Letters to the Editor

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Fertility of Bees and Vitamin E *

THE question arises as to how in the bee colony certain larvæ are turned into queen bees with extraordinary powers of fecundity while the larvæ which become worker bees normally are sterile. The larvæ start equal, for both queen and worker larvæ are incubated from fertilised eggs, and it is known that a worker larva not more than three days old can be converted into a queen. The suggestion was made by one of us that the larva destined to be a queen bee was given a diet rich in vitamin E which is necessary for fertility, while this vitamin was withheld from the worker larva. The queen larva is fed solely on what is termed 'royal jelly', and when the queen is actively laying (for example, 2000 eggs a day) she is fed by her attendants with the same rich food. Royal jelly is generally accepted as being a secretion from the pharyngeal glands. Worker larvæ are supposed to be fed on royal jelly up to the age of three days when they are weaned on a diet of honey and pollen. According to von Planta (Cowan's "Honey Bee") the larval foods of the bees have the following average composition :

	Albumen. (per cent)	Fatty Substances. (per cent)	Sugar. (per cent)
Queen	45·14	13·55	20·39
Worker			
Under 4 days	53·38	8·38	18·09
Over 4 days	27·87	3·69	44·93
Average	40·62	6·03	31·51

To try to prove whether royal jelly contains an amount of vitamin E which is not present in honey and pollen the following research was undertaken :

Ten young female rats in separate boxes with their first new-born litters were put on a vitamin E-free diet on May 20, 1932. The diet was prepared in the chemical department of British Drug Houses Ltd. and a sufficiency of yeast and cod liver oil was added to keep the rats in good condition and maintain the growth of the young. It was considered that by suckling their young up to the weaning period the mothers would be drained of any store of vitamin E in their bodies ; experience has shown that the power of such mothers to breed is lost by the continued feeding on the vitamin E-free diet.

On May 26 mother rats (1 and 2) with their young were given in addition each day about 2 gm. of pollen and honey, while mother rats (3 and 4) and their young received about 2 gm. of honey and pollen a day, the pollen in this case having been first soaked in honey and water for 24 hours. The rats eat the pollen and honey well. On June 27 a supply of royal jelly (queen bee food) collected from colonies about to swarm was available, and mother rats (5, 6 and 7) and their young were given about 0·05 gm. of this jelly in addition to their diet. The royal jelly was put at the back of the tongue of each rat so that it was all swallowed. It was soon realised that the supply of royal jelly would not be adequate for these mothers and their young, so on July 6 the young were removed, and the experiment continued on the mother rats alone ; the young from the other mother rats were removed also. Mother rat (9) had killed her litter soon after birth : from July 6 onwards she was given in addition to the vitamin E-free diet about 2 gm. of worker larvæ bee comb, so that she got both the young larvæ and their food to eat. Mother rats (8) and (10) were kept as controls on the vitamin E-free diet without any addition from the hive.

Healthy bucks kept during the night on a normal diet of bread and milk, oats and green food, were from now onwards put to the mothers during the day time ; the bucks were changed so that every mother rat had an equal chance of fertilisation.

On July 29 one of the royal jelly rats had a litter of five healthy young. She killed these after two days' suckling. The supply of royal jelly having now given out, on Aug. 3 any addition of honey and pollen was also stopped. A few days later another of the royal jelly rats had a litter of fully developed young, but killed them just after birth. One of the other mother rats which had received an addition of pollen and honey to the diet was found with one immature dead fœtus. All the others having failed to conceive, the experiment was stopped on Aug. 12. Each of the mother rats had increased in weight during the experiment, the royal jelly rats by about 25 gm. each, the others by 30–38 gm. and all were in good condition at the end.

The results show that the daily addition of about 0·05 gm. of royal jelly during one month effected the production of two full term litters among three rats, while the addition daily during two months of 2 gm. a day of honey and pollen or for one month of worker larvæ comb was ineffective, only one immature fœtus being produced among five rats.

It is proposed to continue the research next summer, but the evidence so far appears to justify the conclusion that the bees add vitamin E to royal jelly, on which queens are raised, and withhold it from worker larval food. It is surmised that the vitamin is obtained from pollen and concentrated by the workers possibly in the secretion of their pharyngeal glands, which may produce royal jelly.

These experiments may open up a new avenue of research for bee-keepers and lead to better agreement on matters appertaining to the biology of the honey bee (*Apis mellifica* L.).

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Constitution of Cholesterol

ON account of the biological importance of the sterols and bile acids, and the relation of the group to vitamins and hormones, particular interest is attached to a knowledge of their molecular structure ; and I have recently reviewed the whole of the chemistry of these substances from the point of view of the hypothesis that the carbon skeleton of cholesterol is terpenoid, that is, made up of isoprene units with the extrusion of three carbon atoms from one of the units. It has been found possible to devise a formula which identifies the cholesterol carbon skeleton with that of