

TOWNLEY ON BEERS.

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A PRACTICAL TREATISE
ON
HUMANITY TO HONEY BEES;
OR
PRACTICAL DIRECTIONS
FOR THE
MANAGEMENT OF HONEY BEES,
UPON AN IMPROVED AND HUMANE PLAN,
BY WHICH
THE LIVES OF BEES MAY BE PRESERVED,
AND ABUNDANCE OF HONEY OF
A SUPERIOR QUALITY
OBTAINED.

BY
EDWARD TOWNLEY.

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ADVERTISEMENT.

THE primary object of this little compilation, is the dissemination of a more systematic method of conduct pertaining to Honey Bees, than has heretofore been practised.

When our industrious citizens are apprised of the most approved method of cultivating Bees, and the rational amusement and actual profit to be derived from Honey Bees, we may confidently expect that this branch will no longer loiter in the rear of other improvements in rural economy.

Every possible effort has been used, to render this work, in all respects, competent to the purpose in view, that of imparting, in the clearest manner, every point of knowledge requisite for the successful manage-

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ment of Honey Bees. The compiler indulges the hope that his labors will be crowned with the sanction of experienced and respectable authorities, and the approbation of the public.

The destructive ravages of the Bee Moth have, in many places, almost annihilated our Bee establishments, and discouraged all attempts to renewed trials. Not less than one hundred hives have, the past season, been entirely destroyed by that enemy, within a few miles, in New Jersey, and in places where a single hive has yielded one hundred pounds of honey. From a particular investigation of this subject, the compiler is now able, with much confidence, to announce, that an effectual preventive of such depredations will be found recorded in this production.

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INTRODUCTION.

OF THE HONEY BEE.

THE domestic Honey Bee has excited a lively and almost universal interest from the earliest ages. The philosopher and the poet have each delighted in the study of an insect whose nature and habits afford such ample scope for inquiry and contemplation, and even the less intellectual peasant, while not insensible of the profit arising from its judicious culture, has regarded with pleasure and admiration, its ingenious operations and unceasing activity. "Wise in their government," observes the venerable Kirby, "diligent and active in their employments, devoted to their young and to their queen, the

Bees read a lecture to mankind that exemplifies their oriental name, Deburah, she that speaketh. The study is delightful to the mind that contemplates the mysterious operations of nature, and traces its wonderful phenomena up to nature's God. The industrious Bee has ever been viewed by intelligent naturalists as an interesting species of insects, and the fruits of its industry as among the choicest productions of nature."

There is no branch of husbandry, the cultivation of which furnishes for our table a more innocent and grateful luxury, than that of the Bee, nor any part of natural history better calculated to raise our contemplation to that Divine Wisdom which creates and sustains them. If you speak of a Bee, your conversation will be a sort of demonstration of His power whose hand formed them, for the wisdom of the workman is commonly perceived in that which is of little size. He who has stretched out the heavens, and dug up the bottom of the sea, is also He who has pierced a passage through the sting of the

Bee for the ejection of its poison. So high did the ancients carry their admiration of this tiny portion of animated nature, that one philosopher, it is said, made it the sole object of his study for nearly three-score years; another retired to the woods, and devoted to its contemplation the whole of his life; while the great Latin poet, stating, and probably adopting, a prevalent opinion, speaks of the Bee as having received a direct emanation from the Divine Intelligence. After all this study, however, these enthusiastic admirers have thrown but little light on the real nature of this extraordinary insect; and while they have handed down to us many judicious precepts for its practical treatment, their disquisitions on its natural history can now only excite a smile. The chief cause of this failure may be fairly ascribed, perhaps, to the want of those facilities for discovery, which modern science has afforded, and by which the most hidden mysteries of Bee economy are rendered clear and palpable.

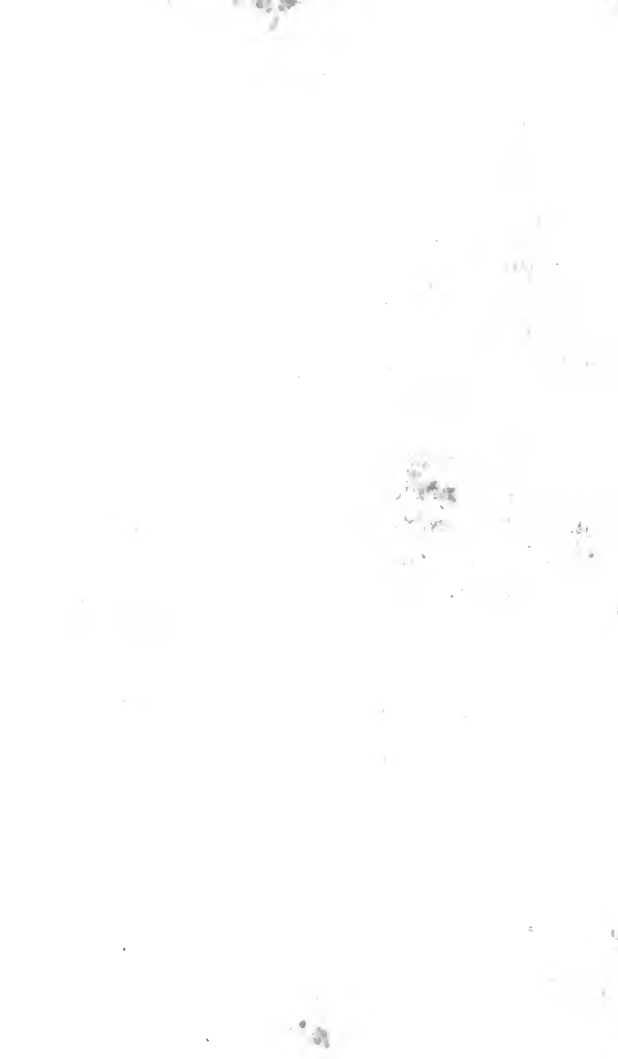
In fact, much has been written and pub-

lished on the subject, calculated to startle a sober reader ; and some of those discoveries which have been blazoned in publications, both at home and abroad, will be found, on strict examination, to have no existence but in the warm fancy or blind enthusiasm of the observers. The incontrovertible facts in the natural history of the Bee, are, in themselves, too remarkable to justify any attempt to draw upon the imagination for additional wonder ; and the naturalist who is desirous of making himself thoroughly acquainted with the instincts and habits of this interesting little creature, should be cautious in considering, as an established fact, any discovery, or supposed discovery, which has not been, again and again, verified by rigid experiment.

In the following details, embracing the Natural History and Practical Management of the Honey Bee, I have endeavored to avoid this error ; stating nothing as fact, but what I know to be so from undoubted testimony, or from my own knowledge and ex-

perience. At the same time, I have not omitted to notice such alleged discoveries or results of experiments, as appear to me to be unsupported by sufficient evidence, or at variance with experiments of my own, made for the express purpose of verification, leaving it to the reader to receive or reject them, as his judgment may dictate.

I have availed myself of the information dispersed throughout a variety of publications, both ancient and modern, with such additions of my own, as have been acquired by the observation of Bees for a period of many years. I trust that the facts detailed, will, of themselves, lead the mind of the intelligent reader to such reflections, and thus become the source of a purer gratification than would have been derived from the suggestions of others.



A PRACTICAL TREATISE
ON THE
MANAGEMENT OF HONEY BEES,
ETC.

The careful Insect, midst his works I view,
Now from the flowers exhaust the fragrant dew;
With golden treasures load his little thighs,
And steer his distant journey through the skies.
Some, against hostile drones, the hive defend,
Others, with sweets the waxen cells distend;
Each in the toil his destined office bears,
And in the little bulk a mighty soul appears.

GAY.

The bee is small among the fowls, yet doth its fruit pass
in sweetness. ECCLESIASTICUS, xi. 3.

CHAPTER I.

ON THE ANATOMY OF THE HONEY BEE.

THE Honey Bee, *Apis Mellifica*, is of the order of insects having four membranaceous wings. Its anatomical structure presents, even to the superficial observer, striking evi-

dences of design in the All-wise Contriver, and of the admirable adaptation of its parts to their several uses. The body of the insect is about half an inch long, of a blackish brown color, which deepens with age, and is wholly covered with close set hairs, which assist greatly in collecting the farina of flowers. Tearing open the anthers of the plant on which it has alighted, and rolling its little body in the bottom of the corolla, the insect rapidly brushes off the farina, moistens it with its mouth, and passes it from one pair of legs to another, till it is safely lodged, in the form of a kidney-shaped pallet, in a spoon-like receptacle in its thigh, to be afterwards noticed. These hairs deserve to be particularly remarked, on account of their peculiar formation, being feather-shaped, or rather consisting each of a stem with branches disposed around it, and, therefore, besides their more effectually retaining the animal heat, peculiarly adapted for their office of sweeping off the farina.

The head, which is of a triangular shape

and much flattened, is furnished with a pair of large eyes, of what is called by naturalists the composite construction, and consisting of a vast assemblage of small hexagonal surfaces, disposed with exquisite regularity, each constituting in itself a perfect eye; they are thickly studded with hairs, which preserves them from dust, &c. In addition to these means of vision, the Bee is provided with three small stemmata, or coronetted eyes, situated in the very crown of the head, and arranged in the form of a triangle. These must add considerably to the capacity of vision in an insect whose most important operations are carried on in deep obscurity. As to the special or peculiar use these ocelli may serve, Reaumur and Blumenbach were of opinion, that, while the larger compound organs are used for viewing distant objects, the simple ones are employed on objects close at hand. It is not improbable, however, that these last, from their peculiar position, are appropriated to upward vision. The antennæ present us

with another remarkable appendage of the head. These are two tubes, about the thickness of a hair, springing from between the eyes, and a little below the ocelli; they are jointed throughout their whole length, each consisting of twelve articulations, and therefore capable of every variety of flexure. Their extremities are tipped with small round knobs, exquisitely sensible, and which, from their resemblance to the stemmata or ocelli, have been supposed by some to serve as organs of vision; by others, as connected with the sense of hearing; and by others, as organs of feeling or touch. This last seems the most probable conjecture, as on approaching any solid object or obstacle, the Bee cautiously brings its antennæ in contact with it, as if exploring its nature. The insects use these organs, also, as a means of recognizing one another, and an interesting instance is stated by Huber, in which they were employed to ascertain the presence of their queen. The mouth of the Bee comprehends the tongue, the mandibles or upper

jaws, the maxillæ or lower jaws, the labrum or upper lip, the labium or lower lip, with the proboscis connected with it, and four palpi or feelers.

The tongue of the Bee, like that of other animals, is situated within the mouth, and is so small and insignificant in its form, as not to be easily discernible. In most anatomical descriptions of the Bee, the real tongue, now described, has been erroneously confounded with the ligula or central piece of the proboscis, afterwards to be described. The upper jaw of the Bee, like that of all other insects, is divided vertically into two, thus forming, in fact, a pair of jaws, under the name of mandibles. They move horizontally, are furnished with teeth, and serve to the little laborers as tools, with which they perform a variety of operations, as manipulating the wax, constructing the combs and polishing them, seizing their enemies, destroying the drones, &c. The lower jaws or maxillæ, divided vertically as the others,

form, together with the labium or upper lip the complicated apparatus of the proboscis.

This organ, beautiful in its construction, and admirably adapted to its end, serving to the insect the purpose of extracting the juices secreted in the nectaries of flowers, consists, principally, of a long slender piece, named, by entomologists, the ligula, and erroneously, though, considering its position and use, not unnaturally, regarded as the tongue. It is, strictly speaking, formed by a prolongation of the lower lip. It is not tubular, as has been supposed, but solid throughout, consisting of a close succession of cartilaginous rings, above forty in number, each of which is fringed with very minute hairs, and having also a small tuft of hair at its extremity. It is of a flattish form, and about the thickness of a human hair, and, from its cartilaginous structure, capable of being easily moved in all directions, rolling from side to side, and lapping or licking up, by the aid of the hairy fringes, whatever adheres to it. It is, probably, by muscular motion, that the

fluid which it laps is propelled into the pharynx or canal, situated at its root, and through which it is conveyed to the honey bag.

The trunk of the Bee, or thorax, approaches in figure to a sphere, and is united to the head by a pedicle or thread-like ligament. It contains the muscles of the wings and legs. The former consist of two pair, of unequal size, and are attached to each other by slender hooks, easily discernible through a microscope, and thereby their motion, and the flight of the insect, are rendered more steady. Behind the wings, on each side of the trunk, are situated several small orifices, called stigmata or spiracles, through which respiration is effected. These orifices are connected with a system of air vessels, pervading every part of the body, and serving the purpose of lungs. The rushing of the air through them against the wings, while in motion, is supposed to be the cause of the humming sound made by the Bees. To the lower part of the trunk are attached three pair of legs. The anterior pair, which

are most efficient instruments, serving to the insect the same purpose as the arms and hands to man, are the shortest, and the posterior pair the longest. In each of these limbs there are several articulations or joints, of which three are larger than the others, serving to connect the thigh, the leg or pallet, and the foot or tarsus, the others are situated chiefly in the tarsus.

In the thigh of each of the hinder limbs, there is an admirable provision made for enabling the Bee to carry to its hive an important part of its stores, and which neither the queen nor the male possess, they being exempted from that labor, viz., a small triangular basket or cavity of a spoon-like shape, the exterior of which is smooth and glassy, while its inner surface is lined with strong close set hairs. This cavity forms a kind of basket, destined to receive the pollen of flowers, one of the ingredients composing the food of the young. It receives also the propolis, a viscous substance, by which the combs are attached to the roof and walls of

the hive, and by which any openings are stopped that might admit vermin or the cold. The hairs with which the basket is lined, are designed to retain firmly the materials with which the thigh is loaded. The three pair of legs are all furnished, particularly at the joints, with thick set hairs, forming brushes, some of them round, some flattened, and which serve the purpose of sweeping off the farina. There is yet another remarkable peculiarity in this third pair of limbs. The junction of the pallet and tarsus is effected in such a manner as to form, by the curved shape of the corresponding parts, a pair of real pincers. A row of shelly teeth, proceed from the lower edge of the pallet, corresponding to bundles of very strong hairs, with which the neighboring portion of the brush is provided. When the two edges of the pincers meet—that is, the under edge of the pallet, and the upper edge of the brush—the hairs of each are incorporated together. The extremities of the six feet terminate each in two hooks, with their points oppo-

sed to each other, by means of which the Bees fix themselves to the roof of the hive, and to one another, when suspended, as they often are, in the form of curtains, inverted cones, festoons, ladders, &c. From the middle of these hooks proceeds a little thin appendix, which, when not in use, lies folded double through its whole breadth; when in action, it enables the insect to sustain its body in opposition to the force of gravity, and thereby adhere to and walk freely and securely upon glass and other slippery substances, with its feet upwards.

The abdomen is attached to the posterior part of the thorax by a slender ligament, like that which unites the thorax and the head, and consists of six scaly rings of unequal breadth. It contains two stomachs, the small intestines, the venom-bag, and the sting. An opening, placed at the root of the proboscis, is the mouth or gullet, which traverses the trunk, and leads to the anterior stomach. This last named vessel is but a dilatation of the gullet, and, in fact, forms the

honey-bag. When full, it exhibits the form of a small transparent globe, somewhat less in size than a pea. It is susceptible of contraction, and so organized as to enable the Bee to disgorge its contents. The second stomach, which is separated from the first, of which it appears to be merely a continuation, only by a very short tube, is cylindrical, and very muscular. It is the receptacle for the food, which is there digested, and conveyed by the small intestines to all parts of the body for its nutriment. It receives also the honey from which wax is elaborated. Scales of this last mentioned substance are found ranged in pairs, and contained in minute receptacles under the lower segments of the abdomen. No direct channel of communication between the stomach and these receptacles or wax-pockets has yet been discovered, but Huber conjectures that the secreting vessels are contained in the membrane which lines these receptacles, and which is covered with reticulations of hexagonal meshes, analagous to the inner coat

of the second stomach of ruminating quadrupeds. The scales of wax are deposited in these two areas, and assume the same shape, viz., an irregular pentagon. Only eight scales are furnished by each individual Bee, for the first and last ring, constituted differently from the others, afford none. The scales do not rest immediately on the body of the insect, a slight liquid medium is interposed, which serves to lubricate the junctures of the rings and facilitate the extraction of the scales, which might otherwise adhere too firmly to the sides of the receptacles.

The sting, with its appendages, lies close to the last stomach, and, like the proboscis, may seem to the naked eye, a simple instrument, while it is, in fact, no less complex in its structure than the former apparatus. Instead of being a simple sharp-pointed weapon, like a fine needle, it is composed of two branches or darts, applied to each other longitudinally, and lodged in one sheath. One of these darts is somewhat longer than the other; they penetrate alternately, taking

hold of the flesh, till the whole sting is completely buried. The sheath is formed by two horny scales, along the grooves of which, when the sting is extruded, flows the poison, from a bag or reservoir in the body of the insect, near the root of the sting. The darts composing this weapon, are each furnished with five teeth or barbs, set obliquely on their outer side, which give the instrument the appearance of an arrow, and by which it is retained in the wound it has made, till the poison has been injected; and though it is said the insect has the power of raising or depressing them at pleasure, it often happens that when suddenly driven away, it is unable to extricate itself, without leaving behind it the whole apparatus, and even part of its intestines, death is the inevitable consequence. Though detached from the animal, this formidable weapon still retains, by means of the strong muscles by which it is impelled, the power of forcing itself still deeper. On the subject of the sting, Paley ingeniously remarks: "The action of the sting affords

an example of the union of chemistry and mechanism; of chemistry, in respect to the venom which in so small a quantity can produce such powerful effects; of mechanism, as the sting is not a simple, but a compound instrument. The machinery would have been comparatively useless, had it not been for the chemical process, by which, in the insect's body, honey is converted into poison, and on the other hand, the poison would have been ineffectual without an instrument to wound, and a syringe to inject the fluid."

Having noticed these particulars in the anatomical structure of the working Bee, as the general representative of the species, we shall next point out in what it differs from the conformation of the queen, and the male or drone. The queen is frequently styled by the naturalist, the mother Bee, and with great propriety, as it seems now ascertained that her distinguishing qualities have a closer reference to the properties of a parent, than to the province of a sovereign. Her body differs from that of the workers, it being con-

siderably larger, and of a deeper black in the upper parts, while the under surface and the limbs are of a rich tawny color. Her proboscis is more slender, her legs are longer than those of the worker, but without the hairy brushes at the joints, and as she is exempted from the drudgery of collecting farina or propolis, the posterior pair are without the spoon-like cavity found in those of her laboring offspring. When about to become a mother, her body is considerably swollen and elongated, and her wings in consequence appear disproportionally short. The abdomen of the queen contains the ovarium, consisting of two branches, each of which contains a large assemblage of vessels filled with eggs, and terminating in what is called the aviduct. This duct, when approaching the anus, dilates itself into a larger receptacle, into which the eggs are discharged, and which is considered by naturalists, as the sperm reservoir, or depository of fecundating matter, from thence they are extruded by the insect, and deposited in the

cell prepared for their reception. The sting possessed by the queen is bent, while that of the workers is straight; it is seldom, however brought into action, perhaps only in a conflict with a rival queen.

The male is considerably more bulky than the working Bee. The eyes are more prominent, the antennæ have thirteen articulations instead of twelve, the proboscis is shorter, the hind legs have not the basket for containing farina, and he is unprovided with a sting. The cavity of the abdomen is wholly occupied with the digestive and reproductive organs. The very loud humming noise he makes in flying, has fixed upon him the appellation of Drone.

CHAPTER II.

THE SENSES OF BEES.

MUCH uncertainty has prevailed on the subject of the senses possessed by this insect,

not so much, perhaps, in regard to their existence, as to the locality of the organs. Most naturalists admit their possession of five senses, analogous to those of man, though the celebrated Huber seems to have some doubt as to the existence of the faculty of hearing in Bees, at least without some important modifications. Greater diversity of opinion, however, prevails as to the situation of those organs by which the impression of sight, touch, taste, sound, and smell are produced on their sensations, and many curious experiments, by different naturalists, have been made with a view to ascertain the truth, but which have not always led to the same results. In researches so minute, it is, perhaps, vain to look for perfect accuracy in our conclusions, and we must be satisfied with any thing like a reasonable approximation to the truth.

CHAPTER III.

SIGHT.

IN my remarks on the anatomical structure of the head of the Bee, I observed that, besides the large reticulated eyes, placed, as in other animals, on the sides of the head, this insect possessed three stemmata or coronated eyes, arranged triangularly on its centre, between the antennæ. That these little specks are, in reality, organs of vision, has been made apparent, from accurate experiments, in which, when the reticulated eyes were blindfolded, the insect was evidently not deprived of sight, though the direction of its flight being vertical, seemed to prove that the stemmata were adapted only or chiefly to upward vision. This additional organ must, doubtless, add considerably to its power of sight, though, probably, its aid may be confined chiefly to the obscure recesses of the hive. As the internal operations of the

insect, in the honey season, are carried on during the night as well as the day, the coronet eyes may, as Reaumur conjectures, serve to it the purpose of a microscope. As to the general power of vision in the Bee, its organs appear better adapted to distant objects, than to such as are close at hand.

When returning loaded from the fields, it flies with unerring certainty, and distinguishes at once its own domicil, in the midst of a crowded apiary. Yet every person, who has at all made this insect the subject of observation, must have seen it often at a loss, in returning to its hive, to find the entrance, especially if its habitation has been shifted, ever so little, from its former station; nay, if, without moving the hive, the entrance has been turned round a single inch, from its former position, the Bee flies, with unerring precision to that point on the alighting board where the door formerly stood; and, frequently, after many fruitless attempts to find the entrance, it is forced to rise again into the air, with a view, I may

suppose, of removing to such a distance from the desired object as is suited to the properties or focus of its visual organ. I am led to conclude, therefore, from these well known facts, that the eye of the Bee has a lengthened focus, and that it must depend on the aid of other organs in those operations wherein its attention is directed to objects close at hand.

CHAPTER IV.

FEELING OR TOUCH.

THE organs of this sense are supposed, with reason, to reside in the antennæ and palpi or feelers, particularly in the former. Huber concludes that the antennæ supply the want of sight in the interior of the hive, and that it is solely by their means they are enabled to construct their combs in darkness, pour their honey into the magazines, feed

the young, judge of their age and necessities, and recognize their queen.

Though it does by no means appear clear that the Bees are devoid of sight when employed in their in-door operations, but, on the contrary, there is reason to believe, as already stated, that the stemmata or ocelli serve as orbs of vision, yet this naturalist is probably not wrong in ascribing to the antennæ an important share in these operations. That the Bees use them as means of communication and recognition, seems readily admitted by apiarians. When a hive has lost its queen, the event, as may well be supposed, causes a high degree of agitation in the colony; the disturbed workers, who have first, by some unknown means, acquired the knowledge of this public calamity, soon quit their immediate circle, and, meeting their companions, says Huber, their antennæ are reciprocally crossed, and they slightly strike them.

The communication made by these means is quickly disseminated, and in a few minutes

the whole colony is in a state of agitation and distress. Of the antennæ being employed as instruments of recognition, the same naturalist gives a striking instance, which our limits prohibit from giving in his own words. Suffice it to say, that by means of a wire grating, wide enough only to admit the circulation of air, inserted in the middle of the hive, he separated the queen from half of her subjects and ascertained that neither sight, hearing, nor smell made the near neighborhood of their sovereign known to them, for they proceeded to rear a new queen from the larva of a worker, as if the other were irrevocably lost. But when a grating wide enough to allow the transmission of the antennæ was discovered, all went on as usual, for the bees soon ascertained by these organs the existence of their queen.

Another important use which the Bees make of this organ of touch deserves notice. Let us follow their operations by moonshine, when they keep watch at the opening of the hive to prevent the intrusion of moths then

on the wing. It is curious to observe how artfully the moth knows how to profit to the disadvantage of the Bees, which require much light for seeing objects, and the precautions taken by the latter, in reconnoitering and expelling so dangerous an enemy. Like vigilant sentinels, they patrol around their habitations with their antennæ stretched out straight before them, or turning to the right and left; woe to the moth, if it cannot escape their contact; it tries to glide along between the guards, carefully avoiding their flexible organs, as if aware that its safety depended on its caution.

CHAPTER V.

TASTE.

IN Bees, taste appears, on a slight view, to differ most materially from that sense in man, and because, with all their eager fondness

for the rich nectar of flowers, they are frequently detected lapping the impure fluid from corrupted marshes, it has been hastily concluded, that their sense of taste is very defective. Huber thought it the least perfect of the bee-senses, and instances their gathering honey even from poisonous flowers, and regaling themselves with fetid liquids. Now, with deference to this distinguished observer, it may be permitted, perhaps to defend our favorites from so injurious an imputation. We have *prima facie* evidence of the delicacy of their taste, in their eager activity in collecting their delicious stores of honey, secreted by the most fragrant flowers; and such is their ardor in these operations, that they defy the elements when the honey season is at its height, and, laying aside their usual fears of bad weather, boldly encounter wind and rain to get at their favorite fluid. Huber acknowledges, that when the lime-tree and black grain blossom, they brave the rain, depart before sunrise, and return later than ordinary. But their activity relaxes after the

flowers have faded, and when the enamel adorning the meadows has fallen under the scythe, the Bees remain in their dwelling, however brilliant the sunshine. Wherefore have they not, in this decline of the flowering season, recourse to the foul marsh and slimy pool, which they are charged with frequenting? Simply because the purposes for which they did frequent these unwholesome liquids have already been answered. The truth is, the Bees have recourse in spring, but, generally speaking, in spring only, to dunghills and stagnant marshes, for the sake of the salts with which they are impregnated, and which their instinct teaches them are advantageous to their health, after their long winter confinement. If we place before the Bees a portion of honey, and a portion of liquid drawn from a corrupt source, their choice will completely vindicate the purity of their taste, and their power of discrimination in the selection of their food.

It is not meant to be denied, however, that the sense of taste in Bees is ever at fault.

This would be going in the face of some well authenticated instances of honey being injured, and even rendered dangerous, in consequence of the Bees feeding on noxious plants. Towards the close of the year, when flowers become scarce, and in those parts of the country where alders abound, and where onions and leeks are cultivated on a large scale, and allowed to run to seed, the Bees, from taste, or from necessity, or from anxiety to complete their winter stores, are seen to feed on these plants, which communicate to the honey a very disagreeable flavor. Father Lamberti also assures us, that a shrub of Mingrelia produces a kind of honey which causes very deleterious effects. It is quite possible that the poisonous juices extracted from these plants might be innoxious to the Bees themselves, and thus the correctness of their taste might be so far vindicated. Sir J. E. Smith asserts, that the nectar of plants is not poisonous to Bees, and an instance is given in the American Philosophical Transactions, of a party of young men, who,

induced by the prospect of gain, having removed their hives from Pennsylvania to the Jerseys, where there are vast savannahs, finely painted with the flowers of the *Kalmia angustipolia*, could not use or dispose of their honey, on account of its intoxicating quality; yet the Bees increased prodigiously, an increase only to be explained, says Dr. Bevan, in his *Honey Bee*, by their being well and harmlessly fed. Nor is this defence of the taste of Bees successfully controverted by the following occurrence, stated in Nicholson's *Journal*. A large swarm of Bees having settled (observe, that they had merely alighted upon it, to rest, perhaps, after a long flight,) on a branch of the poison ash, in the county of Westchester, in the province of New-York, was put into a hive and removed to the place where it was to remain. Next morning the Bees were found dead, swelled to double their natural size, and black, except a few, which appeared torpid and feeble, and soon died on exposure to the air. This was at-

tributed to their being poisoned, not by their having fed upon, but by the effluvia of the *Rhus vernix*.

CHAPTER VI.

HEARING.

CONSIDERABLE difference of opinion has prevailed among naturalists, both as to the existence of this sense in Bees, and the situation of the organ. Aristotle was doubtful whether Bees possess this sense. Linnæus and Bonnet denied them this faculty; and Huber seems undecided on the point, while a host of others, among whom are ranked Kirby and Spence, maintain its existence, and place the organ in the antennæ.

We know that Bees dislike noise, for an apiary situated near mills, smithies, or other noisy work-shops, is seldom prosperous. The different modulations of sound, produ-

ced by the wings in flying, seem intended as a means of communication addressed to an organ of hearing, as signals of attack, of recall, of departure, &c. In consequence of a belief in the reality of this sense in Bees, the practice is common of beating sonorous bodies at the moment of swarming, in order to prevent them from communicating with one another, and thus to present an obstacle to their flying away. We know also that many other insects possess this faculty; and, as we observe in the proceedings of Bees, the same effects which, in other insects, unquestionably proceed from the sense of hearing, we regard these effects as presumptive evidence of the former possessing the same faculty.

Huber set out with intimating a doubt of its existence,—possibly, in deference to his friend Bonnett, to whom his letters are addressed, and who was an unbeliever in its reality,—yet, in the end, confesses that he is strongly tempted to believe in it, or at least, to admit a sense in Bees analogous to hearing, observing that certain sounds, as produced

by Bees, apparently serve as a signal to their companions, and are followed by regular consequences, and that, therefore, they may be additional means of communication to those afforded by the antennæ. He mentions particularly a sound emitted by the queen, which produces paralyzing effects on the Bees in certain circumstances. Describing the attempts of a reigning queen to destroy her rivals, while yet in their cells, he tells us, that the Bees on guard pulled and bit her, and drove her away, in these circumstances she emitted the sound alluded to, standing, while doing so, with her thorax against a comb, and her wings crossed on her back, in motion, but without being unfolded or farther opened.

Whatever might be the cause of her assuming this attitude, the Bees were effected by it, all hung down their heads, and remained motionless. On another occasion, after a queen had put her rival to death, she approached a royal cell, and took this moment to utter the sound, and assume that

posture which strikes the Bees motionless. This discovery of Huber has been brought forward on his authority, by naturalists, as a conclusive evidence of the existence of the auditory faculty in Bees. And so it would be, if Huber was not mistaken in his supposed discovery. A voice of sovereignty producing such powerful and instantaneous effects on her subjects, is so remarkable a property of her Bee-majesty, that it would be desirable to have its existence proved beyond a doubt by succeeding experiments. With much confidence in the accuracy of this distinguished naturalist's observations, I entertain some hesitation on the subject of this magical sound. By my observatory hive, I have seen the queen in all the circumstances, and in all the positions observable within a hive, and have seen her combating with a rival queen, and have observed her very frequently in the particular situation described by Huber, when he first heard the commanding voice, endeavoring to tear open the cell of a rival, and angrily repulsed by the workers,

then standing at a little distance on the surface of the comb, with her wings crossed over her back, and in motion, though not fully unfolded, and emitting the clear distinct sound, which is heard in a hive for a day or two before the departure of a second swarm, and certainly I never witnessed any such effect produced on the Bees as Huber speaks of, and which, had it taken place, could not possibly have escaped my observation. On the contrary, the Bees seemed not in the slightest degree affected by her wrath, for she was evidently in a state of great irritation, but continued to guard the cell of the captive queen with a dogged-looking obstinacy, apparently expecting and prepared for another attempt on it by the enraged sovereign. Huber may be in the right, and his general accuracy affords a presumption in his favor; nevertheless, it would be very satisfactory to have his accuracy, in this particular point, confirmed by some other observer. Taking it for granted, that the sense of hearing does exist in Bees, where are we

to look for the situation of the organ. Naturalists are not agreed on this point, but the majority vest it in the antennæ. Kirby and Spence notice the analogy borne by the antennæ to the ears of vertebrated animals, such as their corresponding in number, and standing out of the head, and observe that no other organ has been found which can be supposed to represent the ear. In that case, this appendage of the head of the Bee, must be regarded as a compound organ, exercising the functions of both hearing and touch. It has already been hinted that some observers have regarded it as the organ of vision ; and we shall afterwards find that there are those who look upon it as the organ of smell. In this deficiency of precise knowledge on the subject, we may perhaps rest satisfied with the opinion of Kirby, that, the antennæ, by a peculiar structure, may collect notices from the atmosphere, receive pulses or vibrations, and communicate them to the sensorium, which communication, though not precisely to be called hearing, may answer the same

purpose. The same author gives an anecdote of another insect, which goes to prove that the antennæ are indeed the organs of this sense : "A little moth was reposing on my window ; I made a quiet, not loud, but distinct noise ; the nearest antennæ immediately moved towards me ; I repeated the noise at least a dozen times, and it was followed every time by the same motion of that organ, till at length the insect being alarmed, became agitated and violent in its motions. In this instance it could not be touch, since the antennæ were not applied to a surface, but directed towards the quarter from which the sound came, as if to listen."

CHAPTER VII.

SMELLING.

OF all their senses that of smell in Bees is the most acute. Attracted by the fragrance

of the flowers, we see them winging their eager way to a very considerable distance, in a straight undeviating course, and in the very teeth of a strong wind, in search of those plants which promise an abundant honey-harvest. Very striking proofs of the acuteness of this sense may be observed within the limits of the apiary. Early in spring, when the bee-master begins feeding his colony, he has reason to marvel at the instantaneous notice which this organ gives them of his approach. Arriving amongst his hives, though from the chillness of a spring morning, not a Bee is seen stirring out of doors, he has not time to fill the feeding-troughs from the vessel in his hand, before he is surrounded by hundreds, and in the space of five minutes or less, the float-board of every trough is covered with a dense mass of eager feeders. In feeding a newly-lodged swarm, during unfavorable weather in summer, it is curious to observe, through the glass, the motionless hemispherical mass at the ceiling of the hive, becoming instantane-

ously elongated, and changed into the form of an inverted living pyramid, having its apex resting on the sides of the hive, while a score or two of stragglers, who have in the confusion been separated or have fallen from the mass above, hasten along, snuffing the grateful fragrance, ranging themselves in a line on the edge of the trough, and eagerly plunging their probosces into the liquid. It is to their exquisite sense of smell also, in all likelihood, that we must attribute their capability of distinguishing friend from foe, among their own species. If a stranger Bee by mistake enter a hive, and this sometimes happens, in consequence of some slight alteration in the arrangement of the apiary, his close resemblance to his fellow-insects will not secure him from an immediate attack from all quarters; he is detected by a more subtle sense than vision, and instant flight alone can save him. Huber, to whose researches we are so much indebted in regard to the senses of Bees, has made some very conclusive experiments on that of smell, all

of which I have repeated with precisely the same results. Like his, our first experiment was to ascertain the acuteness of the sense. He concealed a vessel with honey behind the shutters of an open window, near the apiary. In my experiment, a small box, containing a portion of honey mingled with water, and covered with a piece of wire-gauze, was placed at a distance of one hundred yards from the apiary, where it was by no means conspicuous. In a quarter of an hour a Bee alighted on the box, and in a few minutes more, while this Bee was eagerly exploring and striving to gain an entrance, several more joined it. The cover was then raised, and admission given; and after the first visitors had gone off with a belly-full, the feeders increased in the space of an hour to hundreds. In another instance, a neighbor of mine living on the next block from me, bought a hive of honey for his own consumption, and kept it in the back part of his yard, covered up, and they would go and cut out a piece as they wished it for their own use,

and in the spring my Bees got access to it, took all the honey and left them the empty comb. To diversify the trial, Huber procured four small boxes, to the apertures of which, large enough to admit a Bee, he fitted shutters or valves, made of card-paper, which it was necessary should be forced open in order to gain admission. Honey being put into them, they were placed at the distance of two hundred paces from the apiary. In half an hour, Bees were seen arriving, carefully traversing the boxes; they soon discovered the openings, pressed against the valves, and reached the honey. This is a striking instance of the delicacy of smell in these insects, as not only was the honey quite concealed from view, but its odorous effluvia, from its being covered and disguised in the experiment, could not be much diffused. I repeated successfully similar experiments. In fact, after the first trial, I had no doubt of the issue of the second; for if once the sense of smell in the Bees ascertained the existence and situation of the honey, I had seen

enough of their ingenuity in other cases, not to doubt their success in obtaining entrance.

In endeavoring to ascertain the precise situation of the organ, there is considerable difficulty. Huber's experiment to ascertain this point, is full of interest, and we recommend a perusal of the account of it as detailed in his work. He dipped a pencil in oil of turpentine, a substance very disagreeable to insects, and presented it to the thorax, the stigmata, the abdomen, the antennæ, the eyes, and the proboscis, without the Bee betraying the slightest symptom of uneasy feeling. It was otherwise when he held it to the mouth; it started, left the honey by which it had been enticed, and was on the point of taking flight, when the pencil was withdrawn. He next filled the mouth with flour-paste, when the insect seemed to have lost the sense of smell altogether. Honey did not attract it, nor did offensive odors, even the formidable turpentine, annoy it. The organ of smell, therefore, appears to reside in the mouth, or in the parts depending on

it. To those who may wish to repeat this experiment, I would recommend that they previously deprive the Bee under operation of a portion of its sting, which may be easily done, by forcing the insect to extrude it, and then snipping it off, about the middle, with a pair of scissors; the excision will not vitally injure the insect, and will give confidence to the experimenter.

I cannot conclude this disquisition on the sense of smell in Bees, without gratifying my readers by extracting from Dr. Bevan's work, a remarkable instance of its acuteness and delicacy; and which had been communicated to him, by the son of the gentleman who is the subject of it. It is generally believed that Bees have an antipathy to particular individuals, arising, probably, from some peculiar odor about them, which, though not discernable by, or unpleasant to man, may be so to this sensitive insect. Mr. Wildman had for years been a proprietor and admirer of Bees, and would approach them with impunity. He would at any time search for the

queen, and taking hold of her gently, place her on his hand. But he was unfortunately attacked with a violent fever, and long confined by it. On his recovery he attempted to resume his favorite amusement among the Bees, returning to them with all that confidence and pleasure which he had felt on former occasions; when, to his great surprise and disappointment, he discovered that he was no longer in possession of their favor; and that, instead of being received by them as an old friend, he was treated as a trespasser; nor was he ever able after this period to perform any operation with them, or to approach within their precincts, without exciting their anger. Here then it is pretty evident, that some change had taken place in the counsellor's secretions, in consequence of the fever, which, though not noticeable by his friends, was offensive to the Bees.

CHAPTER VIII.

THE INMATES OF A HIVE.

A HIVE consists of the queen or mother-Bee, the workers or neuters, varying in numbers from 10,000 to 20,000, or 30,000, and the males or drones, from 5 to 700, and double that number.

CHAPTER IX.

OF THE QUEEN BEE.

THE queen Bee is easily distinguished from other Bees by the form and size, and her color tends to a deeper yellow. The slowness, or even gravity of her march, her stature, and above all, the various homage paid her by the Bees, characterize her in a distinguished manner. She is larger, longer

at least, and her wings are shorter in proportion to her size, than those of other Bees. The wings of drones and of common working Bees cover their bodies, but those of the queen scarcely reach beyond the middle. Her hinder part tapers more than the corresponding part of other Bees, something in the shape of a sugar loaf, and is admirably adapted for the purpose of being introduced into the cells to deposit her eggs, which she does without being incommoded by her wings, as she no doubt would be were they long in proportion to the length of her body. Considering then the office she has to perform, the shortness of her wings, and the length and tapering of her body are alike conveniences to her, her belly and legs are yellower, and her upper parts darker than those of other Bees. Though furnished with a sting, she very rarely uses it, only at the approach of another queen, and will bear being handled without being provoked. A young queen is smaller than a full grown one. When three or four days old she is quick in her motions;

but when impregnated she becomes heavy. The queen is the parent of the hive, and her sole province and occupation consist in laying eggs, from which originate those prodigious multitudes that people a hive, and emigrate from it in the course of one summer. In the height of the season her fertility is truly astonishing, as she lays from 100 to 200 eggs per day, and even more when the season is particularly warm and genial, though at a gradually diminishing rate, till the approach of cold weather in October.

So early as February, she resumes her labors in the same department, and supplies the great blank made in the population by the numerous casualties that take place between the end of summer and commencement of spring. Her great laying of the eggs of workers, begins generally about the fifth day of her age; and she continues to deposit eggs of the same kind for the succeeding eleven months, after which she commences laying those of males. It is during the depositing of these last, that the Bees are led

by their instinct to lay the foundation of royal cells, in which, if the population be abundant, the queen deposits eggs at intervals of one or two days between each. In the operation of laying, which I have a thousand times witnessed in my Observatory hive, the queen puts her head into a cell, and remains in that position about a second or two, as if to ascertain whether it is in a fit state to receive the deposit. She then withdraws her head, curves her body downwards, inserts her abdomen into the cell, and turns half round on herself. Having kept this position for a few seconds, she withdraws her body, having in the meantime deposited an egg. She thus keeps on laying eggs, day and night; and I have shown her to hundreds of people, laying eggs, something which they never before saw. The egg itself, which is attached to the bottom of the cell by a glutinous matter with which it is imbued, is of a slender oval shape, slightly curved, rather more pointed in the lower end than in the other. She passes on from cell

to cell, furnishing each with the germ of a future inhabitant; and during these proceedings she receives the most marked and affectionate attention from the workers. Wherever she stops, she is seen continually surrounded by a circle of them, from ten to twelve, who caress her fondly with their antennæ, and occasionally supply her with food from their probosces. This appearance has given rise to the notion commonly entertained, and asserted even by some naturalists, that the queen is followed in her progress through the hive by a number of her subjects formed in a circle round her, and these of course have been regarded as the queen's body guards. The truth is, however, that her Bee-majesty has no attendants, but wherever she moves the workers whom she encounters in her progress, instantly and hurriedly clear the way before her, and all turning their heads towards their approaching sovereign, lavish their caresses upon her with much apparent affection, and touch her softly with their antennæ; and these circum-

stances, which may be observed every hour in the day, in a properly constructed glass hive, have given rise to the idea of guards. The moment she has left the circle the Bees who had surrounded her instantly resume their labors, and she passes on, receiving from every group in her way the homage due to a mother and a queen. There is a fact connected with the instinct of the queen in laying her eggs, which deserves particular notice, and which I have not seen stated by any other writer on the subject of Bees. When she has laid a cluster of eggs, to the number of thirty or forty, more or less according to circumstances, on one side of the comb, instead of laying in all the empty cells in the same quarter, she removes to the other side, and lays in the cells which are directly opposite to those which she has just supplied with eggs, and, generally speaking, in none else. This mode of proceeding is of a piece with that wise arrangement which runs through all the operations of the Bees, and is another effect of that remarkable instinct

by which they are guided ; for as they cluster closely in those parts of the comb which are filled with brood, in order to concentrate the heat for their being hatched, the heat will of course penetrate to the other side, and some portion of it would be wasted if the cells on that side were either empty or filled only with honey. But when both sides are filled with brood, and covered with hive Bees, the heat is confined to the spot where it is necessary, and is turned to full account in bringing the young to maturity.

The mutual aversion of queens is a striking feature in the natural history of this insect ; and though not perhaps strictly in place, one extraordinary effect of it may be mentioned here. Their mutual enmity may be truly said to be an inborn disposition with them, for no sooner has the first of the race in a hive about to throw off a second swarm, escaped from her own cradle, than she hurries away in search of those of her rivals, and, as will be afterwards described, exerts herself with the most impetuous eagerness to

destroy them. I have witnessed this interesting exhibition of Bee warfare, as described by Huber : I have seen two queens that happened to emerge from their cells at the same time, and saw them come in contact with each other, when a pitched battle took place, which generally ends in the death of one of the combatants.

CHAPTER X.

OF THE WORKER BEE.

The workers, to the number of 10,000, 20,000, 30,000, and even 40,000, constitute the great mass of the population, and on them devolve the whole labors of the establishment. Theirs is the office of searching for and collecting the precious fluid, which not only furnishes their daily food, as well as that of their young, and the surplus of which is laid up for winter stores, but also the materials from which they rear their beautiful combs. In the little basket-shaped

cavity in their hind legs, they bring home the pollen or farinaceous dust of flowers, kneaded by the help of the morning dew into tiny balls, which form an important ingredient in the nourishment of the brood; and also the propolis or adhesive gum extracted from willows, &c. with which they attach their combs to the upper part and sides of the hive, and stop every crevice that might admit the winter's cold. Exploring a glass hive in a soft spring morning, and following with your eye a Bee loaded with farina, the observer will perceive the little active forager on her arrival in the interior, hurrying over the surface of the comb in search of a proper cell in which to deposit her burden; and having found one, fastening herself by the two fore feet on its superior border, then bending her body a little forward, that her hinder feet may catch hold of the opposite edge of the cell. In this position she is next seen thrusting back her second pair of feet, one on each side, and sweeping with them from top to bottom

along the two hinder legs, where the farina balls are fixed, and by this means detaching them from the hairy linings of the cavities, and depositing them in the cell. To the workers, also, are committed the various offices of guarding the entrance of the hive by night and day, during the honey season, of repulsing marauders, of keeping their abode free from all offensive matters, of renewing the air within by an ingenious mode of ventilation, of replacing a lost queen, and of destroying the drones at the decline of the honey season.

Receiving from nature these weighty charges, they labor assiduously to fulfil them; and, while each member of the community acts by the impulse of its individual instinct, it works less for private than for the general good. These labors appear unceasing; yet do the weary laborers sometimes snatch an interval of repose. During the busy season I have seen hundreds of the workers retiring into the cells, and exhibiting all the marks of profound sleep. This

fact is very easily observable, especially in those cells which are constructed, as sometimes happens, against the glass, and where that substance forms one side of the cell. There they are, the fatigued laborers, stretched at full length, with their heads at the bottom, and every limb apparently in a relaxed state, while the little body is seen heaving gently from the process of respiration. Huber thinks he has ascertained that there are two kinds of workers in a hive, one of which he calls wax workers, and the other nurses. It does not appear, however, that naturalists were acquainted with the different functions, if the difference really does exist, of the two classes. The office of the first class, according to Huber, is not only to collect honey, which both kinds do, but also to elaborate the wax and construct the combs. The particular function of the other, is to take care of the young. They may be distinguished in entering the hive by carefully examining their shape, the wax workers having their bellies somewhat cylindrical, while those of

the nurses retain their ovoidal figure. The anatomical structure of the two is said to be different, and the capacity of stomach not the same; so that the one species is incapable of fulfilling all the functions of the other. Huber has also directed our attention to a class of workers, which he calls black Bees. In every thing they bear a perfect resemblance to their fellow-workers, except in color, which in them is a deep black. He describes them as persecuted by the other workers, and finally expelled the hives or destroyed.

I have noticed them, though rarely, perhaps not more than ten or twelve in a season. The other Bees did not molest them, as far as I observed, nor indeed seem in any way sensible of their presence. It is not improbable that they are merely aged Bees, and that their deeper color arises from the hair or down with which the young are so thickly clothed, being worn off their bodies. In describing the functions of the working Bee, it would be improper to pass over unnoticed

the fact, that it sometimes exercises the functions of a mother. To account for this apparent anomaly, we must remember that it has been ascertained by minutely accurate dissection, that all the workers are females, though of imperfect organization, a fact confirmed by the very circumstance I am now discussing. We must also keep in mind, that the larva of a queen is nourished with food of a different kind from that of common Bees; and this difference, in conjunction with a more roomy cell, has, in the opinion of naturalists, the effect of expanding the ovarium, and qualifying her to become a mother. It is evident, therefore, that, if the larva of a common Bee were fed with the royal jelly, the imperfection in her bodily organs would, as far at least as depended on the nature of the food, be removed, and she would become capable of laying eggs. Now this does occasionally take place; some of the royal food is dropped, probably by accident, into some of the cells adjoining that of the queen, and the Bees therein reared ac-

quire the power of laying eggs. This fact was discovered by the naturalist Riem, and has been confirmed by Huber. There is, however, a very material and hitherto unaccounted for difference between these fertile workers and perfect queens, the former lay the eggs of males only. I would certainly have expected, *a priori*, that a difference between them should exist, because the workers have fed on the royal jelly only for a short time, and because their birth-place is so much smaller. But I cannot easily conceive how these circumstances should be the cause of their laying only male eggs. In truth, it appears to be one of those mysteries in Bee-economy which, with all my researches on the subject, I cannot yet unravel. These fertile workers are never found in any hives but such as have lost their natural queen. The natural term of the worker's existence does not extend, I think, beyond from twelve to eighteen months. But many never reach that period. Showers of rain, violent blasts of wind, sudden changes

of atmosphere, destroy them in hundreds. In the clear cold mornings and evenings of autumn, their eagerness for foraging entices them abroad early and late; when, alighting on the ground, many are chilled and quickly perish; and should they escape the blighting atmosphere of the close of autumn, a bright sunshine in a winter day, when the ground perhaps is covered with snow, brings them abroad in multitudes, and the half of them never return. From these causes, independent of the numbers which fall a prey to enemies, a swarm which, in July amounted to fifteen or twenty thousand, will, by the following February or March, have dwindled to a mere handful. It is otherwise with the queen; going seldom abroad, she is little exposed to accidents. Her natural life is prolonged to several years, though the precise extent has not been accurately ascertained; yet they have been known to live three or four years.

CHAPTER XI.

THE DRONE BEE.

THE drones are larger than the others; their heads are round, eyes full, and their tongues short, they are also much darker and differ in the form of the belly; they have no sting and they make a greater noise in flying than the common Bees. The sole office of the male, or at least the primary one, is to pair with the queen. He is the father of the hive. Indolent and luxurious, he takes no part in the internal operations of the domicil, and never leaves it with a view of sharing in the labors of the field. When he does venture abroad, it is only in the finest weather, and during the warmest part of the day, at which time the young queens are instinctively led to go out in search of the male. The life of the drone is extremely short; the favored lover perishes soon after his union with the female, and thus an-

ticipates, though only by a short period, the destruction which awaits his race. So early as the beginning of August, the Bees, as if wishing to apply the preventive check, to a superabundant idle population, begin to manifest deadly intentions towards them; and the unfortunate victims, as if to derive consolation from one another's society, or perhaps driven together by their irascible superiors, may be seen about that period clustering closely together in some corner of the combs, where they remain without motion, and without once venturing to approach the provision cells.

Thus weakened by hunger and captivity, and disqualified for resistance by the want of a sting, they fall an easy prey to their merciless assailants; and a scene of carnage takes place which it is difficult to describe. The unhappy wretches are seen driven to the bottom of the hive, and pursued with such fury, that, in spite of their strength, which is greatly superior to that of their persecutors, and which enables them to drag two or

three of their assailants along the board, and even to fly off with them, they are unable to avoid the mortal thrust of their formidable stings, and expire instantaneously from the effects of the poison. But death overtakes them in various forms; for their enemies sometimes seize them by the wings, and with their strong mandibles gnaw them at the roots, and disable them from flying. They may then be seen in numbers crawling on the ground, where they perish from the cold, or are trampled under foot, and devoured by birds or frogs. Such as escape for a while, may be seen flying from destruction, lighting on the shrubs and flowers to enjoy a moment's respite from their terrors; or buzzing about from hive to hive, into one of which they no sooner enter, than certain death awaits them. Nay, so bitter is the fury of their tormentors, that, not satisfied with destroying these unhappy beings themselves, they tear from the cells such of the doomed race as are yet in the state of larvæ, and sucking from their bodies, with instinctive economy, the fluids

they contain, cast the lifeless remains out of the hive. There are cases, however, in which this destruction of males does not take place. "In hives that have lost their queen," says Huber, "the males are spared, and, while a savage massacre rages in other hives, they here find an asylum. They are tolerated and fed, and many are seen even in the middle of January. The cause of this may perhaps be looked for in the additional heat which they would generate in winter; or, perhaps, they may be preserved for the purpose of pairing with a new queen.

CHAPTER XII.

IMPREGNATION OF THE QUEEN BEE.

IN looking into a hive in spring or summer, the queen will be seen laying eggs in the cells; in the smaller cells, those of workers, and in the larger, those of males or drones.

These eggs, if examined on the fourth day from their being deposited, will be found hatched, and a small worm produced, which is floating in a whitish liquid, ascertained to be food introduced for the nourishment of the infant brood ; and in due time a perfect Bee emerges from the cell. But how is this living animal generated ? The queen lays the egg, without doubt, and the insect is evolved from it ; but how is the egg fecundated or rendered fertile ? Has the queen had personal union with the male ? No one can speak positively to such a fact ; by what other means, then, is this effect produced ? The impregnation of the Queen Bee is a branch of natural history which has given rise to more discussion, than almost any other fact connected with the nature of the insect. And indeed the difficulty, we might almost say impossibility, of obtaining any thing like ocular evidence on the subject, will readily account for the diversity of opinion that has hitherto prevailed. And we should hope that this difficulty alone, and not

any preconceived theory or unreasonable prejudice, is the cause of that determined pertinacity with which the discoveries and conclusions of Huber, on this subject, are still in some instances rejected. That justly celebrated naturalist instituted a set of experiments on the subject of the queen's impregnation, the result of which leads to the conclusion that it takes place in the air. Though I was once inclined to differ in opinion with Huber on the subject, from what I have seen in my observatory hive, this summer, (1841), I am led to conclude the accuracy of that remark. I had a queen, which left the hive about the third day of her age, as I supposed, for impregnation, but she never returned to the hive again, and so left it without a queen. I had to supply them with a queen from another hive. I condemn no man who differs from me on this nice subject, as I have no direct proof. My great object is not to dispute with the naturalist, the philosopher, or with the apiarian, how the Queen Bee becomes impregnated: be-

cause, be that as it may, it is, no doubt, consistent with the law of nature; it is, no doubt, a part of that all prevailing law, and though hitherto undiscovered, I do cherish strong hopes that the observatory-hive I have constructed, will, on some auspicious future day, disclose such facts as will set the matter to rest for ever.

CHAPTER XIII.

RETARDED IMPREGNATION.

THERE is a fact connected with this part of the natural history of the Mother Bee, which involves great difficulties. The fact itself was discovered by Huber, but its cause he was unable to develop, and no succeeding naturalist has been able to free it from the obscurity in which he has left it; I mean the effects of retarded impregnation. These effects are such as I could hardly credit, were

not the fact confirmed by numerous experiments. If impregnation be delayed longer than twenty days from the queen's birth, the consequence is that none but male eggs are laid, even during the whole of the queen's life. This phenomenon has baffled every attempt to explain its cause. There are mysteries in the operations of nature, both in reference to the rational and irrational creation, which will, probably, for ever remain inscrutable to man. In the natural state of things, that is, when fecundation has not been postponed, the queen lays the eggs of workers in forty-six hours after her union with the male, and continues for the subsequent eleven months to produce these alone; and it is only after this period that a considerable laying of the eggs of drones commences. Huber asserts that before a queen commences her great laying of male eggs, she must be eleven months old. But he acknowledges that a queen, hatched in spring, will perhaps lay fifty or sixty eggs of drones in the whole, during the course of the ensu-

ing summer. I know this to be true, from my own experience, and also, as the usual consequence of this appearance of male eggs, that the Bees commence building royal cells, the queen lays in them, and swarming takes place. Now this partial laying of drones' eggs takes place only in the case of very early swarms, and if the weather be unfavorable, it does not happen even in them.

CHAPTER XIV.

OF THE BROOD.

IN forty-six hours after impregnation, the Queen Bee, as already noticed, begins to lay the eggs of workers, and continues to do so, without intermission, throughout the season, at the rate of between 100 and 200 a day, unless cold weather intervene, when her operations are suspended, as well as the hatching retarded of the eggs already laid.

The fruitfulness of the Mother Bee is indeed astonishing. It has been computed that the numbers produced in a hive by one queen, during the laying season, amount to 100,000, and I am satisfied the computation is correct. In the beginning of the year it is a tolerably good stock hive which possesses a population of 2000 or 3000. Yet that same hive shall, in June, throw off swarms amounting to 40,000 or 50,000; in many cases the first swarm itself, and in some even the cast or second swarm throws off a colony of 10,000 or 12,000, and still, at the end of harvest, this original stock hive shall exhibit a population of 18,000 or 20,000. Add to all this, in some instances, though rare, a first swarm throws off two colonies.

Before depositing her eggs, the queen carefully examines the cell, inserting her head into it and keeping it there for a second or two, and, as already stated, after having laid a few eggs on one side, and with a view probably of economizing heat, supplies the corresponding cells on that side. Her im-

patience or necessity to commence laying is such, that in a newly established hive, eggs will be found before there are three inches square of comb constructed, and even before the cells have attained the full depth; and in a well peopled hive, even during winter, and while the temperature is chilled by the frosts and snows of January, and the bleak winds of the following month, the indefatigable Mother Bee is found busied in depositing eggs.

I have said that the queen begins laying eggs forty-six hours after impregnation. This does not hold true invariably. A sudden change of temperature may prolong the interval to a very considerable extent. Huber had a queen impregnated in October, which, on account of the inclemency of the season, did not begin laying till the following spring. The eggs, when laid, remain fixed on the superior angle of the cell, to which they are attached by a viscous matter covering them, for three days; on the fourth, the shell, or thin enveloping membrane,

bursts, and a small lively worm is deposited at the bottom. The nursing Bees instantly enter upon their vocation, and administer a copious supply of liquid food, of which farina, honey, and probably water, are the ingredients. As the larva increases in growth, the attention of the Bees in nourishing it is augmented and indeed unremitting, for at whatever time we inspect a brood-comb, we shall observe hundreds of nurses with their bodies inserted in the supplying of the wants of the infant progeny. Although in the vermicular state, and consequently without feet, the larvæ are capable of moving in a spiral direction. During the first three days, their motion is so slow as to be scarcely perceptible, and they have been observed to perform two complete revolutions in not less than two hours. The slightest movement of the nurse Bees, approaching to minister to their wants, is sufficient to attract them to their food, which they devour most voraciously, and it is unsparingly lavished upon them. At first the liquor is nearly insipid, but acquires gra-

dually a perceptible flavor of honey, and becomes more and more saccharine and transparent, in proportion as the larva advances in growth. It is indescribable, the care which the workers lavish on these little nurslings, towards whom they seem to cherish the tenderest attachment. A comb filled with brood, and placed in an empty hive, never fails to retain them there, to the utter disregard of the loss of their stores. The tenderest mother could not watch over her children with more affection, nor supply them with nourishment more impartially, or in greater abundance; at the same time it is done without waste, for the quantity is so proportioned to the demand, that none of it remains in the cells where the larvæ undergo their transformation to the nymph state. At the moment of being hatched, the insect presents the appearance of a small straight worm; it quickly grows so as to touch the sides of the cell, when it contracts its body, and coils itself into a semi-circular figure, and continues enlarging its dimensions till the extre-

mities meet, and form a complete ring. In this state it continues, receiving food from its nurses, for five days, when it ceases to eat; its supplies are, of course, cut off, and the Bees proceed to seal up the sell with a waxed cover, of a brownish color, and slightly convex. Thus left to itself, the larva begins spinning around its body, after the manner of the silk-worm, a fine silken film or cocoon, which completely envelops it. The silken thread employed in forming this covering, Kirby and Spence tells us, proceeds from the middle part of the under lip, and is, in fact, composed of two threads, gummed together as they issue from the two adjoining orifices of the spinner. In the formation of its cocoon, the larva occupies thirty-six hours, and in three days after, it is metamorphosed into a nymph or pupa, terms applied to the mummy-like state to which the larva is subjected, previous to its becoming a perfect insect. During this state of concealment, various changes happen to the enclosed insect. The first change in its situation

is its ceasing to continue in that coiled position in which it originally lay at the bottom of the cell, and extending itself along its whole length, with its head in the direction of the mouth of the cell. The head begins to appear from the inert looking mass, having a small protuberance, probably the rudiment of the proboscis; the first lineaments of the feet also appear, though of diminutive size. After the head is formed and the proboscis prolonged, all the other parts display themselves successively, and the worm is changed to the perfect insect, except that its outer covering is yet white and soft, and has not that dark scaly texture which, as a proper coat of defence, it afterwards acquires. By this transformation the larva becomes divested of its cocoon, which is attached so closely to the internal surface of the cell, that it appears to form part of its substance, and adds considerably to its thickness. These linings are sometimes found, to the number of seven or eight, adhering to the sides of the cell, and often have an injurious effect, diminish-

ing, as they do, the cell's capacity, and exciting, by their strong smell, the attacks of moths and other enemies. The number of linings found adhering to a cell, and which may be disjoined by soaking the comb in water, indicates the number of Bees to which it has been the birth-place. The Bee, thus stripped of its silken envelop, and having all its parts unfolded by degrees, and changed, through a succession of colors, from a dull white to black, arrives at the state of a perfect insect on the 20th day, counting from the time the egg is laid. She then eagerly commences the operation of cutting through, with her mandibles, the cover of her cell, and in half an hour succeeds in escaping from her prison. On quitting her cradle, she appears, for a few seconds, drowsy and listless, but soon assumes the agility natural to the race, and on the same day on which she has emerged from her prison, sets out with her seniors to engage in the labors of the field. Some of the ancient bee-masters enlarge on the attention paid by the seniors

to the young worker on emerging from her prison, describing them as licking her body, supplying her with food, and seeming to instruct her in what is necessary to render her a useful member of the community. These descriptions have been repeated by succeeding writers on the subject, and the existence of these amiable traits in the kind nurses of the young is taken for granted, as an indubitable fact in their natural history. I have reason, in consequence of repeated observations, in my observatory hive, to disbelieve the alleged fact, and must, in accordance with the truth, withhold from my favorites the unmerited eulogiums they have received on this head. They are, in fact, in this particular, harsh and unfeeling in the extreme. In hundreds of instances, I have seen and pitied the infant insect, when, after having long struggled to get out of its cradle, it has at last succeeded so far as to extrude the head, and when laboring with the most eager impatience, and on the very point of extricating the shoulders also, which would at once secure

its exit, a dozen or two of workers, in following their avocations, trample without ceremony over the struggling creature, which is then forced, for the safety of its head, to pop quickly down into its cell, and wait till the unfeeling crowd pass on, before it can renew its efforts to escape. Again and again are the same impatient exertions repeated by the same individual, and with similar mortifying interruptions, before it succeeds in obtaining its freedom. Not the slightest attention or sympathy is observable on the part of the workers in these circumstances, nor did I ever, in a single instance, witness the kind parental cares which seem to owe their existence to the fancy of the writers alluded to.

During the larva-stage, as I have shown, the solicitude of the workers about the welfare and nourishment of their infant charge is extreme ; but from the moment they have sealed up the cell, and while the larva is undergoing its transformation, they seem to cease from every thing like individual attention, and though when a brood-comb is med-

dled with their utmost ire is kindled against the invader, as far as concerns the reception of the newly hatched insect, and its introduction to the duties and avocations of the Bee community they appear altogether selfish and indifferent. There is another case in which this indifference appears very striking: a sudden change of weather, about the end of autumn, from a mild temperature to raw frost, has such an immediate effect on the brood, that it is not uncommon to observe a young Bee, which shall have so far succeeded in breaking its prison, as to extricate its head, and nearly its shoulders, yet perishing from the cold in this situation, without the slightest effort on the part of the workers to save the life of a companion whose rearing has already cost them so much labor.

Immediately after the young Bee has issued from the cell, the workers hasten to clean it out, clear away the ragged remains of the cover, fortify it anew with the usual strong bordering of wax, and thus prepare it for the

reception of another egg, or for honey or farina.

I have hitherto confined my observations to the progress of a worker, from the egg to the state of the perfect insect. The same process takes place in the case of the males and of the queen, though with some difference as to the time occupied in the transformation. Like those of the common Bees, the eggs of the males are hatched in three days, the larva state continues six and a half days, and after having formed their cocoons and been metamorphosed into nymphs, they attain to the state of perfect insects on the twenty-fourth day. I may briefly notice here the statement of Huber respecting the order in which the different kinds of eggs are arranged in the ovarium of the queen, and the law which regulates her laying. He says, that nature does not allow the queen the choice of the eggs she is to lay, that, it is ordained she shall, at a certain time of the year, produce those of males, and, at another time, the eggs of workers, an order which cannot be inverted; that the eggs are not indiscri-

minately mixed in the ovaries of the queen, but arranged so that at a particular season she can lay only a certain kind ; that she can lay no male eggs until those of the workers, occupying the first place in the oviducts, are discharged. I do not mean to question this statement, as holding true generally, but I think it made in terms too unqualified, and that there are palpable and frequent exceptions. He has himself acknowledged, elsewhere, that a queen hatched in spring will sometimes lay fifty or sixty eggs of males during the course of the ensuing summer, and I have repeatedly witnessed the fact. Now, this takes place in certain circumstances, and under certain conditions, namely, that the family of the queen so laying shall have been a very early swarm, that it shall abound in population, and that the season shall be genial, and the secretion of honey in the flowers plentiful. In such a favorable juncture of circumstances, it almost invariably happens that the queen lays male eggs, and that, as the natural consequence,

royal cells are built, in which she lays, and, in due time, she leads off a swarm. Now, does not this fact seem to imply that there is no such arbitrary arrangement of the several kinds of eggs as Huber imagines, and if it would be stretching the inference too far to say, that the queen has the power of laying those of males or of workers, as circumstances may require; does it not imply that the statement of Huber may admit of very important and frequent exceptions?

About the twentieth day from the commencement of the laying of male eggs, the Bees begin to lay the foundation of royal cells, and the queen having resumed laying female eggs, deposits them, at intervals of one or two days, in these cells, from which are hatched, in due time, other queens. This regular process is, however, sometimes interrupted:—if the queen be not a fertile one, and the colony is, in consequence, weak in population, if the hive or domicil itself be large in proportion to the number of its inhabitants, or if the temperature of the season

has been such as to interfere with the copious collection of honey or farina, in these circumstances no male eggs will be laid, no royal cells founded, and no swarms will issue. But in favorable circumstances, the laying of royal eggs takes place regularly during the laying of those of males, and swarming is the consequence. The royal cell is an inch in depth, and it has been considered difficult to comprehend how the body of the queen can reach to the bottom, so as to attach the egg to it; but, in fact, the queen lays when the cell is merely founded, and not deeper than that of a common Bee, and it is not until the precious deposit has been made, that the workers lengthen it to the full size. The egg destined to produce a queen, like that which is laid in a drone cell and that of a worker, is three days old before it is hatched. As soon as this takes place, the royal larva becomes an object of devoted attention to the Bees, who watch over and feed it with unremitting attention and care. It is difficult to form an idea of the anxious care

and attention bestowed by the Bees on the royal larva. The comparison of the affection of a mother for an only child can alone furnish any thing like a conception of it. They seem to feel that their own fate is involved in that of their young sovereign. They feed her with a jelly different from that which is destined for the workers and males ; it is more pungent, and moderately acid, and they supply it in such profusion that she is unable to consume it all ; for, after her transformation, some remains of it are found at the bottom of the cell. At the end of the fifth day of the larva state, the royal cell is closed, and the inhabitant begins spinning her cocoon. It is worthy of remark, that this covering is left incomplete, unlike those of the workers and males, which enclose the whole body. This fact beautifully demonstrates the admirable art with which the Author of nature has connected the various characteristics of this interesting tribe of his creatures. And the fact now under consideration is one of no small importance

in Bee economy ; for, were the queen's cocoon completely to envelop her body, her destruction by her rivals would be rendered extremely difficult, the texture of the covering is so close, that the sting would be unable to penetrate it ; or, if the attempt were made, it might be entangled by its barbs, in the meshes of the cocoon, and the struggling female, unable to disengage it, would become the victim of her own fury. In spinning the cocoon, the queen spends only twenty-four hours, she remains in a death-like torpidity between two and three days, is then metamorphosed into a nymph, and, after remaining in that state four days and a half, she comes forth a perfect queen on the sixteenth day. In the case of the workers and males, the transformation is no sooner completed than they are at liberty to abandon the confinement of the cradle, and hasten,—the former, at least, to partake of the labors of the community, and to range the fields and flower gardens in the very plenitude of Bee enjoyment. But the case is different with

the young queens. Like other sovereigns, they pay the tax of their high estate, in having their inclinations put under restraint for the public good. The royal insect is not permitted to leave the cell, and, as generally happens, to lead off a swarm, unless the weather be very favorable. Were she to obtain her liberty, while, at the same time, emigration was prevented by the state of the external atmosphere, or other circumstances, there would be a plurality of queens in the hive, and mortal strife would ensue. The young queen, therefore, is detained a captive, and the workers, piercing a hole in the cover of the cell, insert their probosces, and supply her with food during her captivity.

CHAPTER XV.

ON THE FORMATION OF SWARMS.

THE swarming season is to the amateur in Bee economy, a most interesting period

in the life and operations of these extraordinary insects, and affords, perhaps, fully as much gratification as any other part of their proceedings. By the mere practical Bee-master, who looks almost exclusively to the return of profit arising from their culture, the honey harvest will of course be regarded as the period of most interest. But by the naturalist, the season of swarming, by bringing into view some of the most striking features of their marvellous instincts, and thus affording additional scope for his favorite studies, will ever be hailed with the most intense delight.

I have already observed, that the breeding season commences about the end of January, or early in February, unless the temperature be unusually severe, and continues with constantly increasing progress and activity throughout the summer. The addition thus made to the population is almost incredible. At the beginning of the year a hive which, in the preceding October, contained no less than 12,000, 15,000 or 20,000 inhabitants,

will be reduced below as many hundreds ; and yet by the beginning or middle of June, the numbers, provided the queen be an ordinarily fertile one, and the season not unfavorable, will be augmented to more than the original amount, exclusive of an immense quantity of brood in progress in the combs. It is not surprising, therefore, that about midsummer, or even before it, there seems a want of room in the hive, and a determination on the part of the Bees to desert their crowded habitation, and to seek for a new one elsewhere.

A crowded population may not be the sole cause of this periodical emigration of the Bees, but it seems to be the usual course of nature that it should be the principal cause, and that others which may be alleged are but subservient to it. No royal brood is reared, unless the population fill the hive almost to overflowing. 'This takes place sooner or later, according to the size of the domicil, and hence we find that, generally speaking, small hives swarm sooner than

large ones. The heat in a full hive is excessive, the thermometer often rising above 100 degrees, and may doubtless have its effect in hastening the swarming. But the increased temperature is the consequence of the overgrown population in relation to the size of their dwelling. The uneasiness of the queen is usually stated as one of the causes of swarming, arising from the sight of so many royal cells, each containing, as a sure instinct teaches her, a future rival.

However this may hold true in after swarms, it seems at least doubtful whether it be applicable to the first. In respect to after swarms, the then queen, prompted by jealousy, is desirous to destroy her rivals, and being prevented by the Bees from doing so she becomes agitated and restless, and finally forsakes a hive where she meets with so much to annoy her. But in the case of a first swarm, the queen mother meets with nothing but respect and attention to her wishes from every member of the community. She is their common mother, and is

never opposed by them, and might destroy all the embryo queens without any opposition; and this in fact does sometimes take place, for the old queen destroys the whole of the royal brood. But it is otherwise in ordinary circumstances, and while she is left at perfect liberty to act as she pleases with regard to the unhatched queens, we are led to believe that she is induced to emigrate, not on account of the presence of her embryo rivals, but in obedience to the wise provision of nature for the increase of the species. Whatever may be the real cause, the proceedings of the queen and the workers at the approach of summer evidently show that matters are ripening for some great internal movement.

About the beginning or middle of May, the Bees, as if aware of the necessity, begin to form large cells, in which the queen immediately deposits the eggs of males, and continues to do so for about thirty days; at the same time royal cells are formed, for there appears to be a secret relation between the

production of the eggs of males and the construction of royal cells, and about the twentieth day of her laying this species of eggs, the queen discovering the royal cells, deposits an egg in one of them, and at intervals of a day between each, in all the other cells of this description. The Bees know to close them at the time when the larvæ are ready to be transformed into nymphs, and as they in part close all the royal cells at different periods, it is evident that the inclosed larvæ are not all of an equal age. The laying of drone eggs having terminated, the queen, previously large and unwieldy, becomes slender in her figure and more able to fly, and begins to exhibit signs of agitation. She traverses the hive impatiently, abandoning the slow and stately step which was her wont, and in the course of her impetuous progress over combs, she communicates her agitation to the workers, who crowd around her and evidently share in her impatience. A loud confused noise is heard throughout the hive, and hardly any of the workers are

observed going abroad to forage, numbers are whirling about in an unsettled manner in front of the hive, and the moment is come to a considerable portion of the family, for bidding adieu to their ancient abode. All at once the noise in the interior ceases, and the whole of the Bees about the doors re-enter, while those returning loaded from the fields, instead of hurrying in as usual, hover on the wing, as if in eager expectation. In a second or two, some workers present themselves again at the door, turn round, re-enter, and return instantaneously in additional numbers, smartly vibrating their wings, as if sounding the march, and at this signal the whole swarm rushes to the entrance in an overwhelming crowd, streaming forth with astonishing rapidity, and filling the air in an instant, like a dark cloud overhanging their late habitation. There they hover for a moment, reeling backwards and forwards, while some of the body search in the vicinity for a tree or bush which may serve as a rallying point for the emigrants. To this they repair

by degrees, and provided their queen has alighted there, all, or at least the greater part, crowd around, and form a dense group, sometimes round like a ball, sometimes clustered like a bunch of grapes, according to the nature of the resting-place they have fixed on.

The queen is not always foremost; it is frequently, or rather generally, not till after the departure of a considerable number of workers that she makes her appearance, and when she does come, it is with a timid irresolute air, as if she were borne along almost against her will, by the torrent that streams out of the hive, for she often turns on the threshold, as if about to re-enter, and in fact frequently does so, but cannot long resist the opposing crowd. The first swarm is invariably led off by the old queen. This I have ascertained by actual observation. The queen leading off a first swarm in one year, has been marked, and has been found at the head of a first swarm in the following year. I saw a swarm that left the hive with the

old queen, and left the young queen in the cell, which came out the next day and took possession of the old hive. This experiment has been so often repeated, and with results so uniform, as to put the fact beyond all doubt. Besides, in examining those hives in which first swarms have been placed, eggs will be found in the cells on the second day, which could not have been the case had the leader been a virgin queen. The reason for the departure of the old queen with the first swarm, is to be found in the fact, that a plurality of queens cannot exist in a hive. Were no swarm to depart, therefore, until a young queen could put herself at the head of it, this plurality must exist for a time, and the danger arises of a combat between the two sovereigns, and the death of one, at least, and probably of the younger and weaker, would be the consequence. By this means swarming would be prevented altogether. A swarm, especially a first one, never departs but in fine weather, and at the warmest time of the day. The passing of a

cloud over the face of the sun, causing a sudden diminution of the light, is sufficient to stop the emigration for a time, although all is in perfect readiness.

The same effect is produced if, at the time of rushing out, there is a sudden change of weather,—a shower of rain however slight, or a gust of wind, will restore quiet instantaneously. No sooner does the wind lull, and the sun shine out, though only for a second or two, than all the symptoms of restlessness and agitation are renewed, and the impatient emigrants rush out in myriads. If suffered to remain any considerable time on the spot where they have alighted in swarming, the bees are apt to rise again and take a new flight. But their flight now has a different aspect from what it had on first leaving the hive. They do not now hover round the apiary, wheeling about in many circles, and in a kind of regular confusion, but dart away in a condensed body, and with a rapid wing, with a shrill whizzing sound, and almost always in a straight line, as if they had

some particular selected spot in view. It is supposed, indeed, and on feasible grounds, that in every case the Bees, previous to swarming, have fixed on a place of abode, that they alight in the first instance on a bush or tree, merely as a general rendezvous before proceeding to their final destination, and that some days previously they send out some of their number in the character of scouts to look out for a suitable habitation. Whether this be the fact or not, is a question which has given rise to considerable discussion, and a host of apiarians have taken opposite sides on the subject. As far as my experience goes, it is in favor of the scout system. At the approach of the swarming season, the Bee-owner should have empty hives in readiness and in their places in the apiary, for the reception of swarms. When a swarm has come forth and has alighted, cut off the limb; if convenient, have your hive in readiness on the table, with the screen bottom out, and lay the limb on the table, and start the Bees with a quill; in the

space of five minutes the Bees will be all in the hive, then set your hive in the apiary where it belongs.

CHAPTER XVI.

SECOND SWARMS.

AFTER the departure of the first swarm, with the old queen at its head, the community is for a time, generally, without a queen. There is brood in the royal cells, but none come to maturity, and it is not till the first to the fifth, and sometimes to the seventh day, in ordinary cases, that the senior of the young princesses is hatched, and takes her place as queen regnant. Her first step is to hasten to the other royal cells, and endeavor to destroy her rivals. In these attempts, with which she is incessantly occupied for several days, she is strongly opposed by the workers, to whom, so long as she remains a virgin, she

is an object of indifference. At every repulse by the workers, she utters the shrill monotonous sound which is called piping, and which is heard for two or three days previous to the departure of a second swarm, while the younger queens in confinement respond, sometimes two or three of them at the same time, in a voice sounding hoarse out of their prison. Irritated by such opposition, and annoyed at the sight of so many royal cells, in every quarter, the young queen becomes extremely agitated, and at last rushes, together with the Bees to whom she has imparted her agitation, through the outlets of the hive, and thus form a second swarm.

Circumstances sometimes occur to prevent the departure of a second swarm. If the young queen, as soon as hatched, set out in search of the males, and is impregnated, no farther emigration takes place; because, being now to become a mother, the character to which alone the Bees render their homage, she enters into the full possession of her rights, and is allowed to attack and destroy

all the unhatched royal brood. And farther swarming is equally at an end, when, after the departure of the first colony, the remaining population is too small to keep up a vigilant guard over the royal cells. In that case, as if aware of the impossibility of a second emigration, the Bees abandon the watch, and the young queens leaving their cells, engage in mutual combat till all are destroyed except one, who reigns undisputed sovereign. But in ordinary circumstances, the agitation of the queen, abundance of brood, a favorable season, and perhaps other causes unknown to us, all lead to farther emigration, and in a populous hive this may take place three, and even four times. The interval between the first and second swarm is from eight to twelve days, it is of a shorter duration between the second and third, and still less between the third and fourth; in fact, when a fourth does take place it is almost always on the day following the departure of the third. It may appear surprising that a hive can swarm so often, without being much weakened. The

first swarm is frequently so large that the hive seems altogether deserted ; yet, in eight or ten days afterwards, the population is in such abundance as to be able to send forth another colony. But we must remember that swarms depart only during the warmest part of the day, when a full third of the workers are busily engaged in the fields, these, returning home, resume their labors, and carry on the necessary operations of the hive. Besides, the queen has left an immense quantity of brood of all ages, which is soon hatched, and which renders the population as great after swarming as before. Thus the hive is perfectly capable of affording a second colony without being too much impoverished. The third and fourth swarms weaken it more sensibly, but the inhabitants always remain in sufficient numbers to preserve the course of their labors uninterrupted, and the losses are soon replaced by the great fecundity of the queen. When the swarming is over in any particular hive, the new queen, on the departure or death of the

rest, and the restoration of the ordinary tranquillity of the community, goes abroad on the following day, generally the fifth of her existence, to meet the males, and is impregnated. Forty-six hours afterwards, she commences laying the eggs of workers, and continues to do so for the eleven succeeding months. This does not, however, hold strictly true in every case, for it sometimes happens, if the season be favorable, that the swarm led off by the old queen, produces, in about a month afterwards, a new colony, which is also by the same female. Before leaving the old hive, she had terminated the great laying of drone eggs, and thus became able to fly, from her greater lightness, and to set out to found a new colony. In this she recommences the laying of eggs of workers, and continues to do so for ten or twelve days, after which she deposits a few drone eggs in cells which the Bees, as if aware that she would require them, have already prepared for their reception. These male eggs, though few, are enough to encourage the Bees to

construct royal cells; and if, in these circumstances, the weather be favorable, a swarm may be formed, and the same queen depart at its head. Nor is this variation in the swarming operations restricted to the instance of the old queen, I have known two or three instances in which a young queen, that is a queen of the current year, after leading off as in ordinary circumstances, has also led off an after swarm from her new habitation. This fact, which it must be acknowledged occurs very seldom, is at variance with the doctrine of Huber, that the young queen lays the eggs of workers only for eleven months successively. He admits, though not very explicitly, that a queen hatched in spring may lay fifty or sixty drone eggs during the course of the ensuing summer; but he refers to the swarm led forth by the old queen, exclusively, when he speaks of its producing a new colony in the same season, in the course of a month after its first departure. With respect to the eleven months, it certainly consists with my own

experience, the time occupied by the queen in laying the eggs of workers, before she begins those of drones, and, of course, those that shall produce queens and their accompanying swarms, varies according to the temperature, and especially to the abundance of food. A swarm, for example, that came off at the end of June, sometimes throws off a swarm about the middle of the following May, which is little more than ten months of an interval, and on the other hand, it sometimes happens that a hive which has swarmed at the middle of May, does not throw off another till the end of June, in the following year, which is above thirteen months.

CHAPTER XVII.

ON ARTIFICIAL SWARMS.

ARTIFICIAL swarming is not generally practised in this country, owing probably to

the want of sufficient practical skill, in most of those who apply themselves to Bee husbandry. In many cases, however, it might be had recourse to with great advantage, and in some it is indispensable, if it is desired to reap the full benefit of the stock. It saves the watching necessary in the case of natural swarms, and if conducted on right principles, renders the artificial colony quite independent of the casualties to which natural swarms are liable. Moreover, it secures the multiplication of swarms in cases where, if left to the natural process, there would be none. Should a continued tract of bad weather take place about the usual period of swarming, the old queen would have time and opportunity to destroy all the royal progeny, for the Bees never oppose the queen mother in such cases, and thereby entirely frustrate the hope of multiplication by natural swarms. To avoid this evil we must have recourse to artificial swarming. The general period proper for the operation is about eight or ten days previous to the time when

natural swarms might be looked for. At that time it is likely royal brood will be found in the combs, or at all events, abundance of eggs and larvæ of workers, from which to rear an artificial queen, and the males are also at this time numerous, a state of things indispensable to the success of artificial swarming. The mode of operation is various. With common hives the process is somewhat difficult, and not always successful. The following experiments, however, will show that it is not impracticable. From the first to the third week in June, my hives had thrown their top or prime swarms ; but instead of sending off their seconds, or casts, ten or twelve days thereafter, as is generally the case, six of them had not swarmed nearly three weeks beyond that period. This was, in all likelihood, owing to an unfavorable change of weather, which, by delaying the swarming, had furnished the reigning queen with an opportunity of putting to death her intended successors. In this state of things, from the crowded condition of the

hives, a mass of Bees, as large as a man's head, hung from the alighting board of each, and were clustered on the outside of the hives, a grievous sight to the apiarian, as these outliers are quite idle. I resolved, therefore, to try artificial swarming with these hives. Availing myself of the discoveries of Schirach and Huber, I cut out of another hive a piece of comb, containing eggs and larvæ of the proper age, and fixed it in one of my principle hives; I then removed one of the hives which had an outlying, or rather outhanging mass attached to its alighting board, instantly clapping down in its place on the same board the already prepared hive, and, with the help of a hot sun, forcing the others to enter. They made a tremendous noise, and seemed much disconcerted at finding, instead of the rich combs they had hitherto been familiar with, nothing but an empty hive. This agitation was kept up all the day by the continued arrival of those Bees which had been abroad when the substitution took place, and who added greatly

to the population. At noon the next day I inspected the new establishment, and found, to my great satisfaction, that the experiment had completely succeeded. The foundations of six royal cells had been laid in the small piece of brood comb I had given them. In due time the queen was hatched, the hive prospered, and at the end of the season, the hive was as good as any of my natural swarms. I may observe, that though it was one of my principle hives I used on this occasion, it would have succeeded equally as well with any other hive; the construction of the hive had no influence on the experiment farther than that it rendered it easier to fasten the piece of brood comb in.

Another experiment I tried on forming artificial swarms, was to drive about two thirds of the Bees out of their old hive with their queen, and put them into an empty hive. I immediately replaced the old hive on its former station, and removed the new one containing the queen, to a little distance. As the former had plenty of eggs and young

brood, they were at no loss to procure another queen, while the other, having a queen, proceeded to work in all respects as a natural swarm. With such a hive as my own, or any other square-shaped hive, that opens in two parts, vertically, the operation is very simple, more satisfactory, and less dependant on contingencies. Let a hive be prepared of precisely the same dimensions as the one to be operated on, and of the same construction, namely, opening vertically in two halves. Early in the morning, or in the evening, when the Bees are all at home, let the hive be gently separated. The Bees, always most irritable when idle, will dart out in no placid humor, and must therefore be kept from annoying the operator, by the use of a gauze veil tied around the hat, and buttoned under the coat, with a pair of woollen gloves on the hands. Apply to each full half an empty one, carefully fastening them together by hooks and eyes previously arranged. We have thus two hives, each half full of Bees, brood, and honey. One of them

will possess the queen, and the other will have royal brood, or at all events, eggs and larvæ of all ages wherewith to originate a queen. As soon as they have recovered from the panic caused by the operation, and have all retired into the interior, let both doors be closed, that there may be no communication between the two divided communities. Two or three hours afterwards, listen attentively to each, and it will be readily ascertained, from the quiet state of the one, and the loud, disorderly buzzing of the other, that the queen is present with the former, and that the other is distressed at the discovery of their loss. Carry off the one with the queen, leaving the other in the original station. If this last had no royal brood at the time of the separation, it will, within twenty-four hours, have set about forming an artificial queen, and the operation is finished.

CHAPTER XVIII.

ON THE CONVERSION OF THE LARVA OF
A WORKER INTO A QUEEN.

BEES, when deprived of their queen, are endowed by nature with the power of remedying this calamity, by converting a worker larva into a royal one, and by means of a cell of a larger size, and of a peculiar kind of nourishment, of producing a female that shall be, to all intents and purposes, a queen or mother Bee, capable of perpetuating her kind. The discovery of this singular fact is generally attributed to Schirach, and, probably, with justice; for, although the practice of making artificial swarms, which can only be effected by causing the production of artificial queens, the manner in which Schirach made the discovery is interesting.

Having used a great quantity of smoke in some of his operations, the Bees were so annoyed by it that numbers of them left the

hive, and among them the queen. Knowing the consequences of her loss, he sought for her diligently, but in vain. Next morning he observed a cluster of Bees about the size of an apple on the prop of the hive whose queen had fled ; here he discovered a queen, and, having carried her to the entrance of the hive which had lost its own, she was immediately surrounded by the Bees, and treated in such a manner as plainly announced that she was their queen. "What was my astonishment," he proceeds, "when wishing to introduce her among the combs, I saw the Bees remaining had already planned and almost finished three royal cells. Struck with the activity and sagacity of these creatures to save themselves from impending destruction, I was filled with admiration, and adored the infinite goodness of God in the care taken to perpetuate his works. Having carried away two of the cells, to ascertain whether the Bees would continue their operations, I beheld, next morning, with the utmost surprise, that they had removed all the

food from around the third worm left behind, on purpose to prevent its conversion to a queen." The fact of this power possessed by the Bees is so extraordinary, that it was at first called in question by several eminent naturalists, among others, by the justly celebrated Bonnett. This naturalist was at last, however, convinced of its reality by experiments instituted by himself, and satisfied that all the working Bees are females of imperfect organization, expressed his opinion that the evolution of the germ is affected by the action of the prolific matter as a stimulant, as a substantial nutriment suitable for that purpose, and he supposes that a certain quality of food, administered more copiously than in ordinary cases, may unfold those organs in the larvæ of Bees that never would have appeared without it.

He conceived also that a habitation like a queen cell, considerably more spacious and differently placed, is absolutely necessary to the complete development of organs which the new nutriment may cause to grow in all

directions. It furnishes a surprising evidence of the slow degrees by which scientific facts make their way, if not essential to general utility, when we consider that to this day, the knowledge of this singularity in the natural history of this insect, is confined almost exclusively to apiarians, and even rejected by some of them. It has however been confirmed by so many experiments instituted by many different individuals, that no unprejudiced mind can withhold its assent from its truth. In the case of the Bee, the egg of a worker placed in a royal cell, only produces an insect which has its powers more fully developed in proportion to the ampler space which it occupies, but it acquires no new powers.

The germ of the ovary existed originally in the common Bee as well as in the mother Bee, but the confined limits of its cell, and the want of the peculiar food provided for the royal race prevented its development. The proceedings of the Bees in order to supply the loss of their queen, are extremely in-

teresting. In about twenty-four hours they are aware of the misfortune that has befallen them, and without loss of time they set about repairing the disaster. They fix upon a worm not more than three days old, demolish the three contiguous cells, and raise around it a regular cylindrical inclosure. At the end of three days the workers change the direction of the cell, which has hitherto been horizontal, into a perpendicular position, working downwards about one inch in length and half an inch in thickness. In addition to this conclusive experiment, I shall take the liberty of detailing some of my own on the same subject, which were made some years ago, and which I have repeated almost every year since with the same success. I give experiments, not from any idea that those of Shirach and Huber require confirmation, or that my own are of importance enough to supply any such supposed deficiency, but on the obvious principle that the more numerous the experiments, and the greater the diversity of experimenters, the

more irrefragable is the alleged fact established, if the result be uniformly the same.

Of the experiment I am now about to detail, the sole object was to prove the existence of the power inherent in the Bees of rearing an artificial queen, when deprived by any accident of their original mother. This, indeed, has been proved, but only incidentally; and I was anxious, by an experiment instituted exclusively for that object, and conducted with minute and scrupulous accuracy, to put the matter out of all doubt in my own mind at least. In June my Observatory hive was full of Bees, brood and honey, the queen was very fertile and laying at the rate of about 100 eggs a day. I opened the hive and carried her off. For about five hours the Bees continued their labors as earnestly and contentedly as if she were still with them. At the end of that time they became aware of their loss, and all was instantly agitation and tumult. The Bees hurried backwards and forwards over the comb with a loud noise, rushed in crowds to the door

and out of the hive, as if going to swarm, and in short, exhibited all the symptoms of bereavement and despair. Night coming on they all went into their hive, and peace and tranquillity appeared to exist amongst them. Next morning, I observed they had laid the foundations of seven royal cells, having demolished the three cells contiguous to each of those containing eggs or worms, which suited their purpose, and by the next morning, there were visible the rudiments of five more royal cells, all in quarters of the comb where before were nothing but eggs and common larvæ of one or two days old. The Bees paid all attention to these royal cells, and they advanced very rapidly. On the seventh day the seven first were sealed, and on the following day the other five were sealed. On the morning of the fourteenth day from the removal of the old queen, I had seven emerged from their cells, strong and active, and exactly resembling those produced in the natural way; and on the next morning I had the other five come forth,

strong and active. I had to watch the hive with all diligence, and open the door and take out the queens as fast as they emerged from their cells, and kept them for the purpose of making artificial swarms—some of them escaped my notice, and I found them lifeless on the ground in front of the hive.

I observed two circumstances respecting these artificial queens, which may be noticed here, though rather, perhaps, out of place, one of them agreeing perfectly with the experience of Huber, while the other is at variance with it. While the surviving queen remained a virgin, not the slightest mark of attention or respect was shown to her by the Bees. No one gave her food,—she was obliged as often as she required it, to help herself, and in crossing to the honey cells for that purpose, she had to scramble, often with great difficulty, over crowds, not an individual would get out of her way, or seemed to care whether she fed or starved. But no sooner did she become a mother than the scene was changed indeed, and all vied in

testifying their affection and regard; one after another presented her proboscis with food, and at every step of her progress, a circle was formed around her by her admiring subjects. The other circumstance alluded to, which varies from the experience of Huber, respects the vigilance of the workers in such cases, and the sound emitted by the queens. He says, that the workers form no guard around the cells of artificial queens, and that these last are perfectly mute; and the naturalist makes some remarks by way of accounting for it. The above experiment is completely in contradiction to this. The cell of the younger queens was most strictly guarded, and both emitted the sounds alluded to, perhaps once every minute, for several hours together. To these experiments I have only to add farther, that, as already stated, I have very frequently repeated the same operation, and always with success; and that in the summer of 1841, I removed the reigning queen of the same Observatory hive three times successively, supposing each queen to

remain just long enough to lay a score or two of eggs before her removal, and each time the workers laid the foundations of five or six royal cells, and brought them to maturity. Within the space of a few weeks I saw the foundations laid of eighteen or twenty royal cells, and at the last removal there were visible several queens at the same time, and I had the good fortune to witness a regular combat between two of them.

From all these experiments, it seems now a fact established beyond all doubt, that Bees can at all times procure a queen for themselves, provided they have a comb containing larvæ not more than three days old, in the common cells, and nothing but certain important conditions, such as a particular kind of food and more spacious lodgment, are requisite for the conversion of common larvæ into queens. At the same time, it ought to be candidly confessed, that while the fact itself seems now completely established, there are circumstances connected with it which I am unable satisfactorily to

explain. That a more abundant supply of food, and of a more stimulant quality, administered in a cell of larger dimensions, should give full development to organs which, by the ordinary treatment, would have remained but partially expanded, I can readily comprehend, but that such extra supplies of food and space should effect an absolute change in the anatomical structure and instinctive propensities, should produce a more slender proboscis, deprive the transformed insect of the downy brushes at the joints of her limbs, and of the basket-shaped cavities in the posterior pair, for retaining the pellets of farina; and, above all, should effect so great an alteration in her instincts, rendering them in numerous particulars entirely different from those of the worker class, for which she was originally destined—these are circumstances which, notwithstanding all my researches, are still involved in mysterious obscurity, and furnishes ample scope for future investigation.

CHAPTER XIX.

ON THE CONSTRUCTION OF THE HIVE.

HIVES are found of almost all shapes and sizes, and of various materials, circumstances influenced sometimes by convenience, but oftener by the taste and fancy of the owners. In France, particularly where the culture of the Bee has been much attended to, the variety of hives is very great; but with few exceptions, they appear to be remarkably deficient in simplicity. This is an important point to be attended to, both as regards the accommodation of the Bees, and the convenience of the Bee master. As far as respects the mere collecting and storing of the honey, the kind of hive is but of secondary importance. If the season be propitious, and the country rich in flowers, the industrious collectors will cheerfully deposit the fruit of their labors in any moderate sized receptacle that appears to afford security and shelter.

It is the interest of the owner, however, to ascertain what material and construction will answer best for sustaining an equable temperature during the heats of summer, and most effectually secure the comfort of the inmates during the severity of winter. And besides these indispensable requisites, there are other considerations to be attended to in the structure of hives, which, to the naturalist and amateur are matters of no little moment. It would far exceed my prescribed limits to attempt a description of the multitude of hives that the ingenuity of one class of Bee masters has invented, and another has improved upon;—I shall therefore notice the one I have in general use, which from its great utility, deserves to be better known.

A Bee hive should be made of one inch and a quarter plank, good seasoned stuff, free from shakes and cracks, and made in a workman-like manner, it should be planed smooth, inside and out, and painted outside, with any color fancy may dictate. Townley's Patent Premium Self Protecting Hive is generally

preferred above all others, for parlor hives, they are easy to manage, and the perfect simplicity of its construction, and the happy effects produced by the wire screen bottom in ventilating the hive, and in keeping out the Bee-moth, there should be a ventilation near the top of the hive, of the lower apartment, to let off the vapor which frequently causes the death of the Bees in the winter by freezing. This hive is made with glass doors, so that you can open it with pleasure, and ascertain the progress of the Bees, and also the very convenient manner in which the surplus honey may be taken from the top of the hive, by the means of boxes and sliders, without being exposed to the danger of a single sting, render it highly desirable by every apiarian acquainted with it. The top of the hive has twelve communications with the boxes, and the boxes have glass sides and ends for ascertaining when the boxes are full, and for taking the surplus honey, without destroying a single Bee, except by accident. The hive should hang in a frame

about two feet six inches from the ground with posts for the frame to rest upon, and also to brace the posts. Many have said much about the proper size of a hive. My Self Protecting Premium Hive, is of sufficient size for ordinary purposes. The body of the hive contains about 35 pounds of honey, and the boxes about 24 pounds. I had one hive that made me 40 pounds of honey in the boxes, in 28 days, in the house 72 Spring Street, in the year 1840, about the center of the city of New-York. The hive contains a sufficient quantity to supply the largest swarms. In large hives, Bees seldom swarm, and if at all, generally very late, rendering the swarm but of little use. Some are in favor of very large hives, in order to prevent swarming, but such persons have but little experience as apiarians. Some may keep Bees merely out of curiosity but generally the principle object is profit. If, in the cultivation of Bees, profit is thought of, they should be suffered to swarm at least once in each season, and be furnished with

suitable sized hives for the purpose. And if they do not swarm I divide them and make them swarm. And I very often have second swarms and I am very glad to have them do so. Second swarms if obtained in June, although small at first, soon increase in numbers, fill their hive, and make as good stock hives for wintering as first swarms. Let us suppose a swarm of Bees to be put into a hive sufficiently large to prevent them from swarming. And at the end of six years, allowing the swarm to yield twenty-five pounds of surplus honey each year, which is a low estimate, we have 150 pounds of honey, and one swarm. The honey is worth two shillings a pound, and the swarm Five Dollars, making \$42 50.

Now let us begin with one swarm, and allow the progressive increase to be one swarm from each of those which have become one year old. At the end of six years you have 64 hives. From each hive with boxes might have been taken the moderate quantity of 25 pounds of honey annually.

At the close of six years the aggregate amount would be 1575 pounds of honey, leaving a balance of 63 swarms and 1425 pounds of honey. The balance in cash would be \$546 25.

CHAPTER XX.

OBSERVATORY HIVE.

My observatory hive possesses in my estimation more valuable properties, taken as a whole, than any other that I am acquainted with. It has all the advantages of a common hive, as to capacity, cleanliness, and security against vermin, while at the same time, it enables the cultivator to ascertain at all times the state of his colony, nay, of every individual cell, the progress of the brood, the quantity of provision, the existence and number of royal cells, and the probable period of swarming. It affords every facility,

too, for making artificial swarms, the queen may be followed in all her movements, and even in her laying. It is easy to open the hive and lay hold of her at any time. The whole of this observatory hive is made to turn round on the shoulder of an upright shaft, through which shaft the passage for the Bees must of necessity be made, and which does not admitt of a bore of above an inch in diameter. As, however, this narrow perpendicular passage is of no great length, it need not be more than three inches, many thousands of Bees will, in the course of a few minutes, if necessary, make their egress and regress through it without incommoding one another.

This observatory hive consists of four frames, each frame contains two lights of glass, one on each side, to open at pleasure ; each frame is twelve inches in height and ten in width, and I can open any particular leaf without meddling with the rest. It is also well adapted for artificial swarming. The Bee-master has the whole interior com-

pletely under his eyes and at his disposal, and can choose what combs best suit his purpose for making artificial swarms. . This hive presents great facilities for making experiments, and for observing the proceedings of the Bees, which being prevented from constructing more than one comb, cannot conceal any part of their operations as in other hives. The panes in this hive being made to open is indispensable for experimental operations, such as seizing the queen, cutting out brood comb, &c. The whole turns on an upright shaft, and when the observer is satisfied with inspecting one side of the comb, he may wheel the hive round and examine the other, without changing his station. By this mode of proceeding he may contemplate his favorites at his leisure, without disturbing them, and without the slightest danger of being annoyed by them ; for it is true that they become so much accustomed to the opening of the shutters, that the admission of the light ceases to disturb them. In short, all the experiments that have ever

been made may be verified by means of this hive, the result found, and new experiments tried.

The body of the hive is protected by a sloping roof, and has three shutters to open at pleasure, and the entrance for the Bees into this hive is made through the thickness of the floor board. I will only add that the appearance of the Bees in this hive is beautiful, and excites admiration and surprise, nay, is capable of enlivening the drooping spirit of the most desponding apiarian, for who can view the queen of the hive constantly laying her eggs, and, by so doing, constantly propagating her species and her thousands of subjects, whose indefatigable labor in all its parts is so conspicuous, without experiencing sensations of the purest pleasure, nay, more, of gratitude to God for his goodness to man.

CHAPTER XXI.

BEE FEEDING.

NEGLECTED generally, as is the management of Bees by their possessors, there is no part of it less attended to, when performed at all, than that of feeding. The Bee-master commonly takes up, as he terms it, his best hives for the sake of the treasures they contain, or are supposed to contain. This is destroying Bees because they are rich. He also takes up the lightest and poorest, (of course, the late swarms and those that are the least likely to live through the winter,) because if he get from one of these but two or three pounds of honey, though he seldom gets so much, and a few ounces of wax, he thinks that that is all clear gain, and if he get neither honey nor wax, he at any rate gets rid of the expense and trouble of feeding his good-for-nothing swarms, which in his opinion, however fed, would never come to

any good. A pennyworth of brimstone will do the job at once, and is more easily paid for than a pound of honey, and after that another and perhaps another. Such is the reasoning, and calculations, and cruel practice of the generality of Bee keepers. Such is the destruction annually dealt out to hundreds of poor swarms, and thousands and millions of poor Bees. I do from my heart pity and deplore the untimely fate of these suffocated, innocent, valuable insects. To destroy Bees because they are rich is a barbarous practice, and ought by all means to be discountenanced and discontinued; to destroy Bees because they are poor and may need support, is cruel, inhuman, and shocking, however little may be thought of it by those who still adhere to this practice. A person may as well kill a favorite horse for his skin, as to destroy a swarm of Bees for their honey. This terrible havoc among poor stocks and late swarms might be prevented, if they who happen to have them would so far improve themselves in the

practical management of an apiary, as to be able to take such Bees out of the hives containing them, and to join them to their richer stock hives, in the latter end of August, or any time in September. This is by far the best plan that can be adopted with poor hives, and there really is no difficulty in the operation; it strengthens the population of the rich stocks, and causes them to swarm early in the ensuing spring; it preserves the Bees, which is of itself, independently of the advantages accruing from it afterwards, a consideration that never should be lost sight of, and in most cases it entirely does away with the necessity of feeding. I confess I should rejoice greatly, and flatter myself that every friend of humanity would rejoice with me, to see this mode of disposing of weak hives universally adopted. Notwithstanding, under certain circumstances, it will always be necessary and judicious in Bee-masters, to have recourse to feeding. If, for instance, after an early swarm is put into a hive, two or three or more cold, ungenial days should

follow, and more particularly if those days should happen to be rainy also, by feeding such a swarm you will assist your impoverished laborers, not only with necessary food, but with materials and treasure which, unfortunately for them, they cannot at such an unfavorable juncture get abroad to collect elsewhere.

Different apiarians have adopted and recommended different ways of feeding Bees, none of which, in my opinion, possess any great merit. In order, therefore, to improve this part of Bee management, my endeavors have been directed to the contrivance and construction of a feeding department, which I put on the top of my hive in so convenient a manner, that I can feed my Bees, at any time when feeding is required, without being molested by a single Bee, in spring, in autumn, or in winter, without disturbing the position of the hive, and without changing its interior temperature, which temperature cannot be kept equable and comfortable, when a hive is frequently lifted up from its

stand, and its interior is suddenly exposed to the action of perhaps an extremely cold atmosphere. And should the Bees be tempted by food or urged by hunger, to descend into these currents, in sharp, frosty weather, but few of them will get away alive, the keen air acting upon them while feeding paralyses and kills them. I am an advocate for keeping Bees cool in winter; yes, cool and still also, let them not be disturbed nor disunited; let them not be forced nor tempted to uncluster themselves. I have no objection to a current of air passing through the hive in winter, provided the Bees be not disturbed, be not exposed singly to its nipping influence; but I strongly object to the feeding of Bees in such currents, because, in that case, feeding is prejudicial to them. Many farmers seldom protect their hives in summer or winter, they are left exposed to all weathers, consequently the less they are disturbed the better. They, therefore, should give their weak stocks a copious feeding in September at the latest, not molest them during the severity of

winter, but in spring, as soon as the Bees begin to make their appearance, put on your feeder, and furnish it with some honey or a little Bee sirup, as feeding is necessary. Lifting up a hive at Christmas, and scattering a few ounces of brown sugar on the stand, and then setting down the hive again, deserves not the name of feeding, though it is all the bounty that is bestowed on some stocks, and is even more than others are treated with. It need not then be wondered at that so many stocks of Bees perish in the winter and in the spring of every year. By judicious feeding, at proper seasons, almost any stock of Bees may be preserved; by injudicious feeding, at an improper season, even good stocks—stocks that would survive if not fed at all nor molested during the depth of winter—may be seriously injured or totally destroyed.

The sum and substance of my directions, as respects Bee feeding, are these:—

1. In spring feed sparingly.
2. In autumn feed plentifully.

3. In winter do not feed at all.

4. Feed swarms, if unseasonable weather immediately follow the act of swarming.

5. Preserve the Bees of weak stocks, and prevent a great deal of the necessity for feeding, by adding them to those that are rich and able to support them. This last is the best, and cheapest, and most scientific—nay, it is even a profitable method of feeding Bees. Early swarming is necessary, and is of great advantage to the watchful apiarian, but not to the inattentive and slothful manager. If early swarms are judiciously fed, supported by a natural heat within, they will be greatly benefited thereby, and eventually prosper. But notwithstanding what has been already said, the cottager may probably ask,—How can I feed my bees without lifting up their hive? I again and again request him to examine my feeding apparatus attached to my Self-protecting Hive, and he will perceive that Bees may be easily fed in this manner, if he have but ingenuity to make a proper feeder and put it on the top of his hive. But

it matters not what sort of weather it may be, if my mode of feeding be adopted. I feed my Bees in their native temperature, without disturbing them or exposing their food to the temptation of robbers. A little food granted to a populous, and even well-provisioned hive in the spring, is attended with very beneficial consequences. It diffuses animation and vigor throughout the whole community, accelerates the breeding of the queen, and consequently conduces to the production of early swarms. I changed Bees this spring (1842) out of the old fashioned country hive, the 6th day of April, and put them into my hives; they filled the hives and swarmed before any country hives that I heard of.

CHAPTER XXII.

BEE FOOD.

HONEY alone is the natural food of Bees, and if given to them pure and untainted, in

its primitive, limpid state, so far from being injurious, it is highly beneficial to them. Of this I have not the shadow of a doubt. For autumnal feeding I prefer honey to all other substances, and recommend it as the most proper food that can be given to them. In general, rich stocks are healthy and strong in the spring. Poverty is the predisposing cause of dysentery among Bees; a regular supply of their natural—their peculiar food, does not induce dysentery or disease of any sort. For spring feeding, I advise to take a certain quantity of honey and put one-third water, and let a small quantity of common salt be added. By a small quantity I mean a drachm or two, at most, to a quart of the liquid. Salt, it has been said, is conducive to the health of the Bees, and the most efficacious remedy for the dysentery, which sometimes affects Bees in the spring; therefore, it may not be amiss to put a little salt into their food, by way of preventive, rather than to have recourse to it afterwards as a remedy.

CHAPTER XXIII.

METHOD OF DESTROYING OR PREVENTING
THE DEPREDATIONS OF THE BEE MOTH.

THIS insect is extremely alert in discovering any crevice by which it may penetrate into the hive, and easily effects its purpose if the Bees are not numerous, and there is no sentinel on watch. They lay their eggs in the sides of the hive, or in the rubbish on the floor, or even in the combs which are farthest from the entrance. Every egg contains an insect, which in due time becomes a moth. It appears first under the form of a worm or larva, and it is in this stage that it commits its ravages, extending its galleries or covered ways throughout every quarter of the interior, and devouring the wax and comb, and the exuviae of Bee nymphs, and, very probably, the nymphs themselves. Certain it is that the population of a hive infested by these destructive creatures, di-

minishes with such rapidity as leads to the conclusion that they prey upon the brood itself as well as on its exuviae. The Bees give ground, step by step, until being greatly reduced in numbers, they at last utterly abandon the hive. There have been hundreds of hives of Bees destroyed by this little insect in our country annually. The Bee moth has become so numerous in New Jersey, and in the Western States, and throughout the State of Ohio, and its success in destroying the Bee so complete, that very many apiarians have become discouraged, and abandoned the enterprise. The New-York Self-protecting Patent Premium Bee Hive is undoubtedly found to be the best hive now in use, for preventing the depredations of the Bee moth, without interfering with the natural course of the Bee. This hive took the premium at the Fair of the American Institute, in 1841, over Mr. Weeks' and Mr. Hall's, and several other patent hives that were there. My hive has a wire screen bottom for keeping out the Bee moth and for

thoroughly ventilating the hive, which keeps the Bees in a healthy condition both winter and summer; for Bees need more air in winter than they do in summer, as in cold weather they crowd together in a small compass, in order to keep warm, and their breath and vapor collect in frost in all parts of the hive, except in the region they occupy. By having a thorough ventilation through the hive the Bees are kept perfectly healthy.

CHAPTER XXIV.

ON VENTILATION.

VENTILATION is one of the greatest results of my studies and experiments on this point of apiarian science. There are but few persons, who are managers of Honey Bees under the old hive system, but have beheld these little creatures, when oppressed with the internal heat of their crowded do-

micil, unhappily clustering and hanging at the entrance, or from and under the floor-board of their hive, in a ball frequently as large as a man's head, and sometimes covering all the front part of their hive, for twenty or thirty days together, and this, be it remarked, at the season of the year which is the most profitable for their labors in the fields and among the flowers. During this distress of the Bees in, or belonging to, such a hive, their labors are of necessity suspended, their gathering of honey ceases,—ceases, too, at the very time that that saccharine substance is most plentifully secreted by the vegetable world. And—why? All because of the want of ventilation in their domicil. My hive is thoroughly ventilated by means of a wire screen bottom and a hole at the top of the hive, so that there is a slow, imperceptible current of air constantly passing in at the bottom and off at the top through the ventilator, to let the excess of animal heat escape in summer, and also to throw off the vapor caused by the breath and other exhala-

tions of the Bees, which cause frost and ice in the hive in the winter, and which are frequently the cause of the death of the Bees.

CHAPTER XXV.

MANAGEMENT OF BEES DURING WINTER.

THE honey harvest being now over, it will be necessary to prepare the stock-hives for passing the winter in safety. Turn over the boxes to prevent the entrance of the Bees in September or early in October. Much speculation has subsisted of late relative to the most eligible situation for hives during the winter. While some are advocates for a warm, sheltered situation, others prefer an exposure to all the vicissitudes of the weather and in both these conditions mortality has in many instances overtaken them. I have witnessed many experiments for the preservation of Bees through the winter, such as

placing them in cellars, barns, &c. but the result proved to my satisfaction, that all interference, however humane, is attended with consequences fatal to them; from my own observation, the hives which are best covered during winter, always prosper most the following summer. The warmer hives are kept in March and April the better, as it accelerates the hatching of the eggs and promotes the prolific nature of the queen. It is almost needless to say, that feeding during winter is out of the question, even though the season should be mild. It is unnecessary, and would prove injurious, tempting the insects to leave the comparatively warm atmosphere of the center of the hive where they are congregated in dense clusters, and to expose themselves to the colder temperature below, which chills, and ultimately destroys them. At the same time I must not be understood as recommending the shutting them up altogether, so that they cannot take the advantage of an occasional interval of sunshine. Leave the narrow apertures free,

to afford the Bees an opportunity of coming abroad when they can do so in safety. Absolute confinement is extremely prejudicial to them. The practice which prevails in some places of removing the hives into the dwelling-house, by way of preserving them from the cold, is by no means to be recommended, and, in fact, is often followed by fatal effects. The increased temperature of the place to which they have been removed, keeps them in such a state of animation and excitement, that they continue to eat during the whole period of their confinement, and not being at liberty to go abroad and evacuate, their bodies become swollen and diseased by the retention of their fœces, for they are most unwilling to soil the interior of their dwelling, and great numbers of them are thus cut off, and when in spring the hive is brought into the open air, the few inhabitants that remain are too feeble to bear the sudden change of temperature, and gradually dwindle away, or are plundered and destroyed by the more vigorous and healthy.

It may be observed as an axiom, that in both animal and vegetable life from the highest to the lowest grade, we gain nothing by withholding a due portion of nutriment, and it may, perhaps, be affirmed, as a demonstrated truth, that Bees which have been amply sustained during winter and spring are earlier in hatching their young brood, and more industrious in providing a store of honey, than those which have been stinted. According to my judgment, the principal requisite for the preservation of Bees in winter, are, that the hive contain a sufficient number of Bees to maintain a certain degree of warmth, that they have a plentiful store of honey, and that they be secluded from the inclemency of snow and rain, and out of the influence of the sun, to be kept still, and undisturbed. It is a philosophical truth, that the vital principle is cherished and promoted by heat, and that all animals and insects flourish and prosper most when under its influence, analogy, therefore, would seem to dictate, that Bees be kept moderately, and as far as possible, uniformly warm.

CHAPTER XXVI.

ON BURYING BEES.

I HAVE lately been made acquainted, and from good authority, with the singular expedient of burying hives of bees in the earth for their preservation during winter. It would appear, *a priori*, a visionary scheme, altogether inconsistent with the principles of nature, that animals or insects, whose residence is on the earth, could exist, when deprived of air and light beneath its surface. Hives of Bees have been preserved through the winter, when deposited three or four feet below the surface of the earth, and this you may try, if you please, only mind you bury them in a dry place. It has been practised in Rhode Island for several years, and it is seldom that a swarm perishes in that situation. To my view, however, it appears an unnatural process thus to subject insects to a sudden transition from atmospherical air

and light to a state of utter darkness. The object in burying Bees in the earth is that they may pass the winter with little or no food, and it is stated that very small, feeble swarms thus treated, or when confined in dark cellars, are preserved, when in any other situation they must have perished of hunger. The method practised in burying Bees is to choose a spot of dry ground where there is no probability of water reaching the hive. Dig the hole considerably larger than the hive, and about eighteen inches deeper than the height of it, fill the vacancy round the hive with straw, cover it over so deep that no frost can reach it. They are buried in November and liberated in April, when if they appear destitute of honey it will be necessary to feed them. That Bees should survive under such circumstances, seems to be among the inscrutable phenomena in natural history. Though I do not hesitate to advance the opinion, that their preservation is to be ascribed more to a uniform degree of warmth, than to any other cause; but with

respect to air for the purpose of respiration during their seclusion in the earth, will the quantity of air enclosed with the hive, together with the aid of their own ventilating powers subserve the purpose of respiration. We know but little respecting the efficacy of their ventilating process, but we know that Bees have in many instances sustained such privations during five months with perfect impunity.

CHAPTER XXVII.

REMEDY FOR THE STINGS OF BEES.

THE stings of Bees are not often attended with serious consequences, though when numerous, they are not altogether without danger. The poisonous liquor which the Bee infuses into the wound causes a fermentation, attended with a swelling, which continues sometimes several days, but that must

be prevented by immediately pulling out the sting, and washing the place with the remedy I shall prescribe. Many things have been recommended as cures—infallible cures, of course, for the sting of a Bee. But if the sting be suffered to remain in the flesh, during a few seconds only, it is not very easy to stop the inflammation and allay the pain. An onion cut horizontally into thin slices, and pressed closely to the wounded part, and renewed at short intervals, has been accounted a good application. If the part stung be first well rubbed with one of those slices, that would perhaps have a soothing effect. The juice of the plantain is also said to be a specific, olive oil is another, so is common salt, so is laudanum, so is spirits of hearts-horn, so is salaratus, so is a solution of sal ammoniæ, and so is chalk or whitening. The doctor says common whitening proves an effectual remedy against the effects of the sting of a Bee or Wasp. The whitening is to be moistened with cold water, and immediately applied. It may be washed off in a

few minutes, when neither pain nor swelling will ensue. Pressure with the hollow end of a small key, or with a pencil-case, is practised by some unfortunates, and is said to check the circulation of the poison. This last mode of treatment—i. e. pressure with a small key, or pencil case, the smaller the better, is the simplest, and, if immediately adapted, is I believe the very best. But its efficacy depends upon the instant application of the key or pencil case to the part stung, by which the poisonous matter is not only prevented from being absorbed into the system, but the puncture is laid open, and the virus thereby expressed and entirely got rid of more readily than by any other means. Accidents may sometimes happen, and the most cautious and humane apiarian may occasionally receive a sting, but gentle treatment does not irritate Bees, and when not irritated they have no disposition to use their stings.

CHAPTER XXVIII.

MEASURE AND WEIGHT OF BEES.

THE following is a table of the average number, measure, and weight of Bees, which I have counted and weighed. It takes 4480 Bees to the pound.

	<i>lbs.</i>	<i>oz.</i>	<i>dr.</i>
17920 Bees, constitute a good swarm will weigh	4	00	00
280 Workers,	0	1	00
100 Drones,	0	1	00
4480 Workers,	1	00	00
1830 ditto—a pint measure,	0	6	5
3660 ditto—a quart, do.	0	12	10

CHAPTER XXIX.

CONCLUSION.

HOPING I have satisfied my readers, for which I have exerted the utmost of my slen-

der abilities, and communicated every observation and experiment worth mentioning, I have only to request their candor and indulgence, and if this treatise shall be instrumental, in any respect, to benefit and profit my fellow-creatures, I shall be amply rewarded for the labor and pains I have taken for that purpose. As the principal object of this treatise is to promote the instruction and good of others, I have only to say, that if in any thing I am mistaken, I shall be glad to be set right, for the more we know of those industrious and profitable insects, the Bees, the more we may be perplexed, but we shall be led to admire and adore their wonderful properties and economy, though no man can search them out to perfection.

P. S. Any gentleman whose Bees have omitted swarming, and who is desirous of increasing his stock, may have swarms taken out of any old hive, by EDWARD TOWNLEY, the author, which shall do as well, or better, than those which come forth of their own

free choice. In like manner, Bees can be taken out of hollow trees, walls, or any other places, and divided so as to make two swarms from one.

TOWNLEY'S PATENT PREMIUM BEE HIVES.

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