

## HOMING FACULTY OF HYMENOPTERA

**I**N connection with Sir John Lubbock's paper at the British Association, in which this subject is treated, it is perhaps worth while to describe some experiments which I made last year. The question to be answered is whether bees find their way home merely by their knowledge of landmarks or by means of some mysterious faculty usually termed a sense of direction. The ordinary impression appears to have been that they do so in virtue of some such sense, and are therefore independent of any special knowledge of the district in which they may be suddenly liberated; and, as Sir John Lubbock observes, this impression was corroborated by the experiments of M. Fabre. The conclusions drawn from these experiments, however, appeared to me, as they appeared to Sir John, unwarranted by the facts; and therefore, like him, I repeated them with certain variations. In the result I satisfied myself that the bees depend entirely upon their special knowledge of district or land-marks, and it is because my experiments thus fully corroborate those which were made by Sir John that it now occurs to me to publish them.

The house where I conducted the observations is situated several hundred yards from the coast, with flower gardens on each side and lawns between the house and the sea. Therefore bees starting from the house would find their honey on either side of it, while the lawns in front would be rarely or never visited—being themselves barren of honey and leading only to the sea. Such being the geographical conditions, I placed a hive of bees in one of the front rooms on the basement of the house. When the bees became thoroughly well acquainted with their new quarters by flying in and out of the open window for a fortnight, I began the experiments. The *modus operandi* consisted in closing the window after dark when all the bees were in their hive, and also slipping a glass shutter in front of the hive door, so that all the bees were doubly imprisoned. Next morning I slightly raised the glass shutter, thus enabling any desired number of bees to escape. When the desired number had escaped, the glass shutter was again closed, and all the liberated bees were caught as they buzzed about the inside of the shut window. These bees were then counted into a box, the window of the room opened, and a card well smeared over with birdlime placed upon the threshold of the bee-hive, or just in front of the closed glass shutter. The object of all these arrangements was to obviate the necessity of marking the bees, and so to enable me not merely to experiment with ease upon any number of individuals that I might desire, but also to feel confident that no one individual could return to the hive unnoticed. For whenever a bee returned it was certain to become entangled in the bird-lime, and whenever I found a bee so entangled, I was certain that it was one which I had taken from the hive, as there were no other hives in the neighbourhood.

Such being the method, I began by taking a score of bees in the box out to sea, where there could be no landmarks to guide the insects home. Had any of these insects returned, I should next have taken another score out to sea (after an interval of several days, so as to be sure that the first lot had become permanently lost), and then, before liberating them, have rotated the box in a sling for a considerable time, in order to see whether this would have confused their sense of direction. But, as none of the bees returned after the first experiment, it was clearly needless to proceed to the second. Accordingly I liberated the next lot of bees on the sea-shore, and, as none of these returned, I liberated another lot on the lawn between the shore and the house. I was somewhat surprised to find that neither did any of these return, although the distance from the lawn to the hive was not above 200 yards. Lastly, I liberated bees in different

parts of the flower garden, and these I always found stuck upon the bird-lime within a few minutes of their liberation. Indeed, they often arrived before I had had time to run from the place where I had liberated them to the hive. Now, as the garden was a large one, many of these bees had to fly a greater distance, in order to reach the hive, than was the case with their lost sisters upon the lawn, and therefore I could have no doubt that their uniform success in finding their way home so immediately was due to their special knowledge of the flower garden, and not to any general sense of direction.

I may add that, while in Germany a few weeks ago, I tried on several species of ant the same experiments as Sir John Lubbock describes in his paper as having been tried by him upon English species, and here also I obtained identical results: in all cases the ants were hopelessly lost if liberated more than a moderate distance from their nest.

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## THE HEIGHTS OF CLOUDS

**F**ROM the Upsala Observatory comes an account of fairly exact measurements of the heights of clouds during the summer of last year, and a very interesting publication it is. It appears that when the circumpolar expeditions were planned the Swedish Meteorological Observatory furnished their station at Spitzbergen with three theodolites, of a somewhat novel though simple construction, for the double purpose of observing the altitude of the aurora and that of clouds. The difficulty that has always been felt in such observations has been that of easy intercommunication between the different observers, so as to fix on the particular part of the cloud of which the height was to be measured. Thanks to modern invention this difficulty was got over by connecting each station with a telephone. The reported good results obtained at the circumpolar station—the publication of which, by the by, has not been done as yet—induced Herr Hildebrandsson, the director of the meteorological observatory at Upsala, to commence a set of similar observations there. On a couple of pillars, about 450 yards apart, and placed on an approximately north and south line, a couple of theodolites were erected, the stations being connected by telephones. The theodolites employed may be described as ordinary theodolites, the object glass of the telescope being replaced by a large open ring, across which were stretched a couple of cross wires, whilst the eye-piece consisted of a simple hole of 3mm. in diameter. When observing near the sun dark glasses would be placed in front of this orifice. As might be expected, there are several unavoidable errors in using these instruments, the principal of which are the uncertainty of an identical point in a cloud being measured at each station, and the want of synchronism of the observation—a very important point when clouds are travelling with any speed. The method of observation was somewhat laborious, and was as follows. The two observers, each at a theodolite, agreed as well as they could on the point in the cloud to be observed, and at a particular time, fixed upon in advance, brought the cross wires on this somewhat indefinite spot, and then read their instruments, noted the time of observation, described the cloud, and if possible sketched it. A second observation of the same point gave the direction and rate of motion of the cloud. Perhaps one of the most easily observed clouds is the cumulus, and we find from a table given that the probable error of observation is very considerable. Thus, in one whose height was calculated to be 1,639 metres, the probable error of one observation was 748 metres, and of the mean of 16 observations 187. Out of 101 observations the mean height of a cumulus was 1,690 metres, and the probable error of the mean 40

"Mesures des Hauteurs et des Mouvements des Nuages." Par N. Ekholm et K. L. Hagström.