

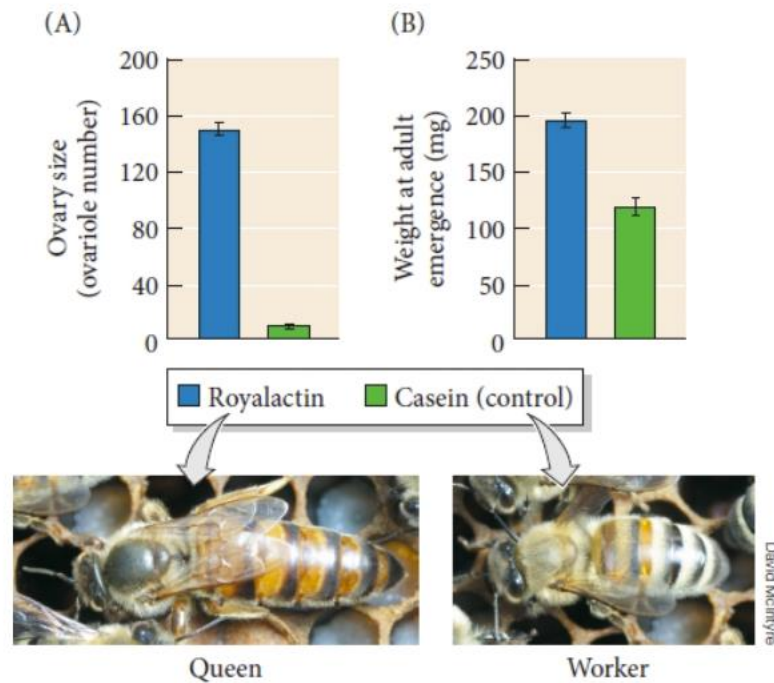
# Royal Jelly: Diet-induced phenotypes in honeybees

In honeybees, adult females are either workers or queens. The queen is the only reproductive member of the hive, laying up to 2,000 eggs per day, and she also lives 10 times longer than the average worker. The workers feed large amounts of a protein and lipid-rich mixture called “royal jelly” to those larvae that become queens. The royal jelly is actually an ecosystem that is fed to the larva that is to become the reproductive female. It contains numerous symbiotic bacteria, fungi, and specific compounds made for and by them (Cui et al 2022).

One of the active ingredients of this mixture is the protein **royalactin**. A significant amount of this protein is required to bind to the EGF receptors in the larval fat body to stimulate the production of juvenile hormone in the developing larva. This elevated level of juvenile hormone switches on a queen-specific set of genes and elevates the levels of yolk proteins that are necessary for egg production in the adult (**Figure 1**; Kamakura 2011). RNAi against either the EGF receptor or its downstream targets abolishes the effects of royalactin. Other factors in royal jelly might also be important for producing the queen phenotype, especially for preventing her early death (Maleszka 2018).

Royalactin may be a protein that has effects on mammalian cells, as well. Wan and colleagues (2018) demonstrated that royalactin can help maintain pluripotency in mouse embryonic stem cells. Indeed, they have found a mammalian homologue to the royalactin protein, which also appears to maintain stem cell pluripotency. This could provide a new method of acquiring and maintaining mammalian embryonic stem cells.

FIGURE 1



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**FIGURE 1** Diet-induced developmental changes can produce either reproductively competent queens or sterile workers. Royalactin induces functional ovaries (A) and increased body weight (B) in the honeybee *Apis mellifera*. (After M. Kamakura. 2011. *Nature* 473: 478–483.)

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