

issue of a swarm. Kirby tells us (*The Honey Bee*, Nat. Lib., p. 54) that the antennæ, 'by a peculiar structure may collect notices from the atmosphere, receive pulses or vibrations, and communicate them to the sensorium, which communications, though not precisely to be called hearing, may answer the same purpose.' I wonder why this is not precisely to be called hearing! Then, again, they are provided with depressions on the antennæ which Mr. Cheshire reasonably suggests are 'auditory hollows,' connected as these depressions are with the end of a nerve, precisely as the auditory hollow on the transmitter of a telephone is connected with the telegraphic nerve-wire. Such an extremely sensitive diaphragm may easily be susceptible to myriads of impressions from members of their own kind, although not responding by visible signs to unintelligible tones made by methods used upon them in vain by modern scientists.

It is well said that we ourselves are not *visibly* affected by the sound of booming cannon, the roar of thunder, or the surging of the waves on a rock-bound coast; yet let a child's tiny shriek fall on one's ear in our crowded streets and all is alarm and agitation. To deny the power of hearing to bees because they don't respond to our sound productions, is equal to doubting the efficacy of the telephone or microphone when their transmitting accuracy is disturbed by violent usage.

Much could be advanced, and innumerable instances quoted, in favor of the theory that our favorite insects can hear, much also that they cannot; amongst the ancient unbelievers being Linnæus and Bonnet; Aristotle and Huber remain doubtful, yet the latter somewhat inconsistently gives instances of sounds uttered by them with the effects produced upon the hearers. Then comes the question, can they speak? I mean by speaking the utterance of sounds intelligible to themselves.

Dr. Wollaston (*Ius. Misc.*, p. 104) says, 'Since there is nothing in the constitution of the atmosphere to prevent vibrations much more frequent than any of which we are conscious, we may imagine that animals, like the crickets (*Grylli*), whose powers appear to commence nearly where ours terminate, may have the faculty of hearing still sharper sounds which, at present, we do not know to exist; and that there may be other insects (this is what I wish you to specially notice) having nothing in common with us, but endowed with a power of exciting, and a sense that perceives, vibrations indeed of the same nature as those which constitute our ordinary sounds, but so remote that the animals who perceive them may be said to possess another sense, agreeing

with our own solely in the medium by which it is excited, and possibly wholly unaffected by the slower vibrations of which we are sensible.' This is what I call a fair description of intensely sensitive auditory organs. Flies on the diaphragm of a microphone have been heard to utter trumpet tones otherwise inaudible to us.

If I can show that bees utter sounds certainly understood by us, how many more must there be which we, with our comparatively coarse appreciation and imperfect comprehension, are unacquainted with? We all know the lazy contented boom of the drone, as contrasted with the irritated whizz and whirr of the disturbed honey-gatherer. We recognise the contented hum of the quiet prosperous hive in opposition to the sharp 'poop, poop' of the lost queenless bee. The sounds of swarming are as distinct to us as are our own distinctive notes. Many of these regular tones, 'familiar to us as household words,' are doubtless of no special moment to the bee, yet they show to their community that 'all goes well,' everything is as it should be outside the hive; these involuntary notes are a sort of perpetual assurance that the outside world is going on much as it should.

Our vocal organs, as we know, consist, firstly of a reservoir of air in the lungs, which can be compressed by means of the diaphragm and the rib-muscles, and expressed either gently or with considerable force; and, secondly, of an air-tube (the throat), at the opening of which is the glottis. It is the striking of air upon the lips of the glottis which, with muscular contraction and expansion tightening or slackening them, causes the varying sounds of the human voice. Let them be so tightened that they touch each other, and their vibrations become so rapid that a high note in the scale results; slacken them, and the notes fall in exact ratio. From the human voice let us go to the sound produced in some musical instruments—the oboe, the bassoon, and various others. Here two pieces of reed are scraped down until they are exceedingly thin; they are fastened together and placed within the lips, when, after a little practice, we are able to produce the peculiar buzzing notes which give to reed instruments their characteristic charm.

So, I contend, is it with the vocal organs of bees; they have their air reservoirs (I do not allude to the trachea in the abdomen) which serve for them the same purposes as our own, namely, for oxygenizing the life fluid, and for uttering these signals to others of their kind which we term language.

Behind each of the bee's four wings, two on either side, are spiracles or air-throats, and these are so placed with regard to the wing, that upon