vated space behind the basilar space; each impressed with eleven longitudinal rows of distinct punctures, more deeply impressed at the base, more especially the rows near the suture; the first shorter, the others approximating, but not very closely, in pairs, the space between each double row granulose and finely punctured, the broader spaces between the pairs nitidous and finely granulose.

Observations on Ants, Bees, and Wasps.—Part V. Ants.

By Sir John Lubbock, Bart., M.P., F.R.S., F.L.S., D.C.L., Vice-Chancellor of the University of London.

[Read February 7, 1878.]

Ants.

Recollection of Friends.

In my last paper I recorded some experiments made on a nest of *Formica fusca* which I had divided into two parts. I found that while a stranger introduced into the nest was attacked, driven out, or even killed ; and while strangers so introduced showed every sign of fear and an unmistakable desire to escape, friends, on the other hand, put back among their old companions, even after months of separation, were amicably received, and made themselves quite at home. Since my last paper I have continued the observations, as follows:—

The nest was divided on the 4th Aug. 1875.

Feb. 11, 1877. I put in two friends from the other division at 10 A.M. I looked at 10.15, 10.30, 11, 11.30, 12, 2, 4, and 6 P.M. They were on every occasion quite at home amongst the others.

Feb. 12. Put in three from the other division at 12. They were quite at home. I looked at them at 12.30, 1, 2, 4, and 6. Only for a minute or two at first one appeared to be threatened.

Feb. 13. Put in one friend from the other division. The ant was put in at 9.15 A.M., and visited at 9.30, 10, 11, 12, and 1.

Feb. 15. Do. The ant was put in at 10.15 A.M., and visited at 10.30, 11, 12, 1, 2, 3, and 4.

Feb. 19. Do. The ant was put in at 10 A.M., and visited at 10.15, 10.30, 11, 12, 1, and 2.

Mar. 11. Do. Do. at 9.30 A.M., visited at 10.30, 12.30, 2.30 and 5.30.

Mar. 12. Do. Do. at 10 A.M., visited at 12, 2, and 4.

Mar. 18. Put in two friends at 1 P.M., visited at 2 and 4.

April 21. Put in one friend at 9.30 A.M. At 10 she was all right, also at 12 and 4.

April 22. Put in two friends at 8.30. Visited them at 9 and 10, when they were almost cleaned. After that I could not find them; but I looked at 2, 4, and 6, and must have seen if they were being attacked.

April 23. Put in two friends at 12.32. Visited them at 1, 2, 3, 4, and 6. They were not attacked.

May 13. Put in two friends and a stranger at 7.45. At 9 the two friends were with the rest. The stranger was in a corner by herself. 11 do., 12 do. At 1 the friends were all right; the stranger was being attacked. 2, the friends all right; the stranger had been killed and dragged out of the nest. The next morning I looked again; the two friends were all right.

May 14. Put in the remaining three friends at 10. Visited them at 11, 12, 1, 2, 4, and 6. They were not attacked, and seemed quite at home.

This completed the experiment, which had lasted from Aug. 4, 1875, till May 14, 1877, when the last ones were restored to their friends. In no case was a friend attacked.

Though the above experiment seemed to me conclusive, I thought it would be well to repeat it with another nest.

I therefore separated a nest of *Formica fusca* into two portions on the 20th Oct. 1876.

On the 25th Feb. 1877, at 8 A.M. I put an ant from the smaller lot back among her old companions. At 8.30 she was quite comfortably established among them. At 9 do., at 12 do., and at 4 do.

June 8. I put two specimens from the smaller lot back as before among their old friends. At 1 they were all right and among the others. At 2 do. After this I could not distinguish them amongst the rest; but they were certainly not attacked.

June 9. Put in two more at the same hour. Up to 3 in the afternoon they were neither of them attacked. On the contrary, two strangers, from different nests, which I introduced at the same time, were both very soon attacked.

July 14. I put in two more of the friends at 10.15. In a few minutes they joined the others, and seemed quite at home. At 11 they were among the others. At 12 do., and at 1 do.

July 21. At 10.15 I put in two more of the old friends. At

10.30 I looked; neither were being attacked. At 11 do., 12 do., 2 do., 4 do., and 6 do.

Oct. 7. At 9.30 I put in two, and watched them carefully till 1. They joined the other ants and were not attacked. I also put in a stranger from another nest. Her behaviour was quite different. She kept away from the rest, running off at once in evident fear, and kept wandering about, seeking to escape. At 10.30 she got out; I put her back, but she soon escaped again. I then put in another stranger. She was almost immediately attacked. In the mean time the old friends were gradually cleaned. At 1.30 they could scarcely be distinguished; they seemed quite at home, while the stranger was being dragged about. After 2 I could no longer distinguish them. They were, however, certainly not attacked. The stranger, on the contrary, was killed and brought out of the nest.

This case, therefore, entirely confirmed the preceding, in which strangers were always attacked; friends were amicably received, even after a year of separation.

Thus, therefore, in these experiments, as in those previously recorded, the old acquaintances were evidently recognized. This is clear, because they were never attacked; while any ant from a different nest, even of the same species, would be set on and killed if she did not succeed in escaping from the nest. This recognition of old friends seems to me very remarkable. In one case the ants had not seen one another for more than a year.

Intelligence tested by Experiments with Honey.

To test their intelligence I made the following experiments:— I suspended some honey over a nest of *Lasius flavus* at a height of about ½ an inch, and accessible only by a paper bridge more than 10 feet long. Under the glass I then placed a small heap of earth. The ants soon swarmed over the earth on to the glass, and began feeding on the honey. I then removed a little of the earth, so that there was an interval of about $\frac{1}{3}$ of an inch between the glass and the earth; but, though the distance was so small, they would not jump down, but preferred to go round by the long bridge. They tried in vain to stretch up from the earth to the glass, which, however, was just out of their reach, though they could touch it with their antennæ; but it did not occur to them to heap the earth up a little, though if they had moved only half a dozen particles of earth they would have secured for themselves direct access to the food. This, however, never occurred to them. At length they gave up all attempts to reach up to the glass, and went round by the paper bridge. I left the arrangement for several weeks, but they continued to go round by the long paper bridge.

Further Test Experiments with Glycerine.

Again I varied the experiment as follows:—Having left a nest without food for a short time, I placed some honey on a small wooden brick surrounded by a little moat of glycerine about $\frac{1}{2}$ an inch wide and about $\frac{1}{10}$ of an inch in depth. Over this moat I then placed a paper bridge, one end of which rested on some fine mould. I then put an ant to the honey, and soon a little crowd was collected round it. I then removed the paper bridge; the ants could not cross the glycerine, they came to the edge and walked round and round, but were unable to get across, nor did it occur to them to make a bridge or bank across the glycerine with the mould which I had placed so conveniently for them. I was the more surprised at this on account of the ingenuity with which they avail themselves of earth for constructing their nests. For instance, wishing, if possible, to avoid the trouble of frequently moistening the earth in my nests, I supplied one of my ant-nests of *Lasius flavus* with a frame containing, instead of earth, a piece of linen, one portion of which projected beyond the frame and was immersed in water. The linen then sucked up the water by capillary attraction, and thus the air in the frame was kept moist. The ants approved of this arrangement, and took up their quarters in the frame. To minimize evaporation I usually closed the frames all round, leaving only one or two small openings for the ants, but in this case I left the outer side of the frame open. The ants, however, did not like being thus exposed; they therefore brought earth from some little distance, and built up a regular wall along the open side, blocking up the space between the upper and lower plates of glass, and leaving only one or two small openings for themselves. This struck me as very ingenious. The same expedient was, moreover, repeated under similar circumstances by the slaves belonging to my nest of *Polyergus*.

On the Origin of new Communities.

It is remarkable that, notwithstanding the labours of so many excellent observers, and though ants' nests swarm in every field and every wood, we do not yet know how their nests commence.

Three principal modes have been suggested. After the marriage-flight the young queen may either—

1. Join her own or some other old nest;

2. Associate herself with a certain number of workers, and with their assistance commence a new nest; or

3. Found a new nest by herself.

The question can of course only be settled by observation, and the experiments made to determine it have hitherto been indecisive.

Blanchard, indeed, in his work on the 'Metamorphoses of Insects' (I quote from Dr. Duncan's translation, p. 205), says:—"Huber observed a solitary female go down into a small underground hole, take off her own wings, and become, as it were, a worker; then she constructed a small nest, laid a few eggs, and brought up the larvæ by acting as mother and nurse at the same time."

This, however, is not a correct version of what Huber says. His words are:—"I enclosed several females in a vessel full of light humid earth, with which they constructed lodges, where they resided, some singly, others in common. They laid their eggs and took great care of them; and, notwithstanding the inconvenience of not being able to vary the temperature of their habitation, they reared some, which became larvæ of a tolerable size, but which soon perished from the effect of my own negligence" *.

It will be observed that it was the eggs, not the larvæ, which, according to Huber, these isolated females reared. It is true that he attributes the early and uniform death of the larvæ to his own negligence, but the fact remains that in none of his observations did an isolated female bring her offspring to maturity.

Other entomologists, especially Forel and Ebrard, have repeated the same observatious with similar results; and as yet in no single case has an isolated female been known to bring her young to maturity. Forel even thought himself justified in concluding, from his observations and from those of Ebrard, that such a fact could not occur.

Lepeletier de St. Fargeau † was of opinion that ants' nests originate in the second mode indicated above, and it is, indeed, far

* 'Natural History of Ants,' Huber, p. 121.

† Hist. Nat. des Ins. Hyménoptères, vol. i. p. 143.

from improbable that this may occur. No clear case has, however, yet been observed.

Under these circumstances I made the following experiments:—

1 *a.* I took an old, fertile, queen from a nest of *Lasius flavus*, and put her to another nest of the same species. The workers became very excited and killed her.

b. I repeated the experiment, with the same result.

c. Do. do. In this case the nest to which the queen was transferred was without a queen; still they would not receive her.

d and *e.* Do. do. do.

I conclude, then, that, at any rate in the case of *L. flavus*, the workers will not adopt an old queen from another nest.

2. I took an old, fertile queen of the same species and placed her by herself with damp earth, food, and water. In a few days, however, she died.

The following, however, shows that whether or not ants' nests sometimes originate in the two former modes or not, at any rate in some cases isolated queen ants are capable of giving origin to a new community.

On the 14th Aug. 1876, I isolated two pairs of *Myrmica ruginodis* which I found flying in my garden. I placed them with damp earth, food, and water, and they continued perfectly healthy through the winter. In April, however, one of the males died, and the second in the middle of May. The first eggs were laid between the 12th and 23rd April. They began to hatch the first week in June, and the first turned into a chrysalis on the 27th; a second on the 30th; a third on the 1st July, when there were also seven larvæ and two eggs. On the 8th there was another egg. On the 8th July a fourth larva had turned into a pupa. On the 11th July I found there were six eggs, and on the 14th about ten. On the 15th one of the pupæ began to turn brown, and the eggs were about 15 in number. On the 16th a second pupa began to turn brown. On the 21st a fifth larva had turned into a pupa, and there were about 20 eggs. On the 22nd July the first worker emerged, and a sixth larva had changed. On the 25th I observed the young worker carrying the larvæ about when I looked into the nest; a second worker was coming out. On July 28 a third worker emerged, and a fourth on the 5th Aug. The eggs appeared to be less numerous, and some had probably been devoured.

This experience shows that the queens of *Myrmica ruginodis* have the instinct of bringing up larvæ and the power of founding communities. The workers remained about six weeks in the egg, a month in the state of larvæ, and 25-27 days as pupæ.

Communication between Ants.

Every one knows that if an ant or a bee in the course of her rambles has found a supply of food, a number of others will soon make their way to the store. This, however, does not necessarily imply any power of describing localities. A very simple sign would suffice, and very little intelligence is implied, if the other ants merely accompany their friend to the treasure which she has discovered. On the other hand, if the ant or bee can describe the locality, and send her friends to the food, the case is very different. This point, therefore, seemed to me very important; and I have made a number of observations bearing on it, some of which are recorded in my previous papers read before the Society.

The following may be taken as a type of what happens under such circumstances. On June 12 I put a *Lasius niger*, belonging to a nest which I had kept two or three days without food, to some honey. She fed as usual, and then was returning to the nest, when she met some friends, whom she proceeded to feed. When she had thus distributed her stores, she returned alone to the honey, none of the rest coming with her. When she had a second time laid in a stock of food, she again in the same way fed several ants on her way towards the nest; but this time five of those so fed returned with her to the honey. In due course these five would no doubt have brought others, and so the number at the honey would have increased.

Some species, however, act much more in association than others—*Formica fusca*, for instance, much less than *Lasius niger*. I have already given an illustration of what happens when a *L. niger* finds a store of food. The following is a great contrast. On the 28th March I was staying at Arcachon. It was a beautiful and very warm spring day, and numerous ants were coursing about on the flagstones in front of my hotel.

At about 10.45 I put a *F. fusca* to a raisin. She fed till 11.2, when she went almost straight to her nest, which was about 12 feet away. In a few minutes she came out again, and returned to the fruit, after a few small wanderings, at about 11.18. She then fed till 11.30, when she returned to the nest.

At 11.45 another ant accidentally found the fruit. I imprisoned her.

At 11.50 the first returned, and fed till 11.56, when she went off to the nest. On the way she met and talked with three ants, none of whom, however, came to the fruit. At 12.7 she returned, again alone, to the fruit.

On March 29 I repeated the same experiment. There were perhaps even more ants about than on the previous day.

At 9.45 I put one (N 1) to a raisin.	At 9.50 she went to [the nest.
9.55 I put another (N 2) to the raisin.	10.0 „ „
10.0 N 1 came back.	10.2 „ „
10.7 „ „	10.9 „ „
10.11 N 2 „	10.13 „ „
10.12 N 1 „	10.14 „ „
10.13 put another (N 3) to the raisin.	10.18 „ „
10.16 N 1 back.	10.17 „ „
10.22 N 2 „	10.24 „ „
(I here overpainted N 2, and she returned no more.)	
10.24 N 1 back.	At 10.26 went to the [nest.
10.30 N 1 „	10.32 „ „
10.33 N 3 „	10.35 „ „
10.35 N 1 „ (She met with an accident. At first she seemed a good deal hurt, but gradually recovered.)	
10.40 N 3 back.	At 10.46 she went to [the nest.
10.46 a stranger came; I bottled her.	
10.47 „ „ „	
10.52 N 1 back.	10.54 „ „
10.57 N 3 „	11.2 „ „
11.8 N 3 „	11.13 „ „
11.10 a stranger came; I removed her to a little distance.	
11.11 „ „ marked her N 4.	

11.16 N3 back.	At 11.18 went.	11.48 N1 came.	At 11.49 went.
11.23 N4 „	11.25 „	11.49 N4 „	11.50 „
11.24 N3 „	11.26 „	11.51 N1 „	11.53 „
11.27 N4 „	11.29 „	11.53 N3 „	11.56 „
11.31 N3 „	11.34 „	11.54 N4 „	11.56 „
11.32 N4 „	11.35 „	12.0 N3 „	12.2 „
11.40 N3 came.	11.42 „	„ N4 „	„ „
11.40 N4 „	„ „	„ N1 „	„ „
11.45 N3 „	11.47 „	12.5 N4 „	12.7 „
„ a stranger came.		12.6 N3 „	12.8 „

12.13	N3 came.	12.15 went.
12.14	N4 „	12.15 „
12.17	stranger came.	
12.19	N4 came.	12.20 „
12.20	N3 „	12.22 „
12.21	N1 „	12.25 „
12.25	N4 „	12.26 „
12.27	N3 „	12.28 „

12.30	N4 came.	12.32 went.
„	a stranger came.	
„	N3 (was disturbed)	12.37 „
12.38	N4 came.	12.40 „
12.42	N3 „	
12.47	N4 „	12.49 „

Thus during these three hours only six strangers came. The raisin must have seemed almost inexhaustible, and the watched ants in passing and repassing went close to many of their friends; they took no notice of them, however, and did not bring any out of the nest to cooperate with them in securing the food, though their regular visits showed how much they appreciated it.

Again (on the 15th July) an ant belonging to one of my nests of *Formica fusca* was out hunting. At 8.8 I put a spoonful of honey before her. She fed till 8.24, when she returned to the nest. Several others were running about. She returned as follows:—

9.10 to the honey, but was disturbed, ran away, and returned at 10.40. At 10.53 to the nest;

„	11.30	„ 11.40	„
„	12.5, but was disturbed; she ran away again, but		
„	1.30.	At 1.44 to the nest;	
„	2.0	„ 2.15	„
„	3.7	„ 3.17	„
„	3.34	„ 3.45	„
„	4.15	„ 4.23	„
„	4.52	„ 5.3	„
„	5.56	„ 6.10	„
„	6.25	„ 6.45	„
„	7.10	„ 7.18	„
„	7.45	„ 8.0	„
„	8.22	„ 8.32	„
„	9.18	„ 9.30	„
„	10.10	„ 10.20	„

During the whole day she brought no friend, and only one other ant found the honey, evidently an independent discovery.

Experiments testing Communication by Sound.

To test the power which ants might have of summoning one another by sound, I tried the following experiments. I put out on the board where one of my nests of *Lasius flavus* was usually fed, six small pillars of wood, about $1\frac{1}{2}$ inch high, and on one of them I put some honey. A number of ants were wandering about on the board itself in search of food, and the nest itself was immediately above and about 12 inches from the board. I then put three ants to the honey, and when each had sufficiently fed, I imprisoned her, and put another; thus always keeping three ants at the honey, but not allowing them to go home. If, then, they could summon their friends by sound, there ought soon to be many ants at the honey. The results were as follows:—

Sept. 8. Began at 11 A.M. Up to 3 o'clock only seven ants found their way to the honey, while about as many ran up the other pillars. The arrival of these seven, therefore, was not more than would naturally result from the numbers running about close by. At 3 we allowed the ants then on the honey to return home. The result was that from 3.6, when the first went home, to 3.30, 11 came, from 3.30 to 4 no less than 43. Thus in four hours only 7 came; while it is obvious that many would have wished to come if they had known about the honey, because in the next three quarters of an hour, when they were informed of it, 54 came.

On the 10th Sept. we tried the same again, keeping as before three ants on the honey, but not allowing any to go home. From 12 to 5.30 only eight came. They were then allowed to take the news. From 5.30 to 6, 4 came; from 6 to 6.30, 4; from 6.30 to 7, 8; from 7.30 to 8 no less than 51.

On the 23rd Sept. we did the same again, beginning at 11.15. Up to 3.45 nine came. They were then allowed to go home. From 4 to 4.30, 9 came; from 4.30 to 5, 15; from 5 to 5.30, 19; from 5.30 to 6, 38. Thus in $3\frac{1}{2}$ hours 9 came; in 2, when the ants were permitted to return, 81.

Again, on Sept. 30, I tried the same arrangement again, beginning at 11. Up to 3.30 seven ants came. We then let them go. From 3.30 to 4.30, 28 came; from 4.30 to 5, 51 came. Thus in four hours and a half only 7 came; while when they were allowed to return, no less than 79 came in an hour and a half.

It seems obvious, therefore, that in these cases no communication was transmitted by sound.

Experiments testing Affection.

To test the affection of ants belonging to the same nest for one another, I tried the following experiments. I took six ants from a nest of *Formica fusca*, imprisoned them in a small bottle, one end of which was left open, but covered by a layer of muslin. I then put the bottle close to the door of the nest. The muslin was of open texture, the meshes, however, being sufficiently large to prevent the ants from escaping. They could not only, however, see one another, but communicate freely with their antennæ. We now watched to see whether the prisoners would be tended or fed by their friends. We could not, however, observe that the least notice was taken of them. The experiment, nevertheless, was less conclusive than could be wished, because they might have fed at night, or at some time when we were not looking. It struck me, therefore, that it would be interesting to treat some strangers also in the same manner.

On Sept. 2, therefore, I put two ants from one of my nests of *F. fusca* into a bottle, the end of which was tied up with muslin as described, and laid it down close to the nest. In a second bottle I put two ants from another nest of the same species. The ants which were at liberty took no notice of the bottle containing their imprisoned friends. The strangers in the other bottle, on the contrary, excited them considerably. The whole day one, two, or more ants stood sentry, as it were, over the bottle. In the evening no less than twelve were collected round it, a larger number than usually came out of the nest at any one time. The whole of the next two days, in the same way, there were more or less ants round the bottle containing the strangers; while, as far as we could see, no notice whatever was taken of the friends. On the 9th the ants had eaten through the muslin, and effected an entrance. We did not chance to be on the spot at the moment; but as I found two ants lying dead, one in the bottle and one just outside, I think there can be no doubt that the strangers were put to death. The friends throughout were quite neglected.

Sept. 21.—I then repeated the experiment, putting three ants from another nest in a bottle as before. The same scene was repeated. The friends were neglected. On the other hand, some of the ants were always watching over the bottle containing the strangers, and biting at the muslin which protected them. The next morning at 6 A.M. I found five ants thus occupied. One had caught hold of the leg of one of the strangers, which had unwarily been allowed to protrude through the meshes of the muslin. They worked and watched, though not, as far as I could see, with any system, till 7.30 in the evening, when they effected an entrance, and immediately attacked the strangers.

Sept. 24.—I repeated the same experiment with the same nest. Again the ants came and sat over the bottle containing the strangers, while no notice was taken of the friends.

The next morning again, when I got up, I found five ants round the bottle containing the strangers, none near the friends. As in the former case, one of the ants had seized a stranger by the leg, and was trying to drag her through the muslin. All day the ants clustered round the bottle, and bit perseveringly, though not systematically, at the muslin. The same thing happened all the following day.

These observations seemed to me sufficiently to test the behaviour of the ants belonging to this nest under these circumstances. I thought it desirable, however, to try also other communities. I selected, therefore, two other nests. One was a community of *Polyergus rufescens* with numerous slaves. Close to where the ants of this nest came to feed, I placed as before two small bottles, closed in the same way—one containing two slave ants from the nest, the other two strangers. These ants, however, behaved quite unlike the preceding, for they took no notice of either bottle, and showed no sign either of affection or hatred. One is almost tempted to surmise that the war-like spirit of these ants was broken by slavery.

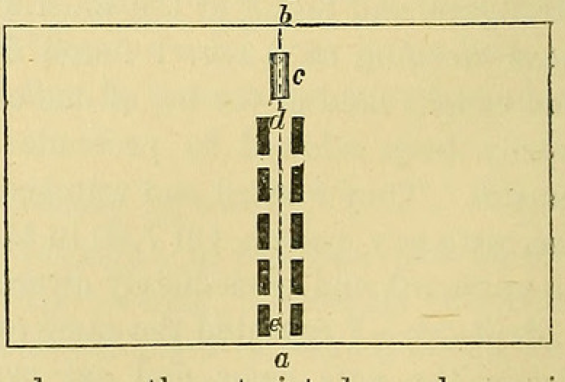
The other nest which I tried, also a community of *Formica fusca*, behaved exactly like the first. They took no notice of the bottle containing the friends, but clustered round and eventually forced their way into that containing the strangers.

It seems, therefore, that in these curious insects hatred is a stronger passion than affection.

Experiments showing the importance of the Sense of Smell to certain Ants.

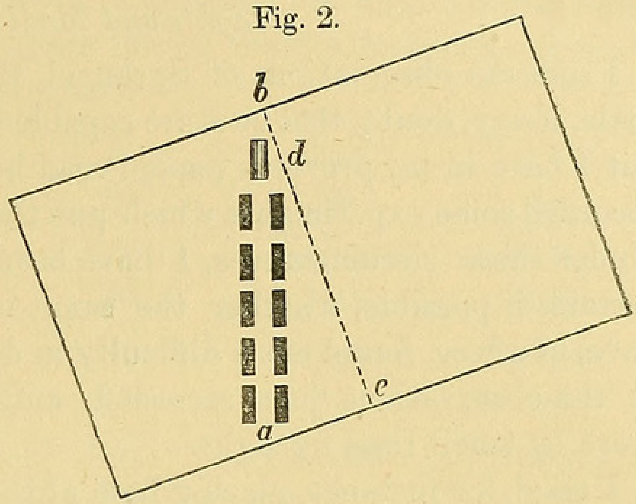
In order further to test how far ants are guided by sight and how much by scent, I tried the following experiment with *Lasius niger*. Some food was put out at the point *a* on a board measuring 20 inches by 12 (fig. 1), and so arranged that the ants in going straight to it from the nest would reach the board at the point *b*, and after passing under a paper tunnel, *c*, would proceed between five pairs of wooden bricks, each 3 inches in length and 1¾ in height. When they got to know their way, they went quite straight along the line *d e* to *a*. The board was then twisted as shown in fig. 2. The bricks and tunnel being arranged exactly in the same direction as before, but the board having been moved,

Fig. 1.



the line *d e* was now outside them. This change, however, did not at all discompose the ants; but instead of going, as before, through the tunnel and between the rows of bricks to *a*, they walked exactly along the old path to *e*.

Fig. 2.



I then arranged matters as before, but without the tunnel and with only three pairs of bricks (fig. 3). When an ant had got quite used to the path *d* to *e*, I altered the position of the bricks and food to *f* (fig. 4), making a difference of 8 inches in the position of the latter. The ant came as before, walked up to the first brick, touched it with her antennæ, but then followed her old line to *a*. From there she veered towards the food, and very soon found it. When she was gone, I altered it again, as shown in fig. 5; she returned after the usual interval, and went again straight to *a*; then, after some wanderings, to *f*, and at length, but only after a lapse of 25 minutes, found the food at *g*. These experiments were repeated more than once, and always with similar results. I then varied matters by removing the bricks, which, however, did not seem to make any difference to the ants.

Fig. 3.

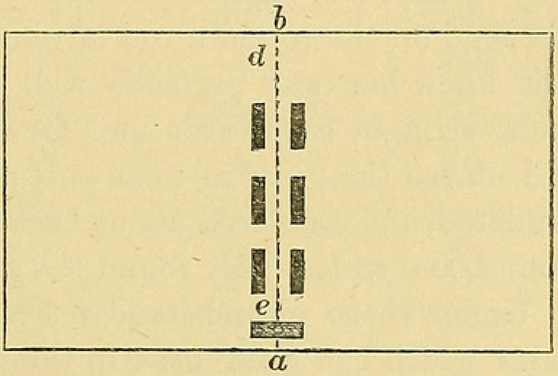


Fig. 4.

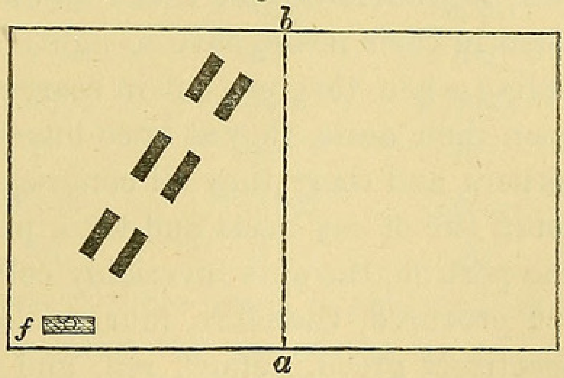
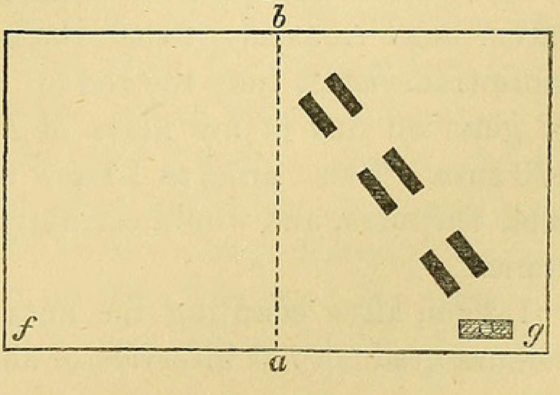


Fig. 5.



Experiments showing how Ants are affected by different coloured Lights and Media.

From the observations of Sprengel there could of course be little, if any, doubt, that bees are capable of distinguishing colours; but I have in my previous papers read before the Linnean Society recorded some experiments which put the matter beyond a doubt. Under these circumstances, I have been naturally anxious to ascertain, if possible, whether the same is the case with ants. I have, however, found more difficulty in doing so, because, as shown in the observations just recorded, ants find their food so much more by smell than by sight.

I tried, for instance, placing food at the bottom of a pillar of coloured paper, and then moving both the pillar and food. The pillar, however, did not seem to help the ant (*Lasius niger*) at all to find her way to the food. I then, as recorded in my previous paper, placed the food on the top of a rod of wood 8 inches high, and when the ant knew her way perfectly well to the food so that she went quite straight backwards and forwards to the nest, I found that if I moved the pillar of wood only six inches, the ant was quite bewildered, and wandered about backwards and forwards, round and round, and at last only found the pillar, as it were, accidentally.

Under these circumstances, I could not apply to ants those tests which had been used in the case of bees. At length, however, it occurred to me that I might utilize the dislike which ants, when in their nests, have to light. Of course they have no such feeling when they are out in search of food; but if light is let in upon their nests, they at once hurry about in search of the darkest corners, and there they all congregate. If, for instance, I uncovered one of my nests and then placed an opake substance over one portion, the ants invariably collected in the shaded part.

I procured, therefore, four similar strips of glass, coloured respectively green, yellow, red, and blue, or, rather, violet. The yellow was rather paler in shade, and that glass consequently rather more transparent than the green, which, again, was rather more transparent than the red or violet. I then laid the strips of glass on one of my nests of *Formica fusca* containing about 170 ants. These ants, as I knew by many previous observations, seek darkness, and would certainly collect under any opake substance.

I then, after counting the ants under each strip, moved the colours gradually at intervals of about half an hour, so that each should by turns cover the same portion of the nest. The results were as follows—the numbers indicating the approximate numbers of ants under each glass (there were sometimes a few not under any of the strips of glass):—

1.	Green.	Yellow.	Red.	Violet.
	50	40	80	0
2.	Violet.	Green.	Yellow.	Red.
	0	20	40	100
3.	Red.	Violet.	Green.	Yellow.
	60	0	50	50
4.	Yellow.	Red.	Violet.	Green.
	50	70	1	40
5.	Green.	Yellow.	Red.	Violet.
	30	30	100	0
6.	Violet.	Green.	Yellow.	Red.
	0	14	5	140
7.	Red.	Violet.	Green.	Yellow.
	50	0	40	70
8.	Yellow.	Red.	Violet.	Green.
	40	50	1	70
9.	Green.	Yellow.	Red.	Violet.
	60	35	65	0
10.	Violet.	Green.	Yellow.	Red.
	1	50	40	70
11.	Red.	Violet.	Green.	Yellow.
	50	2	50	60
12.	Yellow.	Red.	Violet.	Green.
	35	55	0	70

Adding these numbers together, there were, in the twelve observations, under the red 890, under the green 544, under the yellow 495, and under the violet only 5. The difference between the red and the green is very striking, and would doubtless have been more so, but for the fact that when the colours were transposed the ants which had collected under the red sometimes remained quiet, as, for instance, in cases 7 and 8. Again, the difference between the green and yellow would have been still more marked but for the fact that the yellow always occupied the position last held by the red, while, on the other hand, the green had some advantage in coming next the violet. In considering the difference between the yellow and green, we must remember also that the green was decidedly more opake than the yellow.

The case of the violet glass is more marked and more interesting. To our eyes the violet was as opake as the red, more so than the green, and much more so than the yellow. Yet, as the numbers show, the ants had scarcely any tendency to congregate under it. There were nearly as many under the same area of the uncovered portion of the nest as under that shaded by the violet glass.

Lasius flavus also showed a marked avoidance of the violet glass.

I then experimented in the same way with a nest of *Formica fusca*, in which there were some pupæ, which were generally collected in a single heap. I used glasses coloured dark yellow, dark green, light yellow, light green, red, violet, and dark purple. The colours were always in the preceding order, but, as before, their place over the nest was changed after every observation.

To our eyes the purple was almost black, the violet and dark green very dark and quite opake; the pupæ could be dimly seen through the red, rather more clearly through the dark yellow and light green, while the light yellow were almost transparent. There were about 50 pupæ, and the light was the ordinary diffused daylight of summer. (See Table, p. 281.)

These observations show a marked preference for the greens and yellows. The pupæ were $6\frac{1}{2}$ times under dark green, 3 under dark yellow, $3\frac{1}{2}$ under red, and once each under light yellow and light green, the violet and purple being altogether neglected.

I now tried the same ants under the same colours, only in the sun; and placed a shallow dish containing some 10 per cent. solution of alum sometimes over the yellow, sometimes over the red. I also put four thicknesses of violet glass, so that it looked almost black. (See Table, p. 282.)

Under these circumstances, the pupæ were placed under the red $7\frac{1}{2}$ times, dark yellow $5\frac{1}{2}$, and never under the violet, purple, light yellow, dark or light green.

The following day I placed over the same nest, in the sun, dark green glass, dark red and dark yellow (two layers of each). In nine observations the pupæ were carried 3 times under the red and nine times under the yellow.

I then tried a similar series of experiments with *Lasius niger*, using part of a nest in which were about 40 pupæ, which were generally collected in a single heap all together. As before, the glasses were moved in regular order after each

1.	Dark yellow.	Dark green.	Light yellow.	Light green.	Red.	Violet.	Purple.	The pupæ were placed under dark green.
2.	Purple.	Dark yellow.	Dark green.	Light yellow.	Light green.	Red.	Violet.	„ „ „
3.	Violet.	Purple.	Dark yellow.	Light yellow.	Dark green.	Light green.	Red.	„ „ light yellow.
4.	Red.	Violet.	Purple.	Dark yellow.	Light yellow.	Dark green.	Light green.	„ „ dark green.
5.	Light green.	Red.	Violet.	Purple.	Dark yellow.	Light yellow.	Dark green.	„ „ dark yellow.
6.	Dark green.	Light green.	Red.	Violet.	Purple.	Dark yellow.	Light yellow.	„ „ „
7.	Light yellow.	Dark green.	Light green.	Red.	Violet.	Purple.	Dark yellow.	„ „ light green.
8.	Dark yellow.	Light yellow.	Light yellow.	Light green.	Red.	Violet.	Purple.	„ „ dark green.
9.	Purple.	Dark yellow.	Dark yellow.	Dark green.	Light green.	Red.	Violet.	„ „ „
10.	Violet.	Purple.	Purple.	Light yellow.	Dark green.	Light green.	Red.	„ „ red.
11.	Red.	Red.		Dark yellow.	Light yellow.	Dark green.	Light green.	„ „ dark green.
12.	Light yellow.	Purple.	Light green.	Dark yellow.	Dark green.	Violet.	Red.	„ „ dark green 30; red 30.
13.	Red.	Light yellow.	Purple.	Light green.	Dark yellow.	Dark green.	Violet.	„ „ „ „
14.	Violet.	Red.	Light yellow.	Purple.	Light green.	Dark yellow.	Dark green.	„ „ „ „
15.	Dark green.	Violet.	Red.	Light yellow.	Purple.	Light green.	Dark yellow.	„ „ dark yellow 20; red 40.

1.	Dark yellow.	Dark green.	Violet.	Red.	Light yellow.	Purple.	Light green.	Pupæ under	red.
2.	Light green.	Dark yellow.	Dark green.	Violet.	Red.	Light yellow.	Purple.	,,	,,
3.	Purple.	Light green.	Dark yellow.	Dark green.	Violet.	Red.	Light yellow.	,,	,,
4.	Light yellow.	Purple.	Light green.	Dark yellow.	Dark green.	Violet.	Red and alum solution.	,,	dark yellow.
5.	Red.	Light yellow.	Purple.	Light green.	Dark yellow.	Dark green.	Violet.	,,	red 20, dark yellow 40.
6.	Violet.	Red.	Light yellow.	Purple.	Light green.	Dark yellow and alum solution.	Dark green.	,,	dark yellow.
7.	Dark green.	Violet.	Red.	Light yellow.	Purple.	Light green.	Dark yellow and alum solution.	,,	,,
8.	Dark yellow and alum solution.	Dark green.	Violet.	Red.	Light yellow.	Purple.	Light green.	,,	,,
9.	Light green.	Dark yellow and alum solution.	Dark green.	Violet.	Red.	Light yellow.	Purple.	,,	,,
10.	Purple.	Light green.	Dark yellow.	Dark green.	Violet.	Red and alum solution.	Light yellow.	,,	red.
11.	Red and alum solution.	Light yellow.	Light green.	Dark yellow.	Dark green.	Violet.	Purple.	,,	,,
12.	Purple.	Red and alum solution.	Light yellow.	Light green.	Dark yellow.	Dark green.	Violet.	,,	,,
13.	Dark green.	Violet.	Red and alum solution.	Light yellow.	Light green.	Dark yellow.	Purple.	,,	,,

experiment; and I arranged them so that the violet followed the red. As far, therefore, as position was concerned, this gave violet rather the best place. The glasses used were dark violet, dark red, dark green, and yellow, the yellow being distinctly the most transparent to our eyes.

Experiment.			Experiment.		
1.	Pupæ under	yellow.	17.	Pupæ under	yellow.
2.	”	”	18.	”	”
3.	”	”	19.	”	red.
4.	”	”	20.	”	”
5.	”	”	21.	”	yellow.
6.	”	”	22.	”	”
7.	”	green.	23.	”	”
8.	”	”	24.	”	red.
9.	”	red.	25.	”	yellow.
10.	”	yellow.	26.	”	red.
11.	”	red.	27.	”	”
12.	”	yellow.	28.	”	”
13.	”	”	29.	”	”
14.	”	red.	30.	”	yellow.
15.	”	green.	31.	”	red.
16.	”	”	32.	”	green.

I now put two extra thicknesses of glass over the red and green.

33.	Pupæ under	red.	37.	Pupæ under	red.
34.	”	yellow.	38.	”	”
35.	”	red.	39.	”	yellow.
36.	”	yellow.	40.	”	red.

The result is very striking, and in accordance with the observations on *Formica fusca*. In 40 experiments the pupæ were carried under the yellow 19 times, under the red 16 times, and under the green 5 times only, while the violet was quite neglected. After the first twenty observations, however, I removed it.

I then tried a nest of *Cremastogaster scutellaris* with violet glass, purple glass, and red, yellow, and green solutions, formed respectively with fuchsine, bichromate of potash, and chloride of copper. The purple looked almost black, the violet very dark; the red and green, on the contrary, very transparent, and the yellow even more so. The yellow was not darker than a tincture of saffron. The latter indeed, to my eye, scarcely seemed to render the insects under them at all less apparent; while under the violet and purple I could not trace them at all. I altered the relative positions as before. The nest contained about 50 larvæ and pupæ.

Observation.					
1.	Violet gl.	Purple gl.	....	Bichr. pot.	Fuchsine.
2.	....	Bichr. pot.	Fuchsine.	Violet gl.	Purple gl.
3.	Fuchsine.	Violet gl.	Purple gl.	....	Bichr. pot.
4.	Green.	Bichr. pot.	Violet gl.	Purple gl.	Fuchsine.
5.	Violet gl.	Purpl. gl.	Fuchsine.	....	Bichr. pot.
6.	Fuchsine.	....	Bichr. pot.	Purple gl.	Violet gl.
7.	Violet gl.	Fuchsine.	....	Bichr. pot.	Purple gl.
8.	Purple gl.	Violet gl.	Fuchsine.	....	Bichr. pot.
9.	Bichr. pot.	Purple gl.	Violet gl.	....	Bichr. pot.
10.	Fuchsine.	....	Bichr. pot.	Purpl. gl.	Violet gl.

Pupæ and larvæ half under the yellow and half under the green.

I then poured out half the yellow and green solutions and filled them up with water, making them even lighter in colour as before.

Observation.					
12.......	Purple gl.	....	Violet gl.	Fuchsine.	Bichr. pot.
13.......	Bichr. pot.	Purpl. gl.	....	Violet gl.	Fuchsine.

Pupæ and larvæ half under the yellow and half under the green.

Thus in every case the larvæ and pupæ were brought under the yellow or the green.

Aug. 20.—Over a nest of *Formica fusca* containing about 20 pupæ I placed violet glass, purple glass, a weak solution of fuchsine (carmine), the same of chloride of copper (green), and of bichromate of potash (yellow, not darker than saffron).

1.	Violet.	Purple.	Green.	Yellow.	Red.	The pupæ were	placed under	the yellow.
2.	Red.	Violet.	Purple.	Green.	Yellow.	„	„	„
3.	Yellow.	Red.	Violet.	Purple.	Green.	„	„	„
4.	Green.	Yellow.	Red.	Violet.	Purple.	„	„	„
5.	Purple.	Green.	Yellow.	Red.	Violet.	„	„	„
6.	Violet.	Purple.	Green.	Yellow.	Red.	„	„	„
7.	Red.	Violet.	Purple.	Green.	Yellow.	„	„	green and yellow.
8.	Yellow.	Red.	Violet.	Purple.	Green.	„	„	yellow.
9.	Green.	Yellow.	Red.	Violet.	Purple.	„	„	green and yellow.
10.	Purple.	Green.	Yellow.	Red.	Violet.	„	„	yellow.
11.	Violet.	Purple.	Green.	Yellow.	Red.	„	„	„

Here, again, in every case the pupæ were brought under the yellow or the green.

I then tried a nest of *Lasius flavus* with the purple glass, violet glass, the very weak bichromate of potash, and chloride of copper as before.

Observation.					[and green.
1.	Yellow.	Green.	Purple.	Violet.	The pupæ were brought under the yellow
2.	Violet.	Yellow.	Green.	Purple.	,, ,, green.
3.	Purple.	Violet.	Yellow.	Green.	,, ,, ,,
4.	Green.	Purple.	Violet.	Yellow	,, ,, ,,
5.	Yellow.	Green.	Purple.	Violet.	,, ,, yellow.
6.	Violet.	Yellow.	Green.	Purple.	,, ,, green.

The results, then, were the same as in the previous cases.

In these experiments, then, the violet and purple affected the ants much more strongly than the yellow and green.

It is curious that the coloured glasses appear to act on the ants (speaking roughly) as they would, or, I should rather say, inversely as they would, on a photographic plate. It might even be alleged that the avoidance of the violet glass by the ants was due to the chemical rays which are transmitted. From the habits of these insects such an explanation is very improbable. If, however, the preference for the other coloured glasses to the violet was due to the transmission and not to the absorption of rays—that is to say, if the ants went under the green rather than the violet because the green or red transmitted rays which were agreeable to the ants, and which the violet glass, on the contrary, stopped—then, if the violet was placed over the other colours, they would become as distasteful to the ants as the violet itself. On the contrary, however, whether the violet glass was placed over the others or not, the ants equally readily took shelter under them. Obviously, therefore, the ants avoid the violet glass because they dislike the rays which it transmits.

Mr. Busk suggested that as the red glass stops the chemical rays more effectually than the yellow or green, while the violet is most transparent to them, and as the ants prefer the red glass to the yellow or green, and these, again, to the violet, possibly the explanation might be that the chemical rays were peculiarly distasteful to them. To test this, therefore, I made some experiments with fluorescent liquids which Mr. Hanbury was kind enough to procure for me from Mr. Benger, of Manchester. They were prepared by M. Caro, of Manheim. One was opake grass-green by reflected light and orange by transmitted; one violet by transmitted light and red by reflected; and a third green by transmitted and red by reflected light. I believe their exact chemical composition is not known, but that, in all cases, fluorescine is the principal ingredient. They stop the chemical rays, or rather turn them into visible rays. The action takes place altogether at the surface of the liquids, so that it is not necessary to use any large quantity. I poured them into shallow glass cells about $\frac{1}{2}$ inch deep, which I put, as before, over the ants. If now they were affected mainly by the chemical rays, it must appear to them to be dark under these solutions. This, however, was not the case. The solutions seemed to make no difference to them. I also tried quinine and uranium glass with the same effect.

In order to ascertain what colours were transmitted by these several media, I then tested them with the spectroscope, and with the following results :—

The violet glass	transmitted	violet, blue, some green and yellow to about the line D in the spectrum or a trifle beyond.
,, ,, (double)	transmitted	violet and blue with tinge of red.
green glass	,,	most of blue, and about to line "*a*."
,, ,, (double)	,,	green, yellow, and red to about line "C."
,, ,, (dark)	,,	green and some yellow.
yellow ,,	,,	the spectrum from red end to about half-way between "F" and "S."
,, ,, (dark)	,,	from red to end of green about "F."
red ,,	,,	red with a touch of orange.
,, ,, (double)	,,	only red.
purple ,,	,,	a little violet, a little yellow, orange, and red.

Amm. sulph. of copper	(blue)	transmitted	violet and blue only.
Chloride of copper ...	(green)	,,	green, an edging of blue, and faint yellow with an edging of orange.
Saffron..................		,,	every thing except violet and blue.
Bichromate of potash	(orange)	,,	red, orange, yellow, and very little green.
,,	(very pale yellow)	,,	red, orange, yellow, and green.
Fuchsine	(carmine)	,,	red only.
Solution of carmine ..	,,	,,	,,
Solution of iodine	,,	,,	red, orange, and a very little yellow.

But though the ants so markedly avoided the violet glass, still, as might be expected, the violet glass certainly had some effect, because if it was put over the nest alone, the ants preferred being under it to being under the plain glass only.

I then compared the violet glass with a solution of ammonio-sulphate of copper, which is very similar, though perhaps a little more violet, and arranged the depth of the fluid so as to make it as nearly as possible of the same depth of colour as the glass.

Approx. number of Ants under the	Exp. 1.	Exp. 2.	Exp. 3.	Exp. 4.	Exp. 5.	Exp. 6.
Glass............	0	0	0	2	0	2
Solution	40	80	100	80	50	70

Exp. 7.	Exp. 8.	Exp. 9.	Exp. 10.	Total.
0	2	3	0	9
60	40	90	100	710

In another experiment with *Lasius niger* I used the dark yellow glass, dark violet glass, and a violet solution of 5 per cent. ammonio-sulphate of copper, diluted so as to be, to my eye, of exactly the same tint as the violet glass ; in 8 observations the pupæ were three times under the violet solution, and 5 times under the yellow glass. I then removed the yellow glass, and in 10 more observations the pupæ were always brought under the solution.

It is interesting that the glass and the solution should affect the ants so differently, because to my eye the two were almost identical in colour. The glass, however, was more transparent than the solution.

To see whether there would be the same difference between red glass and red solution as between violet glass and violet solution, I then (Aug. 21) put over a nest of *Formica fusca* a red glass and a solution of carmine, as nearly as I could make it of the same tint. In 10 experiments, however, the ants were, generally speaking, some under the solution and some under the glass, in, moreover, as nearly as possible equal numbers.

Aug. 20.—Over a nest of *Formica fusca* containing 20 pupæ, I placed a saturated solution of bichromate of potash, a deep solution of carmine, which let through scarcely any but the red rays, and a white porcelain plate.

Observation							
1.	Under the bichromate of potash were	0 pupæ,	carmine	18,	porcelain	2.
2.	,,	,,	0 ,,	,,	6	,,	14.
3.	,,	,,	6 ,,	,,	3	,,	11.
4.	,,	,,	0 ,,	,,	5	,,	18.
5.	,,	,,	6 ,,	,,	4	,,	10.
6.	,,	,,	0 ,,	,,	19	,,	1.
7.	,,	,,	0 ,,	,,	0	,,	20.
8.	,,	,,	4 ,,	,,	15	,,	1.
9.	,,	,,	2 ,,	,,	4	,,	14.
10.	,,	,,	0 ,,	,,	4	,,	16.
11.	,,	,,	0 ,,	,,	3	,,	17.
	Total.......		18		81		124

I then put over another nest of *Formica fusca* four layers of red glass (which, when examined with the spectroscope, let through red light only), four layers of green glass (which, examined in the same way, transmitted nothing but a very little green), and a porcelain plate. Under these circumstances the ants showed no marked preference, but appeared to feel equally protected, whether they were under the red glass, the green glass, or the porcelain.

Thus, though it appears from other experiments that ants are affected by red light, still the quantity that passes through dark red glass does not seem to disturb them. I tested this again by placing over a nest containing a queen and about 10 pupæ a piece of opake porcelain, one of violet, and one of red glass, all of the same size. The result is shown below.

Observation.						
1.	Queen went under red glass.	5	pupæ were taken under red glass,	2	under porcelain.
2.	,, porcelain.	0	,, ,,	7	,,
3.	,, red glass.	0	,, ,,	7	,,
4.	,, ,,	6	,, ,,	2	,,
5.	,, ,,	6	,, ,,	2	,,
6.	,, ,,	3	,, ,,	7	,,
7.	,, ,,	10	,, ,,	0	,,
8.	,, ,,	4	,, ,,	6	,,
9.	,, ,,	1	,, ,,	0	,,
10.	,, porcelain.	0	,, ,,	10	,,
11.	,, red glass.	10	,, ,,	0	,,
12.	,, porcelain.	4	,, ,,	6	,,
13.	,, red glass.	7	,, ,,	3	,,
14.	,, porcelain.	4	,, ,,	6	,,
15.	,, red glass.	4	,, ,,	6	,,
16.	,, porcelain.	0	,, ,,	10	,,
17.	,, red glass.	10	,, ,,	0	,,
18.	,, ,,	8	,, ,,	2	,,
19.	,, porcelain.	7	,, ,,	3	,,
20.	,, ,,	1	,, ,,	9	,,
		90		88	

Obviously, therefore, the ants showed no marked preference for the porcelain. On one, but only on one occasion (Obs. 9), most of the pupæ were carried under the violet glass, but generally it was quite neglected.

I now tried a similar experiment with two layers of yellow glass.

Obs.								
1.	Queen	went under the	porcelain.	8	pupæ were taken	under yellow,	2	under porcelain.
2.	,,	,,	,,	2	,	,,	8	,,
3.	,,	,,	,,	8	,,	,,	2	,,
4.	,,	,,	yellow glass.	5	,,	,,	5	,,
5.	,,	,,	porcelain.	3	,,	,,	8	,,
6.	,,	,,	yellow glass.	8	,,	,,	3	,,
7.	,,	,,	porcelain.	6	,,	,,	5	,,
8.	,,	,,	,,	0	,,	,,	7	,,
9.	,,	,,	,,	0	,,	,,	10	,,
10.	,,	,,	yellow glass.	9	,,	,,	1	,,
11.	,,	,,	porcelain.	8	,,	,,	2	,,
12.	,,	,,	,,	3	,,	,,	7	,,
13.	,,	,,	yellow glass.	10	,,	,,	0	,,
14.	,,	,,	porcelain.	0	,,	,,	10	,,
15.	,,	,,	yellow glass.	10	,,	,,	0	,,
16.	,,	,,	,,	7	,,	,,	3	,,
17.	,,	,,	,,	10	,,	,,	0	,,
18.	,,	,,	porcelain.	1	,,	,,	9	,,
19.	,,	,,	,,	0	,,	,,	10	,,
				98			92	

I then put two ants on a paper bridge, the ends supported by pins, the bases of which were in water. The ants wandered backwards and forwards, endeavouring to escape. I then placed the bridge in the dark and threw the spectrum on it, so that successively the red, yellow, green, blue, and violet fell on the bridge. The ants, however, walked backwards and forwards without (perhaps from excitement) taking any notice of the colour.

I then allowed some ants (*Lasius niger*) to find some larvæ, to which they obtained access over a narrow paper bridge. When they had got used to it, I arranged so that it passed through a dark box, and threw on it the principal colours of the spectrum, namely, red, yellow, green, blue, and violet, as well as the ultra-red and ultra-violet; but the ants took no notice.

At the suggestion of Prof. Stokes, I then tried the following experiments. Mr. Spottiswoode not only most kindly placed the rich resources of his laboratory at my disposal, but he and his able assistant Mr. Ward were good enough to arrange the apparatus for me.

We tried the ants with coloured lights in a Bunsen's burner, using chloride of strontium and carbonate of lithia for red, chloride of barium for green, and chloride of sodium for yellow. The lithium gives an almost pure red, the strontium and barium give a little yellow, but so little that I do not think it would affect the ants.

The ants on which we experimented were *Formica fusca* and *F. cinerea* and *Cremastogaster scutellaris*; but it was rather too late in the season, and they were somewhat torpid.

The yellow of the soda-flame certainly affected the *Formica cinerea*, but the others seemed to take no notice of it.

The barium also affected the *F. cinerea*, but neither of the others; I could not feel sure whether it was the green or the accompanying yellow which disturbed them. The red of the lithium was not so brilliant, still the *F. cinerea* seemed to perceive it.

The strontium-flame did not seem to have any effect on the ants.

It is obvious that these facts suggest a number of interesting inferences. I must, however, repeat the observations and make others; but we may at least, I think, conclude from the preceding that:—(1) ants have the power of distinguishing colour; (2) that they are very sensitive to violet; and it would also seem (3) that their sensations of colour must be very different from those produced upon us.

As to the Longevity of Ants.

I have been much surprised at the longevity of my ants. I have still two queens of *Formica fusca** which have been with me since 1874. They must therefore now be at any rate four years old; but as they were probably a year old when I captured them, they would now be not less than five years old. As regards workers, I have some specimens of *Formica sanguinea* and *F. fusca* which M. Forel was so good as to send me from Munich in the beginning of September 1875, some *F. cinerea* which I brought back from Castellamare in Nov. 1875, and a great many belonging to various species which have been with me since 1876.

On the Butterflies in the Collection of the British Museum hitherto referred to the Genus *Euplœa* of Fabricius. By ARTHUR G. BUTLER, F.L.S., &c.

[Read February 21, 1878.]

IN the year 1866 I published a "Monograph of the Diurnal Lepidoptera belonging to the Genus *Euplœa*," in the 'Proceedings of the Zoological Society.' In this memoir I split up the group into arbitrary and, as I now see, very unnatural divisions, overlooking the fact that several natural genera existed.

* These ants are still alive, Aug. 1878.