XII. *On the Aqueous Vapour expelled from Bee-hives.* By GEORGE NEWPORT, Esq., F.R.S., Fellow of the Royal College of Surgeons, &c. Communicated by the Secretary.

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THERE is one circumstance connected with the economy of the Bee-hive which does not appear to have engaged the attention of naturalists. It is the transpiration of vapour from the interior of the hive, at certain seasons, during the act of ventilation. Every bee-keeper must have noticed that at the latter part of the summer there is often a deposit of blackish carbonaceous matter on the footstool of straw hives, which is extended a few inches from the entrance-hole. This deposit is accumulated there in the course of a few months. When it first attracted my attention, I supposed that it was occasioned by the bees alighting at that spot and accidentally shattering some of their loads of pollen; or that, perhaps, it might be rejected excrementitious matter; but I afterwards satisfied myself that it does not arise from either of these causes. The pollen conveyed by the bee is rarely or ever shattered in its transit, while the bees are always particularly careful to remove obnoxious materials from the interior of their dwelling or its immediate vicinity. Other circumstances have since led me to believe that it results from the accumulation of small quantities of wax that had adhered to the feet of the bees that have just left the combs and are passing outwards, and that its dark appearance may perhaps be due to the same cause as that which discolours the combs in the interior, and changes them in the course of a few months from a delicate yellow to a dark brown, and even to a blackish hue.

When a hive is examined very early in the morning, at the end of summer, after a fine cool night, we usually observe at the entrance-hole a stream of moisture passing from it, sometimes in drops. This is more or less abundant at different periods according to the temperature of the preceding day, the activity of the bees, and the coolness of the night. There seems reason to

believe that this fluid results in part from the respiration of the bees, and the extraneous transpiration from their bodies, generated during the night in the form of vapour, which is condensed and deposited as it comes into contact with the cold night air during the ventilation of the hive. It has already been stated by Huber, that the vitiated air of the hive is removed by the fanning of the bees, and that by this process a double current of air is established. The respired air is removed by the one, while fresh air enters by the other. My own observations have fully satisfied me of the correctness of these statements; and I have little doubt that it is to the contact of these two currents that the deposition of moisture at the entrance of the hive is due. In order to ascertain the quantity of fluid that is expelled from a hive in one night, I made an experiment, which, although not free from objections with reference to the hygrometric condition of the air during the night, satisfied me that the quantity is often very considerable. I cut off the bottom of a glass phial, and then ground the edges carefully so as to fit accurately to the front of one of my wooden hives: the phial was then affixed to the entrance-hole, with its contracted neck left open, so that all the air which escaped from and entered the hive passed through it. By this means a part of the vapour that was expelled from the hive was condensed in the phial, and the experiment, to a certain extent, was successful. During eleven and a half hours of the night of the 1st and 2nd of September, from half-past six in the evening till six in the morning, there was condensed in the phial about a dram and a half of fluid, besides what had escaped from the open mouth of the phial in the form of vapour. The temperature of the vapour, within the phial, as it issued from the entrance-hole of the hive, at half-past six o'clock in the morning, was 69° Fahr.; that of the external atmosphere was then only $59^{\circ}5$ Fahr. The temperature of the vapour within the phial was ascertained at a distance of four inches from the hive, the thermometer being held free within the neck and not in contact. At eight o'clock on the following morning, when the temperature of the external atmosphere was 61° Fahr., the vapour in the phial was $71^{\circ}5$ Fahr., while a thermometer inserted through the top of the hive, and which had remained untouched for several days, showed that the interior of the upper part of the hive was then only 69° Fahr. The bees at that time were perfectly quiet. Thus the expelled atmosphere of the phial,

as on the preceding morning, was $10^{\circ}5$ Fahr. above that of the open atmosphere, and $2^{\circ}5$ above that of the top of the hive. At six o'clock of the evening of the same day, when the temperature was sinking, and was then only $53^{\circ}9$ Fahr., that of the vapour in the phial, taken as before, was only 59° . The hive had then become quiet for the night, and its temperature was reduced. The temperature of the expelled air was thus shown to depend much on the degree of activity or quiescence of the bees, and consequently on the greater or smaller amount of their respiration. The bees were now in a state of rest, and respired but little; while in the morning they were becoming active, and preparing to enter upon their labours. During this night the temperature of the atmosphere sunk down to 32° Fahr.; and when I again examined it in the morning, September 4th, at six o'clock, it had risen only to $41^{\circ}5$ Fahr. The hive was then quiet, the bees had been reposing all night, and were disposed to pass into their state of semi-hybernation. The temperature of the interior, at the top of the hive, was then only 54° Fahr., and that of the vapour in the phial, even at the entrance-hole of the hive, was but 59° Fahr.; and the quantity of vapour condensed within the phial scarcely amounted to so much as three minims. These concordant circumstances seem to prove that the vapour expelled from the hive results in chief part from the respiration of the bees, and the extraneous transpiration from their bodies; that this is most abundant when the bees are most active and are respiring freely, and when the greatest amount of heat is evolved by them. On the contrary, as the activity of the bees is diminished, the temperature of the hive becomes reduced and the quantity of air deteriorated, and the vapour expelled is lessened. And may we not also conclude from the fact, that the vapour, which thus seems to be the result of respiration by the bees, and which is condensed and deposited as it issues forth, holds in solution a superabundance of carbonaceous matter, which is deposited with it, and occasions the discoloration of the combs and of the entrance to the hive?