

Glimpses of Nature.

VIII.—ABIDING CITIES.

BY GRANT ALLEN.

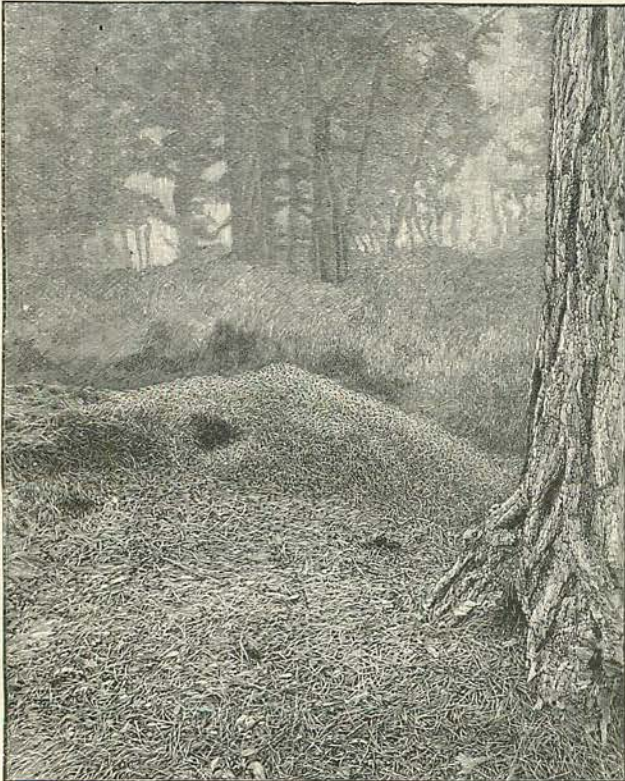


THE papery nests of wasps, as I mentioned in the last of these essays, are purely temporary empires: the vespine race has "no abiding city here"; each summer sees the populous homes built afresh from the ground; each winter sees them unpeopled and demolished. But with ants, which are builders for time, things are quite otherwise. The communities of those clever and intelligent little creatures are tolerably permanent; they go on from year to year, and generation to generation, often for very long periods together. Lest I weary you unnecessarily by a long preamble, however, I shall present you with views of one such nest at once, outside and inside, in Nos. 1 and 2, in order that you may see without delay the curious method of their detailed construction.

The city whose external lineaments are shown you in the photograph reproduced in No. 1 is actually situated on St. George's

Hill, near Weybridge, just ten feet away from the large Scotch fir whose trunk appears on the right of the illustration. It is only one among many various types of ants' nests, built by different species. From outside, all you can see of it is a confused mass of dry pine-needles, arranged in a barrow-shaped hill or mound, some eight feet across at the base, and two feet high. But that is in reality only the outwork or top story of the communal habitation. Beneath it lies a second layer, six inches thick, composed entirely of roots of heather and rootlets of fir-trees, all carefully stripped clean of bark, and making a dry foundation for the warm hillock of pine-needles. Below this woody layer, again, the ground is tunnelled to an unknown depth by long subterranean galleries, driven right through a stratum of solid sandstone. These inner galleries extend, not only beneath the hillock, but also all round it; for wherever you step, the soil treads soft, and gives beneath your foot to a depth of six or eight inches. This illustrative example is a city built by our common English Wood Ant; I have had another just like it—an insect London—under observation for three or four years in a copse on a spur of Hind Head, not far from my cottage.

In No. 2 Mr. Enock has represented for us, with his usual skill, a very small section of such a city, "all a-growing and a-blowing"—all engaged in the active exercise of its everyday functions. How it came into being, and how it is ruled and peopled, I will tell you a little later on; for the present I want first to familiarize you with the general course of its domestic economy in practical action. We have here an interior view, with one wall removed, of a tunnel or gallery, which runs through the soft upper portion of the nest, composed of pine-needles; together with a small piece of the outer surface. An ant, which has been out foraging for food, approaches one of the mouths of the nest. Beneath are three



1.—A WOOD ANTS' NEST, EXTERIOR.

successive floors or stages of the tunnel, with excavated chambers, each appropriated to its own particular purpose. In the upper floor of all, we see two groups of minute eggs awaiting their hatching. These are the real eggs, not the much larger things sold as "ants' eggs" for bird food in London, which are really the pupæ. Four of the eggs have just arrived at hatching point; therefore, one of the careful nurses who look after them is seen just in the act of bundling them over on to stage two, which is the floor here reserved for the nursery of the hatched-out grubs or larvæ. In this second stage you see a chamber with a group of such grubs, all hungry and greedy, waiting for their nurses to bring them food from outside the household. Observe the obvious expectancy of their attitude, with heads held up, like that of small birds clamouring eagerly for food when their mother approaches them with a worm or a caterpillar. After feeding for some time in this legless, grubbish condition, the larva turns into a pupa, and incloses itself in a cocoon; one larva has just completed this happy transformation, and a watchful nurse ant is therefore at this moment engaged in carrying it tenderly a stage lower down to the floor reserved for the chrysalis condition. On the third floor, below, you see a group of pupæ, lying by in the dark, and awaiting their development. The wall of one cocoon has here been removed; and within, you may catch a glimpse of the imprisoned grub, now recently transformed into the adult ant pattern. Of course, the nest contains many hundreds of such tunnelled galleries, all teeming with life, and all made up of several distinct chambers.

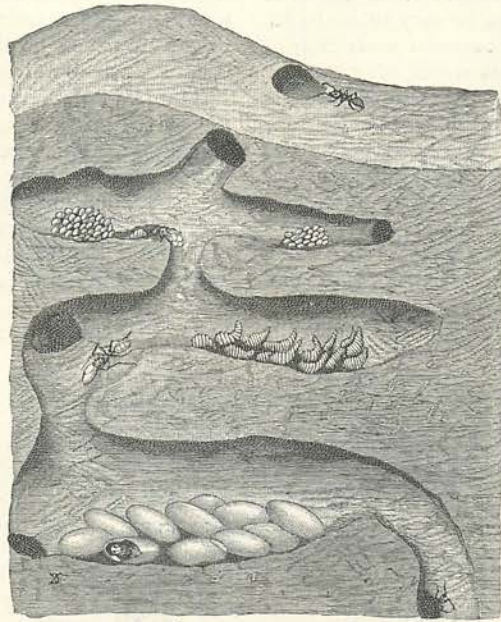
Now, how does such a nest begin to be? Well, it starts from a queen, or perfect female, who sets out with a few others to form a colony. This colony soon grows; but it is rather a republic than an Amazon kingdom,

like the hive of bees or the nest of wasps: it is composed of several perfect females (instead of one queen), numerous imperfect females or workers, and a few males, who, as is usual among social insects, are very unimportant and unconsidered creatures. The males and females are winged when they first emerge from their cocoons; and they use their wings for their marriage flight, which is a recognised

institution among all insect socialists. But as soon as the perfect females have been safely wedded, their wings drop off; or, in cases where they do not fall off themselves, the insects themselves wriggle and pull them off with their legs in the most comic fashion. I have sometimes seen a dinner-table in Jamaica covered by a sudden irruption of female winged ants of tropical species, which insisted on immolating themselves in the soup and the wine (to the advantage of neither party), while others blackened the table-

cloth, and devoted themselves to getting rid of their wings with unpleasant gyrations. As for the males, they are of no further use to the community, so they die at once. But the mass of the larvæ develop into imperfect females or workers, which are always wingless from the very first; and it is these that form the ordinary ants of the everyday observer. In many kinds there are also two types of neuters: the one type, workers proper, have rather large heads and moderate jaws—they are the foragers and builders of the community; the other type, soldiers, have still bigger heads and very powerful jaws—it is their task to fight in defence of their native city. Other differences of less importance will come out in the course of our subsequent explanation.

The winged ants have large and many-faceted compound eyes, to aid them in their flight abroad; and they have also single eyelets or *ocelli*, as in the case of the wasp, which seem to be useful to them in finding



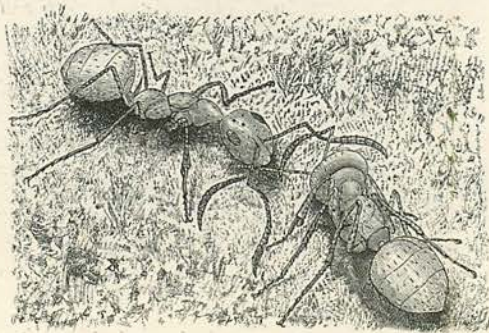
2. — A WOOD ANTS' NEST, INTERIOR; EGGS, GRUBS, AND COCOONS, WITH WORKERS ENGAGED IN TENDING THEM.

the way over large areas, as the compound eyes are probably designed for nearer and minuter vision. But the workers have always the true eyes small, and often rudimentary; while the eyelets or *ocelli* are mostly wanting. To put it plainly, they are almost blind. The reason for this peculiarity is that walking ants do not much need sight; they seem to feel and smell their way about; vision with them ranks far second to odour as a means of information. There can be very little doubt, too, that their principal organ of sense resides in the antennæ, or feelers, which are probably used in part for smelling. Whatever may be the perceptive function which these curious appendages subserve, however, nobody who has watched ants closely ever doubts that they are also used as a means of intercommunication, almost analogous to human language. Whenever two ants of the same nest meet, they stop and parley with one another by waving and crossing their antennæ; so obvious is it that the information thus conveyed makes one ant follow another towards a source of food, or other object of interest, which the first ant has discovered, that the process is universally described by ant-observers as "talking."

In No. 3 we get an illustration of two workers belonging to an English species known as the Warrior Ant, from its predatory habits, engaged in just such a profound confab together. They are meditating war, and discussing a plan of campaign with one another; for the Warrior Ant is a slave-making species. It is a large red kind, and it makes raids against nests of the small yellow Turf Ant, a mild and docile race, large numbers of which it carries off to act as servants. But it does not steal fully-grown Turf Ants; their habits are formed, and they would be useless for such a purpose. What the Warrior Ant wants is raw material which can be turned into thoroughly well-trained servants. So it merely kills the adult ants which strive to oppose its aggression, and contents itself with trundling home to its own nest the larvæ and pupæ of the Turf Ants which it has put to flight and vanquished. In process of time, these grubs and cocoons produce full-grown yellow workers, which,

having never known freedom, can be taught by the Warrior Ants to act as nurses and housemaids, exactly as if they were living in their own proper city. I once saw in a garden in Algiers a great pitched battle going on between slave-makers and the family of the future slaves, in which the ground was strewn with the corpses of the vanquished; not till the nest of the smaller ants was almost exterminated did they retire from the unequal contest, and allow the proud invader to carry off their brothers and sisters in their cocoons, asleep and unconscious.

The two ants figured in No. 3 are deliberating on the chances of such a cocoon-lifting expedition. The one to the right has been hunting for honey up the stems of vetches, and has fallen in by the way with a small nest of Turf Ants. Returning post-haste to her own home, big with this exciting intelligence, she encounters a comrade, to whom she communicates in antennæ-language her belief that the Turf Ants she has discovered



3.—A CONVERSATION: "LET'S GO SLAVE-HUNTING!"

are not very numerous, and her conviction that they would fall an easy prey to a well-organized party of Warrior raiders. The two friends cross their antennæ as they talk, wave them mysteriously about, and evidently succeed in conveying their respective views on the situation to one another. After a short

delay, both return, all agog, to the nest together, and rouse the guard with intelligence of plenty of pupæ ready to be plundered. At once the city hums alive with bustle and preparation. Workers run to and fro and communicate orders from head-quarters to one another. "There's a big slave-hunt on; sister-fighter so-and-so has just brought news of a city of Turfites, quite near, and unprotected. The doors are open, and she noticed as she passed that the sentries looked most lax and indifferent. The whole place has apparently been demoralized by a recent marriage flight. Everybody in our nest is going to the war. Come along and help us!"

Forthwith, they sally out, and make for the city of the despised yellow Turfites. They fall upon it, unexpectedly, and kill the outer sentries. Then the battle begins in earnest. Half the Turfites rush out in battle array, and, banding themselves together, to

make up for their individual small size, fall fiercely upon this or that isolated Warrior. Occasionally, by dint of mere numbers, they beat off the invader with heavy loss; but much more often, the large and strong-jawed Warriors win the day, and destroy to a worker the opposing forces. They crush their adversaries' heads with their vice-like mandibles. Meanwhile, within the nest, the other half of the workers—the division told off as special nurses—are otherwise employed in defending and protecting the rising generation. At the first alarm, at the first watchword passed with waving antennæ through the nest, "A Warrior host is attacking us!" they hurry to the chambers where the cocoons are stored, and bear them off in their mouths into the recesses of the nest, the lowest and most inaccessible of all the chambers. When at last the day is lost, the Warriors break in and steal all the pupæ they can lay their jaws upon; but many survive in the long, dark tunnels, with a few devoted workers still left to tend and teach them.

No. 4 shows us the last final stage in such a slave-hunt. The big red Warriors have won; the little yellow Turfites have been repulsed and defeated with great slaughter. The victors are at present engaged in carrying captured cocoons to their own nests; there, the pupæ will hatch out shortly into willing slaves, and, never having known any other condition, will take it for granted that the natural post for small yellow ants is to clean and forage and catch food for big red ones.

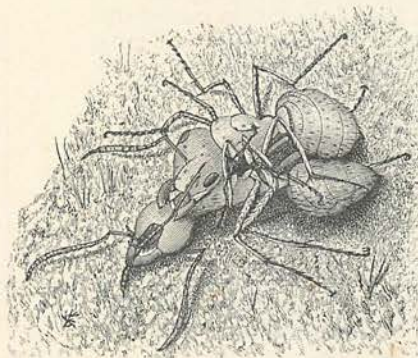


4.—A SLAVE-HUNT; CONQUERORS CARRYING OFF THE COCOONS OF THE ENEMY.

Our own Warrior Ants are slave-holders which still retain some power of working and acting for themselves; but there are other species in which the "peculiar institution" has produced its usual degrading result by rendering the slave-owner incapable and degenerate, a mere fighting do-nothing. Among the Amazon ants, which are very confirmed slave-makers, Sir John Lubbock found that a great lady, left alone without

slaves, in the presence of food, did not even know how to feed herself; she was positively starving to death in the midst of plenty. Then Sir John provided her with a single slave; instantly, the industrious little creature set to work to clean and arrange her mistress and to offer her food. This is a striking illustration of the moral truth that slavery is at least as demoralizing for the master as for his servant.

No. 5 introduces us to a passing phase in a combat of ants—a life-and-death conflict



5.—PAVING OFF OLD SCORES; A LIFE-AND-DEATH CONFLICT.

between two single antagonists. Ants, indeed, are desperate fighters; the workers and perfect females have sometimes stings, like the bees and wasps; but in most species they fight by biting with their jaws, which are moulded into strong and vice-like nippers or pincers. Moreover, they have a gland which secretes the same poisonous material as that contained in the venom-bag of the sting among wasps and bees; and after the ant has made a hole with her jaw in her enemy's armour, she injects into it a little of this painful, irritating acid, which kills small insects. During a battle, ants are all most reckless of their own lives; indeed, no ant seems ever to consider herself by comparison

with the interests of the community at large. The individual exists for the state alone, and sacrifices her life and happiness, automatically as it were, on behalf of her city.

In No. 6 we see an illustration of the great muscular strength possessed by ants, especially in their gripping jaws or mandibles. Here, two comrades have got hold of a dead and rigid prey, which they are striving to carry off by main force to the

nest; for ants are omnivorous. They feed off whatever turns up handy; all is fish that comes to their net—they seem almost indifferent whether what they dine off is honey or honeydew, a worm or a beetle, a dead bird or a departed lizard. A few workers will seize whatever edible object they happen to find, and combine to drag it away, by pushing and pulling, to the underground chambers. In this particular case, the two ants began by hauling together; but the lower one, giving one good tug with her jaws, has succeeded in raising the whole carcass aloft, and hoisting up her astonished neighbour into the air on top of it. It is impossible to watch a nest of ants at work for any length of time without being the spectator of many such comic little episodes.

I implied above that ants are very fond of honey. But plants by no means desire their attentions; because, being creeping creatures, guided mainly by the sense of smell, they crawl up the stems of one species after another, indiscriminately, and so do no good in setting the seeds of any particular kind of flower. To baffle them, accordingly, many plants cover their

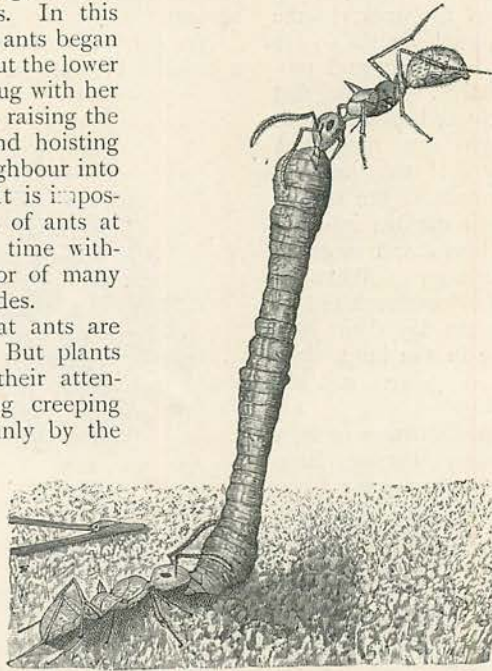
stems with downward-pointing hairs, which prove to the ants as impenetrable an obstacle as tropical jungles to the human explorer; while other sorts set various traps like lobster-pots on their stalks, to catch and imprison the unwelcome visitors. But the wild English vetches have a still more curious and instructive habit, shared by not a few other ingenious plants. They buy off the intruders by an organized system of blackmail. Below the flowers intended for fertilization by flying insects, which flit straight from one blossom to another of the same kind, the vetches put some arrow-shaped guards or stipules, so arranged like barriers on the stem that a prying ant cannot easily creep past them. In the centre of each stipule, however, the plant produces a little black gland, which secretes honey. This honey is a bribe to the marauding ant; the vetch puts it there in order that the insect, finding its progress toward the flower blocked, may just stop

en route and sip this pittance of nectar, leaving the richer and more valuable stock of honey in the actual blossom to be rifled by the bees which are the honoured guests and allies of the vetches. Nature is all full of such quaint plots and counterplots. One example occurs in a South American tree, so very remarkable that I cannot pass it by even in this hasty notice.

A certain ant, very common in Brazil, has the habit of cutting large round pieces out of the leaves of trees, which it then conveys to its nest for the purpose of growing fungi upon them—in human language, making tiny mushroom-beds. Now, this habit is naturally obnoxious to the trees, which produce the leaves for their own advantage, not for the sake of leaf-cutting ants which hack and rob them. To guard against the burglarious leaf-cutters, accordingly, one clever South American acacia has hit upon an excellent plan of defence. It

produces curious hollow thorns; while each leaflet has a gland at its base which secretes honey. Into these hollow thorns, colonies of a small and harmless ant migrate, and take up their abode there. They live off the honey at the base of the leaflets. They thus acquire a vested interest in the acacia tree, which is their home and territory; and whenever the leaf-cutting ants attack the acacia, the little occupants of the thorns and owners of the honey-chambers pour out upon them in their thousands, and compel the invaders to beat a hasty retreat with heavy losses. Thus the cunning tree supplies its insect body-guard with board and lodging in return for efficient protection against the dreaded onslaught of the common enemy.

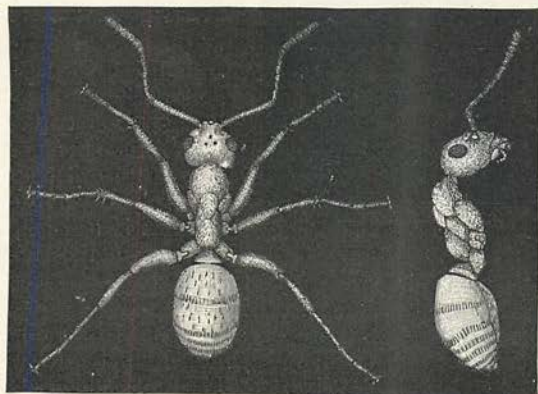
And now that I have succeeded, I hope, in interesting you a little in the habits of ants, I am going to tell you a few facts about their structure. That is my dodginess, you see; I knew if I began by giving you details of



5.—A LONG PULL, AND A STRONG PULL, BUT NOT ALL TOGETHER.

legs and body and segments, you would vote the whole thing dry; but now that you understand what sort of objects the ant wants to attain, you may be content to examine the organs she attains them with.

In No. 7 you have a portrait of the common Garden Ant of England, one of the

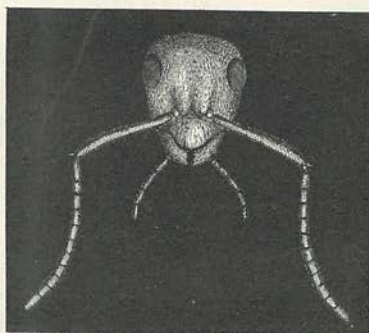


7.—THE GARDEN ANT—PORTRAIT OF A WORKER.

most interesting creatures in the world to watch in action. This is a worker specimen; therefore, it has a very big head, with very powerful jaws; and when you remember that ants work for the most part with the head only, you will understand why that portion needs to be the most muscular and powerful part of the body. A lobster has two very strong claws in front, because those are his fighting and prey-catching organs; the ant's jaws just answer in function to the lobster's claws, and to our hands and arms, and, therefore, they are correspondingly big and muscular. Male and female ants do not have to dig tunnels, to build up chambers, to drag heavy weights back to the nest; therefore, they have smaller heads and bigger eyes; they are adapted only for flying and for producing the younger generation. The middle segments of the body, on the contrary, are large and powerful in the males and females, because they have to work the wings; while in the workers they are smaller, especially in one segment, because the workers are wingless. The legs, however, are fairly strong, since they need to pull and to supply a firm footing when the ant is tugging hard at some heavy

object. But between the part of the body which forms the attachment for the six legs and the abdomen, or "tail," there is a single characteristic segment, or stalk, very thin and slender, which bears a sort of scale, peculiar to the ant family. The side view, with the legs removed, enables you to note how admirably the ant is adapted for turning in almost any direction, and explains that extraordinary flexibility of body which you must have noticed whenever you have watched a troop of ants trying to drag a dead insect over a gravel path, and surmounting all obstacles with clumsy ingenuity. Ants, in short, are built for navvies; they are insect engineers, and they have acquired a form exactly adapted to their peculiar habits.

But why are the worker ants so nearly blind? That must surely be a disadvantage to them. Not a bit of it. Ants work mainly in dark underground passages, where the sense of sight would be of little use; and, moreover, like all hunting animals, they find smell more important as an indicator of food in the open than vision. The hound does not *look* for the fox—he sniffs and scents him. Now, whenever any sense is relatively unimportant, an economy may be effected by suppressing or curtailing it; the material that would otherwise go to making and repairing its organ is more profitably employed on some better work elsewhere. Ants are obviously descendants of flying ancestors, none of which were workers; and the flying males and females possess to this day the organs of sight necessary for their habits. But in the class of workers it has been found more useful, on the whole, to concentrate attention on smell and on strength of jaw than on sight and flight: the important point is that the worker ant should be able to find scattered foodstuffs, and should be strong enough to pull them back to the city. So, in No. 8, you get a front view of the head of the common Garden Ant; and you will see for yourself that its eyes, when compared with the numerous eyelets and large compound organs of the wasp, are relatively imperfect; while its antennae are large and fully developed appendages. They turn in a beautiful ball-and-socket joint, which enables them



8.—HEAD OF GARDEN ANT, WITH EYES, ANTENNAE, JAWS, AND FEELERS.

to move freely in every direction. Now, these antennæ quite clearly serve several most important uses in ant life. They are the organs of speech in ants, as well as the organs of a special sense; just as, with us ourselves, the mouth is used equally for tasting and talking. Darwin said with justice, indeed, that, considering its size, the brain of an ant was perhaps the most marvellous piece of matter in the whole universe; and its raw material of intelligence is apparently supplied it most of all through the mysterious antennæ.

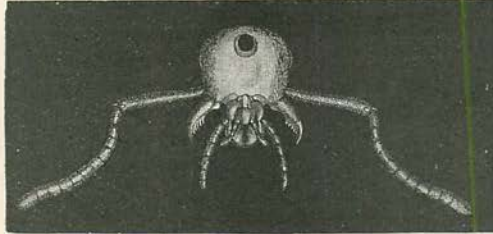
No. 9 is a back view of the same head, with the various jaws and mouthpieces expanded. It shows very well the complicated nature of the tongue, the palps, the shield, and so forth, and also the powerful nipping jaws, with their closely serrated and tooth-like edge—these last being the weapons used in battle and in repelling the attacks of large enemies. It also excellently exhibits the complex arrangement of the beautiful jointed antennæ, whose movements appear to serve the ants in place of language. The black spot in the centre of the head above is the cut neck, or esophagus. I advise you to look closely at the mouth-organs in this microscopic drawing, and to compare them with the corresponding parts in the wasp, illustrated by Mr. Enock in the last number.

Considering how important the antennæ are, it will not surprise you to learn that the clean little ants have a special instrument, like the bees and wasps, for keeping these useful out-growths in proper order. The singular brush-and-comb with which they clean them is shown in No. 10, together with a

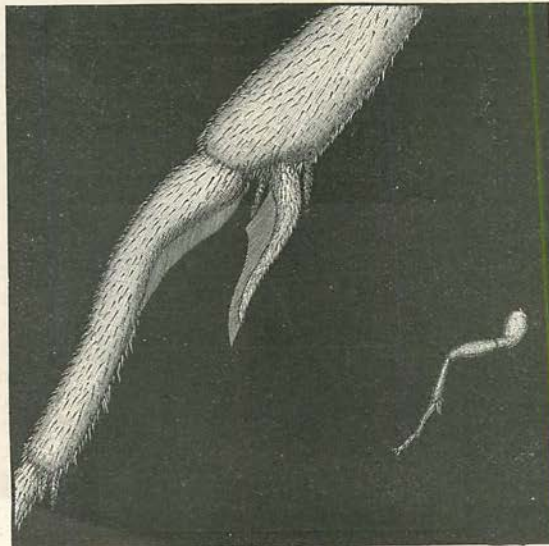
smaller representation of the entire leg on which it exists, so as to enable you to see where the ant carries it. Ants, indeed, are as fond of washing themselves as cats; and when any accident happens to one, such as getting smeared with honey, you will see the little creature carefully getting rid of the foreign body with her hairy legs, and paying particular attention to her precious antennæ. The mere existence of such developed brushes is sufficient to prove the immense importance of the organs they clean to the bee-and-ant order.

The life-history of an ant falls into four periods or ages: the egg, the grub, the pupa, and the perfect insect. The eggs, which are very tiny, are white or yellowish, and somewhat elongated; those observed by Sir John Lubbock, the great authority on ants, have taken a month or six weeks to hatch. The larvæ, like the young of bees and wasps, are white, legless grubs, narrow towards the head. The picture in No. 2, indeed, only imperfectly suggests the constant care with which they are tended by the nurses in early life; for they are carried about from room to room at different times, apparently to secure the exactly proper degree of warmth or moisture; and they are also often assorted in a sliding-

scale of ages. "It is sometimes very curious to see them in my nests," says Sir John Lubbock, "arranged in groups according to size, so that they remind one of a school divided into five or six classes." After a longer or shorter period of grubhood, which differs in length in different species, they turn into pupæ, either in a cocoon or naked. It takes the insects three or four weeks, in the pupa



9.—BACK VIEW OF HEAD, WITH JAWS OPEN, AND ORGANS EXPANDED.



10.—THE ANT'S BRUSH-AND-COMB, FOR CLEANING THE ANTENNÆ.

form, to develop into full-grown ants; and even when they have finished, they are as helpless as babies, and could not escape from the cocoon but for the kind offices of the worker attendants. "It is pretty to see the older ants helping them to extricate themselves, carefully unfolding the legs and smoothing out the wings" of the males and females, "with truly feminine tenderness and delicacy." This utter helplessness of the young ant is very interesting for comparison with the case of man; for it is now known that nothing conduces to the final intellectual and moral supremacy of a race so much as the need for tending and carefully guarding the young; the more complete the dependence of the offspring upon their elders, the finer and higher the ultimate development.

Ants are likewise great domesticators of various other animals; indeed, they keep many more kinds of flocks and herds in confinement than we ourselves do. Besides the green-flies, which I have already treated in a previous paper, and which the ants use as cows, milking them for their honey-dew, a large selection of beetles and other insects are commonly found in ants' nests. Then there is a funny little pallid creature, called *Beckia*, an active, bustling small thing, remotely resembling a minute earwig-larva, which runs in and out among the ants in great numbers, keeping its antennæ always in a state of perpetual vibration. The nests also harbour a queer, armour-plated white wood-louse, whose long Latin-German name I mercifully spare you; and this strange beast toddles about quite familiarly among the ants in the galleries. Both kinds must have been developed in ants' nests from darker animals; and both are blind, from long residence in the dark underground tunnels which they never quit; their lightness of colour and the disappearance of their eyes tend alike to show that they and their ancestors have resided for countless ages in the homes of the ants. Yet no ant ever seems to take the slightest notice of them. Still, there they are, and the ants tolerate their presence; while an unauthorized interloper, as Sir John Lubbock remarks, would at once be set upon and killed. The accomplished entomologist in question suggests that they may perhaps act as scavengers, like the wild dogs of Constantinople or the turkey-buzzard vultures of the West Indies and South America. I have sometimes almost been inclined to suspect, myself,

that they may be kept as totems, much as human savages domesticate one of their revered ancestral animals as an object of worship.

In other cases the relation between the ants and their domesticated animals is more distinctly economical. For instance, there is a blind beetle—most ant-cattle are blind from long residence in the tunnels—which has actually lost the power of feeding itself; but the ants feed it with their own food, and then caress it with their antennæ, apparently in order to make it give forth some pleasant secretion. This secretion seems to be poured out by a tuft of hairs at the base of the beetle's hard wing-cases; these tufts of hair the ants take into their mouths and lick all over with the greatest relish. Some ant tribes even strike up an alliance with other ants of a different species, whose nest they frequent and whom they follow in all their wanderings. Thus, there is a very tiny yellow ant, known as *Stenammas*, which takes up its abode in the galleries of the much larger Horse Ants and Field Ants. When these big friends change their quarters to a new nest, as frequently happens, the tiny *Stenammas* accompany them, "running about among them," says Sir John Lubbock, "and between their legs, tapping them inquisitively with their antennæ, and even sometimes climbing on to their backs, as if for a ride, while the large ants seem to take little notice of them. They almost seem to be the dogs, or perhaps the cats, of the ants." In yet another case, a wee parasitic kind makes its own small tunnels in and out among those of a much larger species, members of which cannot get at the petty robbers, because they are themselves too big to enter the minute galleries. The depredators are, therefore, quite safe, and make incursions into the nests of their bigger victims, whose larvæ they carry off and devour—"as if we had small dwarfs, about eighteen inches long, harbouring in the walls of our houses, and every now and then carrying off some of our children into their horrid dens."

When once one begins upon these fascinating insects, the difficulty is to know when to stop. But I have said enough, I hope, to suggest to you the extraordinary interest of the study of ant life. Even if observed in the most amateurish way, it affords one opportunities for endless amusing glimpses into the politics of a community full of comic episodes and tragic *dénouements*.