

their development in the different species of bees is in proportion to the social specialization. They vary from a group of cells opening by separate ducts upon the pharyngeal plate to the highly developed condition they present in the honey bee. The writer questions, however, whether these authors did not mistake the median pharyngeal glands of these lower genera of bees for rudimentary representatives of the lateral glands. Bordas states that the former occur in all Hymenoptera, but Schiemenz and Cheshire did not seem to recognize them. The bumblebees have them almost as well developed as the honey bee, especially the large females. In the genus *Psithyrus* they are similar to those of *Bombus*, but are smaller, while in such genera as *Andrena* and *Anthophora* they are rudimentary or consist of a few scattered cells. Both Schiemenz and Cheshire have thus argued strongly that these glands of the pharynx are the organs that produce the brood food. On the other hand, Schonfeld (1886) has made an equally strong plea in favor of the ventriculus as the producer of this important material. He believes that the brood food, especially royal jelly, is regurgitated chyle. Both Schonfeld and Cook (1904) fed bees in a hive some honey containing powdered charcoal, and later found this in the brood food in the comb cells, thus, apparently confirming its ventricular origin. However, the charcoal that got into the cells might have come from the mouth, the oesophagus, or the hone stomach. It, of course, could not have gone through the stomach walls and entered the pharyngeal glands, as proved by Dr. J. A. Nelson, from microtome sections of bees fed on lampblack. The arguments, then, in favor of the stomach, and the pharyngeal glands seem equally strong, and perhaps the truth is, as occurs in so many cases, that both sides are right—that the brood food is a mixture of chyle from the stomach and of secretion from the pharyngeal glands.

Arnhart (1906) seems to adopt the position that the brood food is chyle which has been acidified by the addition of an acid from the glands. He states that the acid reaction of the royal jelly is due to the presence of three-fourths of 1 per cent. of tartaric acid. The contents of the ventriculus, on the other hand, are for that matter of all the parts of the alimentary canal, are alkaline. Hence, it seems very logical to suppose that if the brood food comes from the stomach, its acid constituent is furnished by the glands in the head. But the difference between the brood food found in the cells and the contents of the ventriculus is so great that it would seem as if a very substantial addition of something more than a mere preservative acid must be made to the latter.

The brood food is given to the queen larvae, known as royal jelly, is a gummy paste of milky-white color when fresh but when taken out of the cell it soon acquires a darker tone with a yellowish tint. Under the microscope it appears to be a homogeneous, very minutely granulated mass. It is very acrid and pungent to the taste, and must be strongly acid. Samples examined by the writer taken from cells containing queen larvae two and four days old contained a number of fresh undigested pollen grains but no bits of hair such as occur in the stomach.

The possible ventricular origin of a part of the brood food and its regurgitation will be further discussed when we treat of the stomach. The writer does not advocate any personal view regarding the origin of this larval food—the fact is there is not enough known about it to enable one to formulate any opinion worth while. We know only that the whitish paste comes out of the mouths of the workers but we know nothing of where it is made or of how it is made. Hence we can await the evidence of further investigation.

The brood food is fed to the workers and is produced in abundance by the young queens. The larvae of the queens receive nothing but pure royal jelly throughout their entire period, while the larvae of the workers are given the same only during the first three days. From the beginning on, honey is said to be the diet of the drones and in the case of the former, they also receive a certain amount of brood food throughout their lives. Do not get it they become weak and they can feed themselves. They apparently cannot eat consequently are not able to digest the protein element of diet unless it is in a pre-digested condition by the queen. During egg-laying activity the queen especially demands this food and when withholding it the queen usually has the power of inhibiting her production of eggs. Arnhart (1906) says that the queen is a weak or starved member of the colony, the material being added to the upper surface of the cell where it is sucked up by the proboscis by the other workers. Statements, however, concerning the diet need to be verified by experiment. Cheshire (1888) stated that the stomachs of queen bees contain a substance which is "microscopically distinguishable from the substance of the pollen grains," scarcely a pollen grain is recoverable in it. If this is true, it seems to prove that the queen receives a substance by the worker, and that the latter's secretion, which of the latter is invariably a dark-brown slime containing a large amount of pollen and in no way resembling royal jelly. Cheshire stated that before impregnation the