that of the queen, their wings of the same size. The four hinder legs are furnished with brushes of stiff hair, with which to collect pollen; the two hindmost with spoon-shaped cavities, in which it is packed away for transportation to the hive (Fig. 2). The head of the worker is triangular, and its sting straight. The drones are the males; in size they are about one third larger than the workers; in form they are thicker, and in color darker. Their jaws and probosces are shorter than those of the common bee; they are destitute of brushes, pollen baskets, and stings, and have heads somewhat similar to the queen.

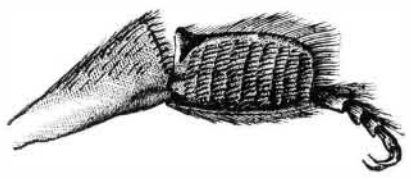

Fig. 2.—LEG OF BEE (magnified).

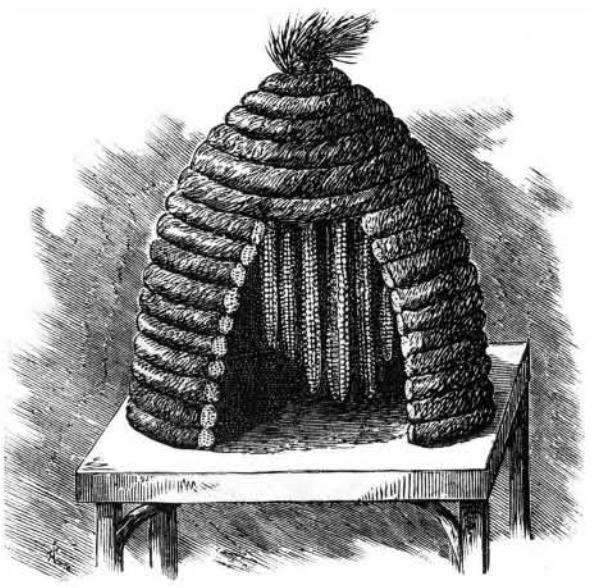

Fig. 3.—INTERIOR OF AN OLD-FASHIONED HIVE.

There is, unless in exceptional cases, only one queen in a swarm; her function is simply to supply her realm with subjects. The workers number from ten thousand to sixty thousand; they perform the whole labor of the hive; they rear the young, defend the common home, stand sentinels at its entrances, collect and store the provisions, elaborate the wax, build the comb, guard, attend, and provide for the queen, and take charge of the sanitary department. The drones perform no work of any kind, and seldom exceed fifteen hundred in an ordinary swarm.

There are two other kinds of bees noticed by apiarians which are frequently found in swarms; these they call the black bee and the captain bee. They both, upon microscopic examination and careful dissection, show an internal structure identical with that of the worker. It seems to be very well established now that the black bee is only a demoralized worker, who, having once tasted the sweets of stolen fruits, has abandoned honest labor, and given himself up to pilfering as a profession. Squeezing through small holes in the pursuit of his nefarious business, he has bedaubed himself with honey, and so plastered down and darkened the delicate plumage of his body. The captain bee has probably unintentionally adorned himself with the pollinia of some orchidous plant, and in this way gained the top knot which distinguishes him from his comrades.

The old-fashioned beehives (Fig. 3) were so constructed that the whole internal economy of the colony was a mystery. Nothing of it could be ascertained except in the examination of results after the destruction of the colony. Though some of the ancients devoted years to the study of the habits of these insects, a large proportion of the results given to the world was almost valueless. Fact was so mixed up with fancy, observation with conjecture, that the value of the whole was greatly impaired. Some of these difficulties have been removed by the introduction of glass observing hives, though many still beset every observer, from the fact that bees love the darkness, and in every way endeavor to obscure their movements within the hive from observation.

We will suppose that we are observing a new hive into which a swarm of bees has been introduced in order that every peculiarity of bee life and work may be considered in their natural order Before the swarm left the old hive, each bee had gorged itself with honey; beside this provision, a quantity of filled comb is generally supplied to them, so that they may not suffer in their new home.

Fig. 4.—CLUSTER OF BEES.

Before anything else can be done, comb must be built. A number of the workers, therefore, fill themselves with honey and suspend themselves in festoons or curtains (Fig. 4), and there they remain motionless for about twenty-four hours. At the end of that time, in the little depressions on the under side of the abdomen, between the overlapping rings of the body (Fig. 5), will be seen thin scales of pure white wax. It is a kind of external fat secreted by the bee from the honey it has assimilated, much as the fat of animals is secreted, especially from saccharine food. Some of these scales are solid wax, others thin films, and others again only delicate spiculæ. Bees, like the higher animals, do not all secrete the same amount of fatty matter from a given quantity of food.

The bees loosen themselves, and one of their number, using the pincers at the joint of one of its third pair of limbs, seizes a wax scale from its own body and brings it to its mouth. The scale is turned about in every direction by the claws, and its edge is broken down and off by the mouth of the bee. These particles are then accumulated in the hollows of the mandibles, from which it issues in the form of a very narrow ribbon. The tongue, during this operation, assumes a great variety of shapes, being sometimes flattened like a trowel and again pointed like a pencil. After the tongue has imbued the whole ribbon with a frothy saliva, which gives to the wax opacity and adhesiveness, it is again accumulated in the mandibles, and again issues forth in the ribbon-like form. The wax thus prepared is applied to the vault of the hive by a single bee (Fig. 6). After the store of wax of this founder bee is exhausted, others follow. Though there is perfect harmony among the builders, there is no coöperation in the true sense of the word, unless the fact that the many wait, while the one assumes the part of architect and lays the foundation, can be called cooperation. A solid arch of wax is built in an inverted position in the upper part of the hive. These little insects always prefer to begin at the top and build downward, though their instinct is wonderfully flexible in its power of conforming itself to circumstances; and if they are prevented from building in one direction, they build in another. Cells are then excavated from this arch, and after the foundation is dug the remainder of the comb is built upon it (Fig. 7). Ordinary cells are six-sided, but the upper rows in the comb are necessarily only five-sided. The six-sided cells are of two sizes: those built for worker broods number twenty-five, and those for drone broods sixteen, to the square inch. The royal cells we will describe later. The comb, when finished, consists of a sheet of double cells arranged back to back with the utmost nicety, so that the greatest economy of space and material is secured (Fig. 8). Maraldi, the inventor of

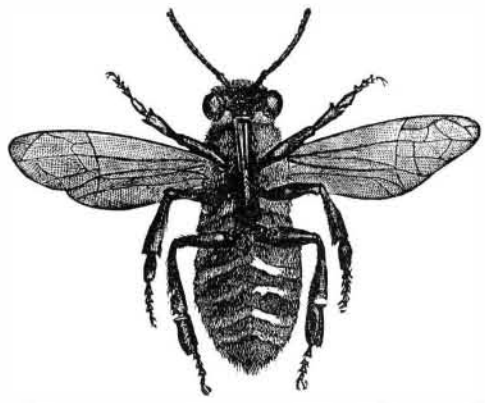

Fig. 5.—BEE (magnified), SHOWING THE WAX BETWEEN THE SEGMENTS.

the glass hives, measured the angles of the cells with great care; he found them to be respectively 109° 28′ and 70° 32′. M. Kœnig, a well known mathematician, without any previous knowledge of this measurement, was requested to determine by calculation what should be the angles of a hexagonal tube with a pyramidal base, in order that the least possible material should enter into its construction. His angles, reached by the methods of calculus, were 109° 26′ and 70° 34′.

In curving their comb, as they are sometimes forced to do, and in conforming themselves to many adverse circumstances, bees often show wonderful wisdom and skill in the variation of size and shape in their cells. In curved comb, for instance, the shape of every individual cell must be changed from the ordinary hexagonal tube with parallel sides. In this case the bases of the double row of cells are of the usual size and shape; the cells on the concave side of the comb narrow from the base to the open end, while those on the convex side widen. When a transition from worker to drone comb, or *vice versâ*, is necessary, it is effected by interposing several rows of cells of gradually increasing or decreasing size. These irregular cells are used for the storing of provisions, never for food.

When first completed the comb is pure white and very brittle; it is afterward strengthened and somewhat discolored by the addition of propolis. This is a gum collected from certain trees by the bees, and is used to make the hives both airtight and watertight. The fragile white comb is sometimes varnished with a thin coating of propolis, and at times the bees have been observed pulling down the first built comb, and working the wax over with an admixture of this gum. The propolis is often kept ready for use in a lump placed in an accessible part of the hive. In this form it hardens till it is almost like stone; when the bees desire to use it, they have been observed to soften it by the application of the same saliva with which they imbue the wax.

When sufficient comb has been supplied to the hive the workers begin to collect stores; they rove the fields for pollen and honey. The pollen dust is gathered by the bee with its brushes and packed away in the pollen basket It is generally collected in the morning, while the moisture renders it cohesive enough to be formed into the little balls with which they fill their baskets. When this is impossible, in consequence of the dryness of the air, the bee rolls himself in the pollen, and flies home as dusty as any miller. In the hive the farina is collected from his body and packed away. It has been known since the days of Aristotle that these little insects never store the pollen of different flowers in the same cell. Each bee comes home loaded with a homogeneous mass, and no temptation is sufficient to induce him to visit more than one kind of blossom in a single excursion. If the flowers visited by the bee yield both pollen and honey, he loads himself with both on the same trip.

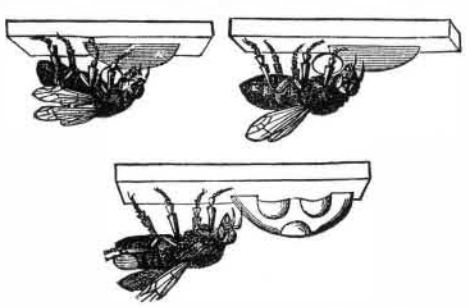

Fig. 6.—BEES CONSTRUCTING CELLS.

The honey is gathered by means of the bee's mouth, which is a most complicated organ (Fig. 9). The proboscis penetrates the nectarium of the flower; by the aid of the tongue and other portions of the mouth, the honey is drawn up and conveyed into the honey receptacle—a sort of second stomach surrounded by powerful muscles, which enable the bee to regurgitate its contents when it reaches the hive. The saccharine secretion of flowers undoubtedly undergoes some

change while in the stomach of the bee. Honey made from the clover, sugar and water, from fruit juice, does not possess a flavor that would reveal the source from which it had been obtained. The taste is not, however, wholly independent of its source: certain plants yield much more delicate honey than others. The honey of Mount Hymettus, of Narbonne, and of Pontus, all owe their exquisite and peculiar flavors to the plants frequented by the bees.

These provisions stored by the bees have their specific uses. The honey is used as food for the mature bees, and is the material from which wax is secreted. The pollen forms the food of the larvæ, and supplies to them the nitrogenous matter necessary to growing larvæ and pupæ. Many experiments have at last proved that pollen has its use also in the secretion of wax. With pollen alone bees secrete no wax; without it and with abundance of honey they at first secrete it abundantly, but soon seem exhausted.

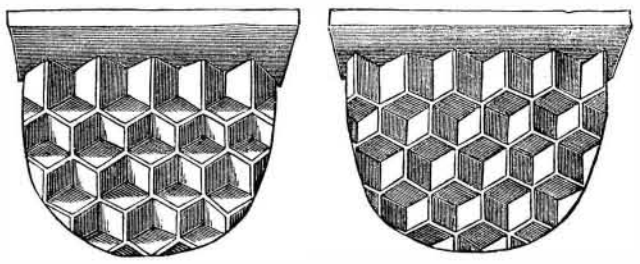

Fig. 7.—CELLS.

As our hive is supposed to be supplied with a perfect, fertile queen, it will be necessary to go back a little. An old queen almost invariably leads off the swarm. She is therefore ready to begin stocking the comb with brood as soon as the workers have builtit. Soonafter our queen was hatched in the parent swarm, she took her first and only flight, with the exception of that in swarming time. A single fertilization is sufficient to impregnate the hundreds of thousands of eggs laid by the queen during her life of several years. Like many other insects she is fecundated on the wing. Dr. Joseph Leidy, of Philadelphia, by the aid of microscopic investigation, discovered a small sack opening into the oviduct

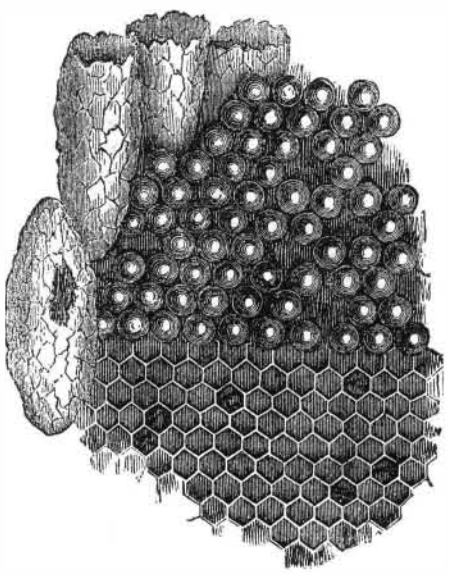

Fig. 8.—PART OF COMB.

of the queen, which is the permanent receptacle of the spermatic fluid. Dzierzon, Von Siebold, and, in fact, all the greatest living naturalists of the world, have been forced into the remarkable conclusion that female bees, workers, and queens are produced from fertilized, and drones from unfertilized, eggs. The sex of the egg is determined by several causes: if the queen from any malformation of the wings is unable to leave the hive, if she does not effect her flight before the expiration of three weeks from the time she is hatched, if she is starved for twenty-four hours, if she is subjected to intense cold for any length of time, and when she becomes old, she lays only drone eggs. The microscope proves that in each of these cases the spermatic sack has withered away, and can no longer perform its function of vivifying the eggs as they pass it. How the queen is able to effect this fertilization at will, though an ascertained fact, is an unexplained mystery.

While thousands of busy workers have been laying in provision for the young of their swarm and for themselves, the queen has not been idle. She has been actively employed in supplying the brood comb with eggs, sometimes to the number of three thousand a day. She generally begins the season with laying only worker eggs; these she is very careful to deposit only in their appropriate cells. If by accident or by way of experiment the hive possesses only drone comb, the queen will drop her eggs about anywhere rather than place them in the wrong cells, where they will not only perish, but, in all probability, fill the comb to no purpose.

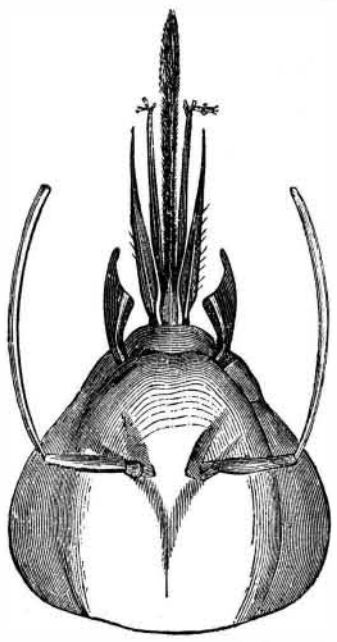

Fig. 9.—HEAD OF THE HIVE BEE (magnified).

Although the queen knows what kind of an egg she is about to lay, the workers cannot distinguish their sex, as has been proved by repeated experiments. This discriminating instinct, which is perfect in the fertile queen, is wanting to the unfertilized drone-laying queen. She will frequently deposit her drone eggs in worker cells, or on the edge of comb, or any where else, though there may be empty drone comb in the hive. The bees have a wonderful way of dividing their labor, and then taking it for granted that each portion has been faithfully done. Where the workers find eggs in comb they assume that the queen has performed her part well, and they give it the treatment appropriate to the brood which should be found in that particular kind of cell.

After the eggs are laid they remain apparently unchanged for three or four days (according to the kind of bee which is to be developed); each one then hatches out into a small white maggot. The smaller workers, called nurse bees, now devote themselves unweariedly to the care of the larvæ. They swallow the pollen, with probably a minute quantity of honey, and after a partial digestion regurgitate it for the benefit of the young. The food is not only administered to the baby bees, but they appear to be always immersed in a sort of bath of the jelly-like substance, and to take in as much of their nutriment by absorption as by direct feeding. The little nurses are models of watchfulness and care; but occasionally they have to be reminded of their duties by the tapping of the baby bee against the side of the cradle. When the nurses think it time to feed their charges, the attention of the larvæ is attracted by some motion on their part, and the always welcome food administered. In four or six days the larva has reached maturity; the nurse bees then cap over its cell with a brown, porous, convex cover—the caps of the drone cells being more curved than those of the workers. The amount of food supplied to the maggot is ample, but it is carefully proportioned to its needs; no food is ever left in the cell when the workers close it in to undergo its final transformation.

Huber's observations of the cocoon spinning were made through the walls of blown glass cells into which the eggs had been removed. Two minute threads issue from the larva's upper lip; these become gummed together at a short distance from the mouth. The constant shortening and lengthening of its body finally enables it to complete its delicate silky covering. The common bees completely envelope themselves, whils the queen spins a partial cocoon,

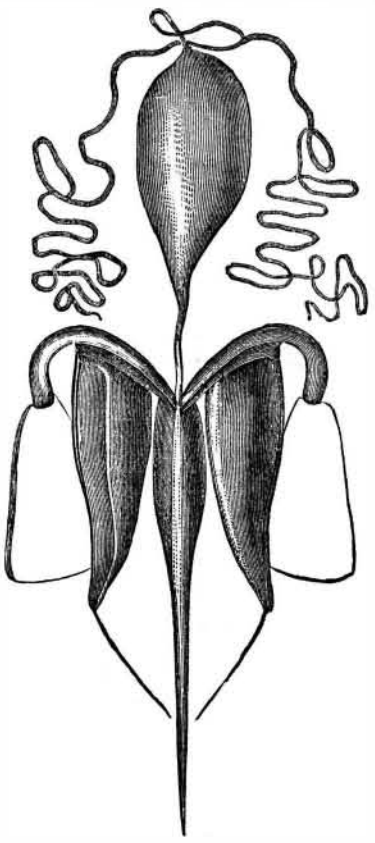

Fig. 10.—STING AND VENOM GLANDS (magnified).

which only reaches to the second abdominal ring. The cocoon done, the bee has reached the second of its transformations, and becomes a nymph or pupa.

The drones require twenty-four days, the workers twenty, and the queen sixteen, to complete their development, from the laying of the eggs to emergence as a perfect insect. When the time for their exit comes, the common bees make

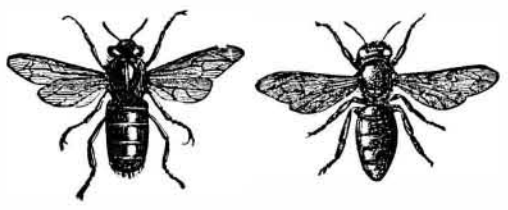

Fig. 11.—FERTILE WORKER. QUEEN, NOT BORN BUT BRED.

their way out of the cells as best they can, while the queen receives every care and assistance. In this the common bees would seem to need help far more than the queens, since their cocoons bind them more closely.

Each insect, as it quits the cell in which it was reared, leaves behind it its cocoon. As soon as a cell is vacated, some of the workers go in to clean it out and prepare it for future use; in doing this the film of silky threads is not removed, but is incorporated into the walls of the cell; as many as seven of these cocoons have been removed, one after the other, from a single brood cell. While the successive deposit of the cocoons strengthens the comb, it also contracts the cells, and in these smaller apartments the nurse bees are

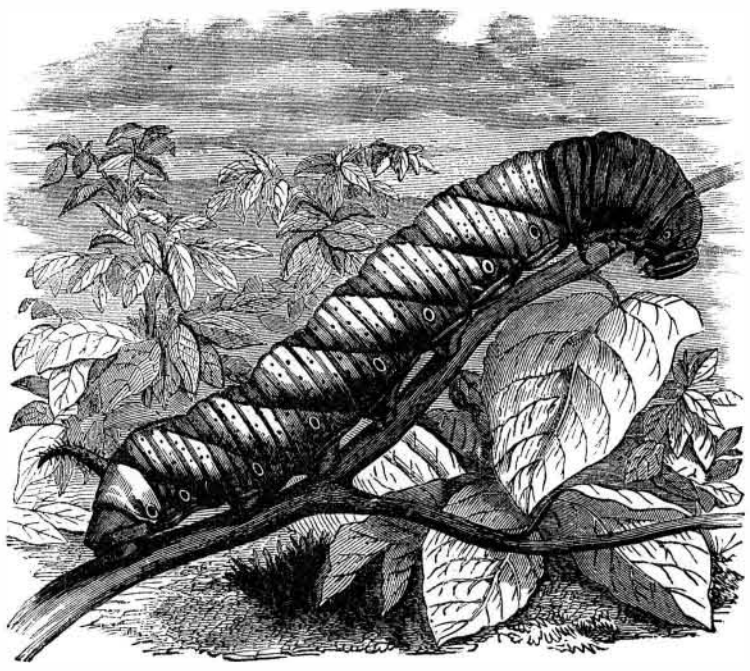

Fig. 12.—LARVA OF THE DEATH'S HEAD MOTH.

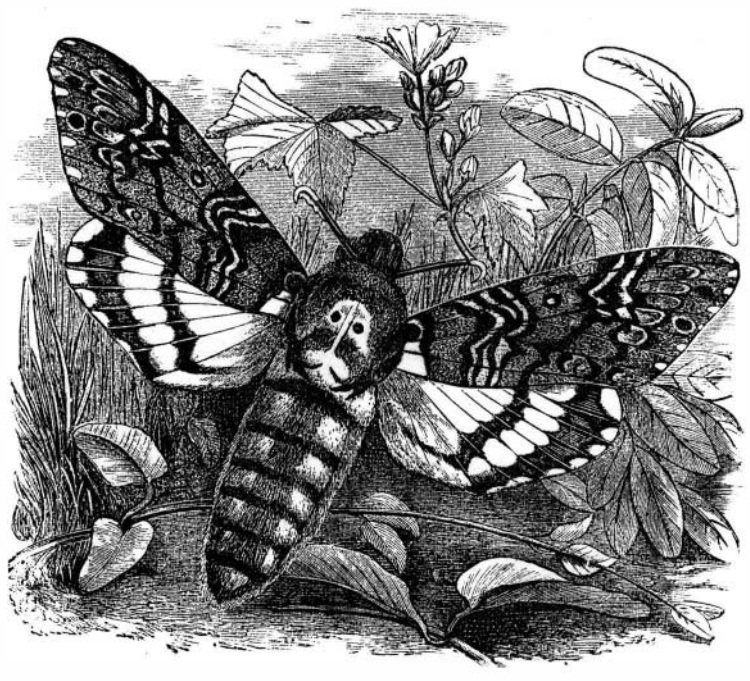

Fig. 13.—THE DEATH'S HEAD MOTH.

reared. These bees differ from the other workers only in their size and in the functions which they fulfill.

A colony of bees frequently becomes queenless either by accident or through natural causes. In this case a most singular scene may be witnessed in the hive. The bees leave their ordinary work when the news has been communicated throughout the hive; they huddle together as if in the deepest consternation. A great buzz, apparently of consultation, is heard. Finally they seem to come to the conclusion that there is no mending the matter, and they agree to set to work to make another queen. Several worker larvæ, in cells not adjacent, are selected and devoted to royalty. (Several are chosen, to provide against contingent loss). The worker maggot chosen may be two or even three days old. The first thing the bees do to each of the selected larvæ is to enlarge its cell by cutting away the partition walls of three adjacent cells, thus throwing them into a single apartment. The worms occupying two of these three cells are destroyed, and all the ordinary food removed. The maggot is then supplied with different food, known as royal jelly, and with a much larger quantity of it. This jelly is a translucent substance, possessing a slight acidity and astringency of taste. The embryo bee which has been taken from the ranks and anointed queen receives the most devoted attention. She is royally supplied with a superabundance of food. When she is ready to go into the condition of a nymph, the bees cap her cell over with a pendent convex cover; and the cell looks, in this condition, more like a roasted peanut than anything else. When the queen is mature, the bees thin the cover of her cell by scooping out waved circles, till it becomes easy to distinguish the royal nymph within. She is generally retained prisoner by her subjects for some days after she has reached her full development. This is more frequently the case when the queens are reared for swarming time than when they are made by the bees in order to supply a deficiency.

The captive queen seems very impatient of her detention. She utters a cry, called by apiarians piping. The workers supply her with honey by means of a small hole in the cap of the cell, through which she extends her proboscis to be fed. Many observers, and among them some of the most accurate and faithful, say that the worker bees stand with their heads inclined, as if in reverence, while this note is sounding.

The moment a queen is released her whole energy is concentrated upon one point. She traverses the comb eagerly seeking for other royal cells. When she finds one, she falls upon it in fury, tears away the cover, and stings the nymph within to death. In this way she destroys every possible rival to her own power within the hive.

The bees generally provide against the simultaneous emergence, of the several queens which they rear, by selecting larvæ in different stages of development. Occasionally, however, two queens come out at once. They soon meet as they wander over the comb in search of royal cells. When this is the case, the workers, who under every other combination of circumstances defend their queens with their very lives, draw back, clear a space, and watch to see the result of the royal combat. The two queens rush upon each other, they grapple, and each endeavours to sting her antagonist fatally. If they happen to get into such a position that the thrust of the stings would prove fatal to both at the same time, their instinct teaches them to withdraw; the hive must not again be left queenless; private animosity must yield in favor of the public weal. They, however, soon rush again at each other. Finally one or the other gains such an advantage that she can destroy her rival without forfeiting her own life, and then the fatal thrust is given. It was long believed that the queen, like the drones, possessed no sting, because she will allow herself to be torn limb from limb rather than use it on any but a royal antagonist.

The peculiar treatment by means of which the larva of a worker is converted into a queen is, as far as we at present know, without a parallel in the annals of natural history. A difference of food, in kind and amount, increased room, and possibly a change of position, to which the embryo insect is subjected, has wrought a transformation almost too wonderful for belief. It is not a mere superficial change which has been effected, but one which penetrates far below form and structure, to the very mystery of life itself; it is a transformation alike of function, of structure, and of instinct. The larva which, under the ordinary conditions of development would have become a worker, which would have gathered the provisions and stored them, which would have defended the hive and guarded it, which would have reared the young, and performed the thousand domestic, civil, and military offices of the common hive, is converted into a queen who does not possess a single habit in common with the workers. The whole structure of the insect is also changed. The head, instead of being triangular, is round, the legs lose the pollen baskets and brushes, and the ovaries, which in the common bee are rudimentary, become enormously developed. The instincts are not only changed, but in many cases are reversed by this difference of treatment. The worker goes out of the hive many times every day, the queen but twice in her life. The worker is ready to sting anything which interferes with it, but never under any circumstances uses its sting upon a queen; the queen will die sooner than use its sting upon any ordinary foe, but will fly in fury upon another queen and thrust her through. The maternal instincts belonging to the brute creation are curiously divided between the workers and the queen. As mother the sovereign carefully deposits her eggs where they will have the best chance of coming to maturity; here her care ceases. Just at this point the workers take up the maternal duties, and they perform them with a zeal and devotion worthy of all praise. Increased room and two days' feeding on different food have wrought this miracle. It is remarkable, too, that the queens require four days less to develop, and live six or eight times longer than the workers.

Among the workers of a swarm there are found, here and there, a few which are fertile. In the cases where investigation has been possible, it is found that these workers, when larvæ, occupied cells adjacent to the royal cell, and so, it is probable, partook of the royal jelly and became partially transformed. They have bodies which are longer and slenderer than common bees, and which approximate more nearly to those of the queen. They never lay anything but drone eggs.

Before swarming time several queens are reared (in this case on the edge of the comb, and frequently they depend from it by a sort of stem). It is not by any means true that swarming takes place always in consequence of the overcrowding of the hive. It seems to be closely connected with extreme heat, whether as cause or effect has not been very satisfactorily ascertained. A number of royal cells have been constructed, so that when the old queen leads off the swarm a new one may be ready to emerge and take her place in the old hive. The queen wanders over the comb in a restless way; her agitation is communicated to the other bees; a commotion arises; the bees gorge themselves with honey, send out a few scouts to discover a secure place for the swarm, and finally pour out of the entrance in a steadily increasing stream. Among them is the queen, who generally rises, and the workers cluster around her. Sometimes she falls and is lost in the grass, and then the bees return to the hive from which they have just issued. An inverted hive is held below the cluster of bees, which have happily found their queen and settled around her. As many as thirty swarms have come from a single stock in one season; some of these, however, were in the second generation.

Usually the fertilization of the queen takes place in June; after this, early in July, there is a general massacre of the drones. When there is no queen, or only a drone-laying queen, in the hive, this slaughter is deferred. The bees fall upon the defenseless drones, pierce through their abdominal rings with their little barbed and poisoned darts, and then twist themselves over in order to extricate the sting without injury to themselves.

The sanitary regulations of the hive are very wonderful; nothing uncleanly or offensive is ever allowed to remain which it is within their power to remove. Réaumur mentions that a snail once invaded one of his observing hives and attached itself to a pane of glass. The weight of the creature was too great for even bee industry and enterprise, but not too much for bee ingenuity. They fastened the shell securely to the glass by means of propolis, and then sealed over the mouth of the shell with a quantity of the same gum. A slug which was once caught in one of Maralde's hives met a similar fate, except that, in this case, the whole body of the creature was entombed in the propolis.

This same substance is used to exclude every enemy of the insect tribe, as well as moisture and draft. The bees know very well that currents of air are desirable and drafts treacherous. While they cut off every avenue for the entrance of air where it would make them liable to disease, they supply a steady ventilation where it is needed. Lines of workers station themselves radially from the door to every portion of the hive: by a constant and well timed motion of their wings, steady currents of air are generated, which keep the hive pure and sweet. The force of the current is sufficient to turn small anemometers.

A guard is always stationed at the door of the hive to exclude enemies. The insects inside assume that the guards have done their work properly; for after robber bees or any other intruders have found their way in, it is generally long before any notice is taken of them. Occasionally a large moth, the *sphinx atropos*, or death's head moth, effects an entrance (Figs. 12 and 13) in spite of the vigilance of the guard. Once inside, the ravages of this creature are terrible. On dissecting one a tablespoonful of honey was found in its stomach. A very curious instance of transmitted intelligence is recorded of a swarm of bees, in connection with this foe of theirs. One of these moths had committed a serious raid upon the winter store of the swarm before it was discovered; several years afterward another member of the same family of moths entered the same hive; the bees at once took measures to secure themselves; the moth was excluded; barriers of wax were erected so that the door would not admit it, though the opening was still large enough for the bees themselves. The tradition of this moth had evidently been handed down: they knew all about him the second time he came. Several generations of workers had been born and had died in the meantime, for the workers live only from five to seven months at the furthest. The ordinary bee moth is a terrible enemy to the hive, and does much greater damage than the sphinx, because its attacks are so much more insidious, and because it not only devours the honey, but the brood as well.

Bees are pugnacious little creatures, if roused by any fancied wrong or by the very human vice of cupidity. They are not disposed to sting if let alone, but are sure to revenge any hurt or indignity. Whole swarms often engage in pitched battles; this is almost always for the possession of territory. One piece of carelessness on the part of a bee keeper, and a whole swarm is sometimes demoralized; if they once gain access to honey, and can steal it, they are very apt to abandon all pretense of honesty, and give themselves up to a predatory life. Some of them, as has been before said, are professional sneak thieves; others are highwaymen. Huber and other apiarians mention the shameless behavior of some of these highway robbers. One of them will arrest a luckless humble bee on its way home laden with honey, and force it to disgorge its treasure. Violence will not do here, for the humble bee's honey pocket is far beyond the reach of our little thief. He does not kill his victim, but only calls "stand and deliver at the peril of your life," and generally succeeds in exacting that for which he asks. When the humble bee yields and gives up its honey, the bee allows it to depart in peace, and licks up the sweets with great gusto.

Our little honey bees, with all their wisdom and virtue, have their faults; and robbery, wholesale and otherwise, is not the only one. They sometimes make themselves thoroughly drunk on the juices of ripe fruits, and may be seen lying on the ground in a state of intoxication.

There are some things in the history of the honey bee which show a fidelity and devotion that is really touching. There is something almost human in their loyalty toward their sovereigns. Several instances are upon record where bees watched over and guarded the remains of their queen for days, licking and caressing her as though they were trying to restore her to life. Though food was supplied they refused to eat, and at the end of four days every bee was dead.

When a queen makes a royal progress through the hive she is always attended by a body guard, not a particular number of bees which are devoted to her person, but a body guard which forms itself at her approach out of the subjects through whom she is about to pass, but who fall back into their regular work when she has gone by. She never lacks the most dutiful and devoted attention; those about her, whenever she moves, caress her, offer her honey, and cluster around her to keep her warm if she is chill.

When a swarm loses a queen, they are at first in deep and violent grief; if a new queen is immediately given to them, they refuse to accept her. If, however, twenty-four hours is allowed to elapse, they reconcile themselves to the idea of her loss, and receive a substitute with royal honors.

The instinct of the bee denies all our traditions of instinct; it adapts itself to circumstances, overcomes new and unexpected obstacles, benefits by experience, employs temporary expedients, and then casts them aside when the occasion for their use is gone, in a way which is marvelously like reason. It is, indeed, difficult to draw any line between the two qualities when looked at in minute detail; it is only in its cumulative power, which produces such different effects, that we can dare to make the distinction, and then we are still at a loss for a definition. It is strange to find in the insect world, among an order of beings so low in the scale of the naturalist, a faculty so nearly akin to the divine gift of reason which is man's crowning glory. But it is just here, among the bees and among the ants, that it is most marvelous and most perfect.

NEW BOOKS AND PUBLICATIONS.

HAY FEVER OR SUMMER CATARRH; its Nature and Treatment. By George M. Beard, A. M., M. D. New York city: Harper & Brothers, Franklin Square.

The theory held in this work, relative to the very distressing malady to which it is devoted, is that the disease is a complex resultant of a nervous system especially sensitive in this direction, acted upon by the enervating influences of heat, and by any one or several of a large number of vegetable and other irritants. The book is the direct result of the author's practical investigation, and it deals with its subject with a thoroughness and care which the serious nature of the ailment has long demanded. Although, from the nature of the disease, no specific will likely ever be found for it which will meet every case, yet remedies almost approaching specifics have already been found for individual cases; and there are but few cases that cannot obtain more or less relief from some one of the many remedies that have been tested and laid down in this work.

MANUAL OF THE VERTEBRATES OF THE NORTHERN UNITED STATES, including the District East of the Mississippi and North of North Carolina and Tennessee. By David Starr Jordan, M.S., M.D., etc. Price $2.00. Chicago, Ill.: Janson, McClurg, & Co., 117 & 119 State street.

This is an excellent catalogue of the vertebrates of the principal part of this country. The definitions are especially clear and accurate, and the classification is such as to afford the greatest facility in identifying species. The information is thoroughly and judiciously condensed, so that the book, although dealing exhaustively with a very widely extended subject, is convenient in size, and may be carried by the tourist, to whom, if he have a taste for natural history, it will be especially valuable.

HANDBOOK OF MODERN STEAM FIRE ENGINES, including the Running, Care, and Management of Steam Fire Engines and Fire Pumps. With Illustrations. By Stephen Roper, Engineer, Author of "Handbook of Land and Marine Engines," etc. Price $3.50. Philadelphia, Pa.: Claxton, Remsen, & Haffelfinger, 624 to 628 Market street.

This book is claimed, by its author, to be the only one treating its special subject thoroughly; and he has succeeded in compiling a handy volume on the subject. He states, with becoming candor, that "its value to the class of men for whom it is intended, lies not so much in its originality as in the judicious selection, arrangement, and presentation of the matter it contains;" to which might well be added the authorization of such selections by giving due credit to the sources whence they are derived. The volume, which is in neat, pocket book form, is compendious and well arranged, and will be useful to any member of a fire brigade who desires to understand the science of his machine.

USEFUL TABLES AND INFORMATION APPERTAINING TO THE USE OF WROUGHT IRON, for Engineers, Architects, and Builders. Compiled by A. G. Haumann, C. E. Price $1.50. Pittsburgh, Pa.: Carnegie, Brothers, & Co.

These tables are among the best we have ever seen, and comprise calculations of the weights of iron beams of all forms of cross section, and the comparative strengths of cast and wrought iron of all sizes. Some extensive mensuration tables are given in addition, and also formulæ for bridges and roofs, the latter being founded on the writings of Professor Rankine. It is altogether a thoroughly trustworthy handbook, and deserves a large sale.

THE TEXTILE COLORIST, a Monthly Journal of Bleaching, Printing, Dyeing, etc. Edited by Charles O'Neill, F.C.S., etc. New York city: John Wiley & Son, 13 Astor place.

We are pushing England very hard in the manufacture of colored textile abrics; and we are now enabled to learn how many of her best designs and most effective colors are produced. The monthly magazine before us contains complete treatises on various methods of dyeing and producing variegated effects as practised in the best factories in England, the explanations being illustrated by pieces of fabric attached to the page. Though only