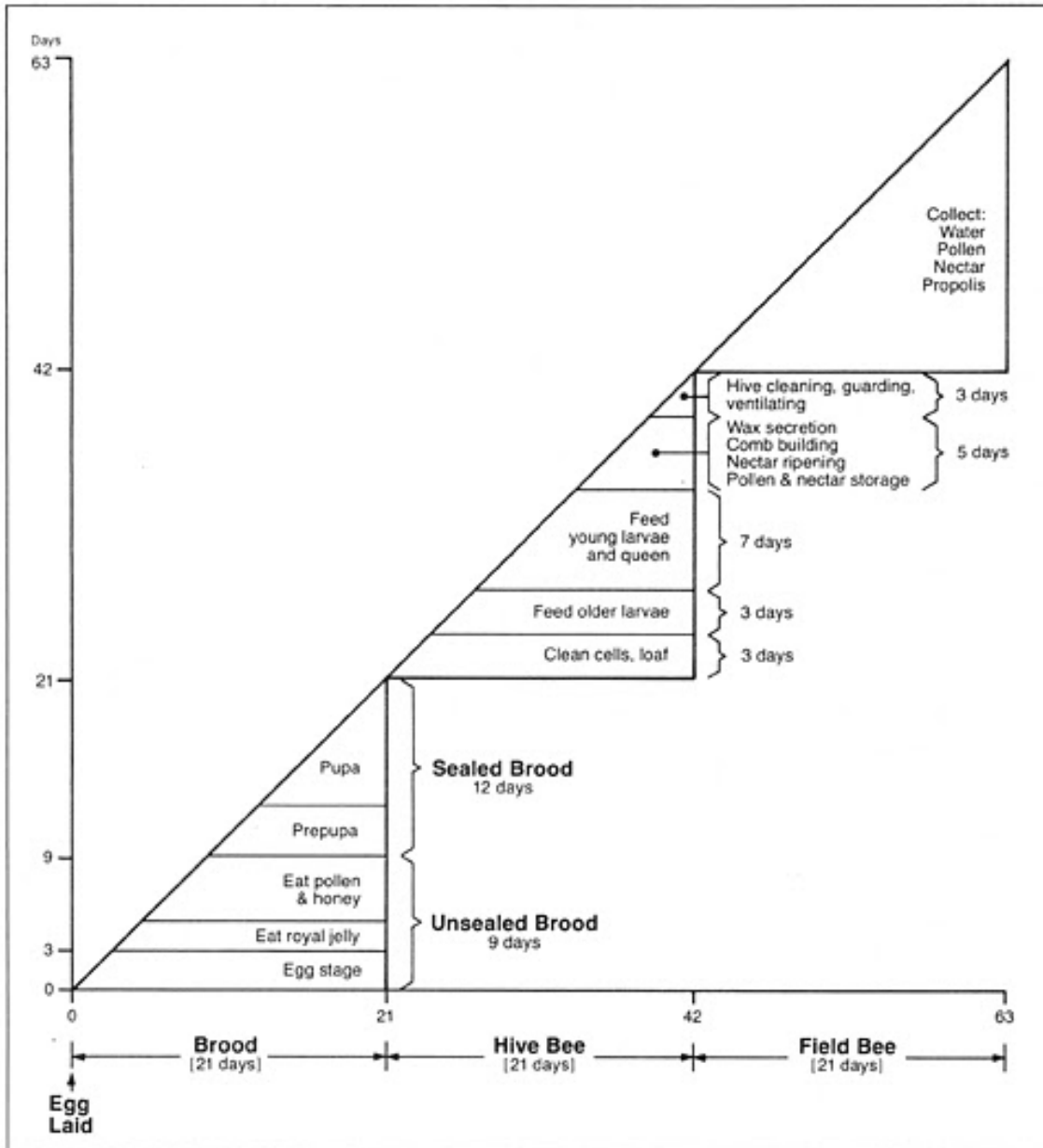


# Honeybee: Imaginal Discs

Most beekeepers learn quite a bit about the short, six-week life of the adult bee, much less about the three weeks of development preceding each bee's emergence as an adult.

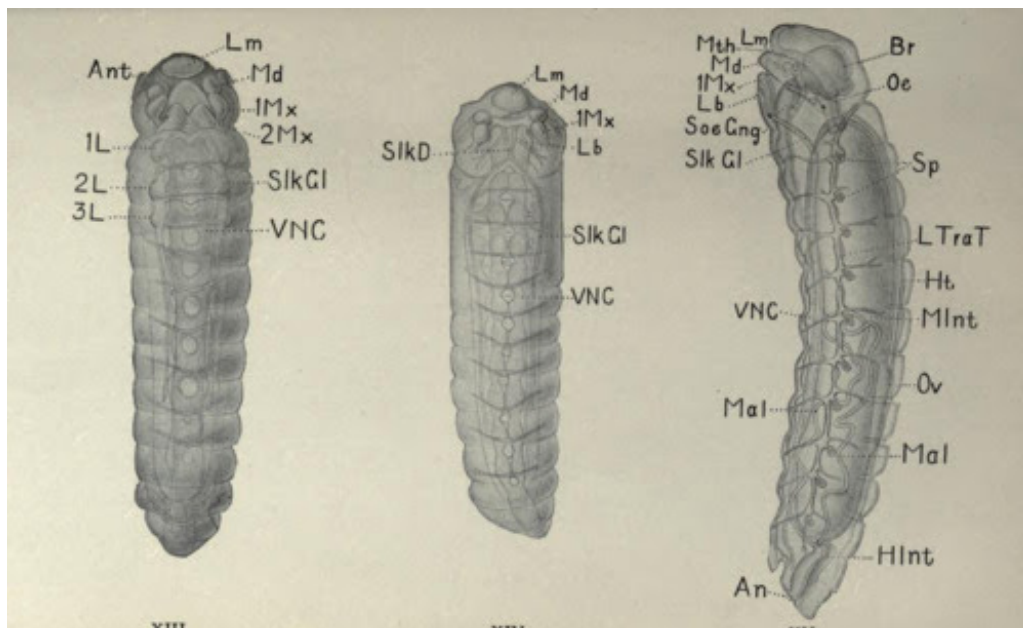


It all starts with a *single egg cell* encased in an oblong egg deposited by the queen at the bottom of a wax brood cell. Within 3 days, that *one cell* ( fusion of a queen's egg and a sperm she collected during her nuptial flight ) has divided by mitosis *again and again and again* ... cell division frequency averaging perhaps once every 3-1/2 hours ... when the egg hatches on day 3, a larva of nearly 1,000,000 cells is born.

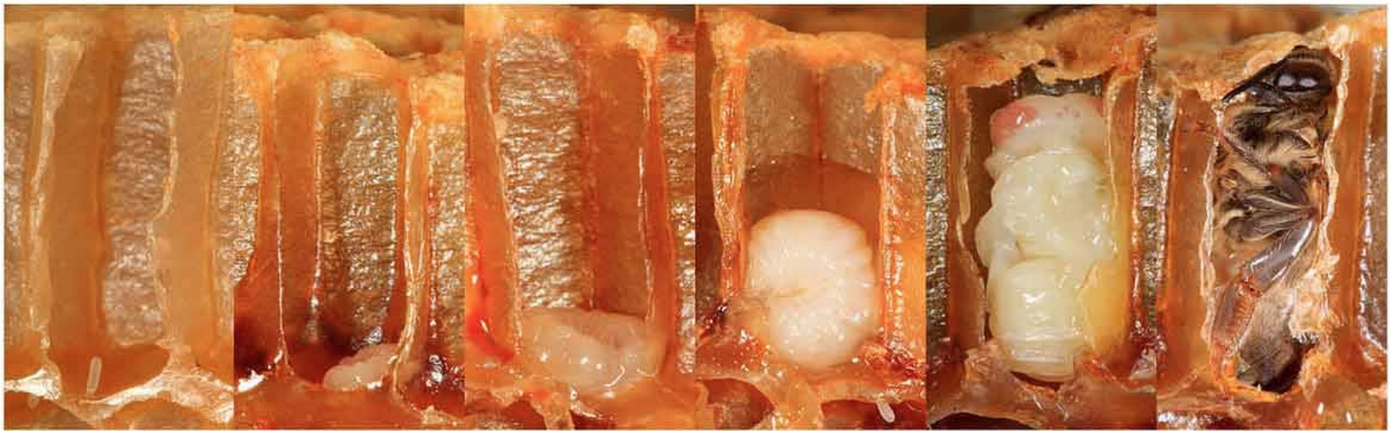


For the next few days, the larva is fed by its sisters ... and *bee milk* is its only food. ( Though more commonly termed *royal jelly*, this white liquid is produced by nurse bees, who secrete the protein-rich fluid from sets of glands located in the head. ) After three more days of feeding, which includes pollen and honey, the larva is sealed into its brood chamber with a wax cap.

Metamorphosis begins.



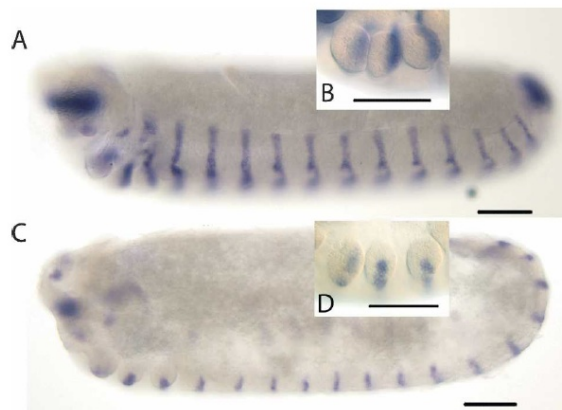
Over the following two weeks, the grub-like larva - which no longer eats - is *digested from within* by groups of cells - ***imaginal discs*** - organized according to the structural parts of the adult bee which they are destined to become. ( The word itself is a bit magical: *imaginal* derives from *imago*, Latin for *image* ... in insects, the *imago* is the adult body form attained in the last stage of metamorphosis. )



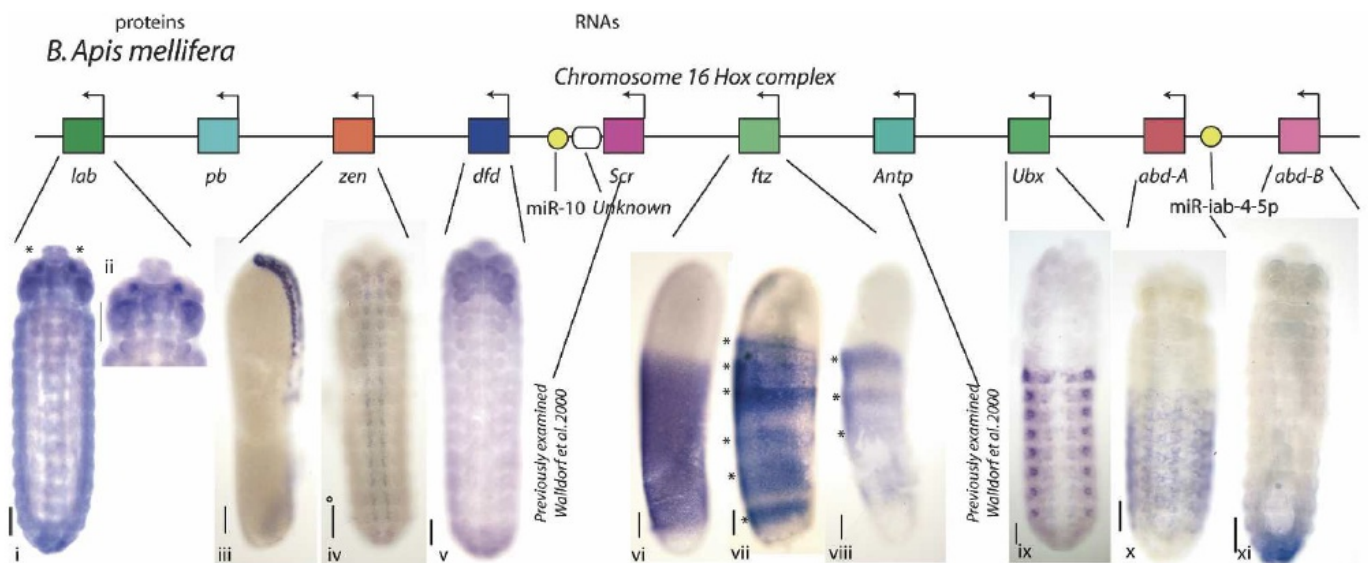
Un œuf fécondé pondus par la reine se transforme en larve en 3 jours. Nourrie par les abeilles avec de la gelée royale, la larve grandit rapidement. À 7 jours, son alimentation est remplacée par une bouillie de miel, de pollen et d'eau. Deux jours plus tard, la cellule est fermée par les abeilles avec de la cire, puis la larve se transforme en nymphe à 11 jours et la naissance a lieu au 20<sup>e</sup> jour.

<http://www.thehoneygatherers.com/blog/wp-content/uploads/2013/11/The-Queen.jpg> ]

Though *imaginal disc* formation in honeybee embryos has been observed by microscopists for over a century, our understanding of the underlying developmental biology is ongoing. On a molecular level, genes responsible for coordinating the assembly of body parts - of honeybees and of all living things - are organized into segments called *homeobox* - or *Hox* - genes. *Hox genes* code for short (60 amino acid long) proteins - transcription factors - which bind to specific areas of honeybee larval DNA and direct the sequential expression of certain DNA segments, orchestrating the assembly of an adult bee from the formless larva sealed into the brood chamber on day 6 of life. The [Nobel Prize in Physiology or Medicine for 1995](#) (<click) was awarded to three scientists for their work in elucidating of the role of *Hox* genes in guiding embryonic development. Though they studied the model organism *Drosophila* (fruit fly), their findings apply to other organisms, including honeybees and mice ... and men.



**Figure 3.** Expression of honey bee *hh* and *wingless* (*wg*) in embryos. Embryos are oriented anterior-left, dorsal-up. Scale bars, 100  $\mu$ m. (A) *hh* RNA expression in a stage 10 embryo. Honey bee *hh* is expressed in a



Organization of the honey bee *Hox* complex and expression of *Hox* genes. Illustration (not to scale) of *Hox* complexes f

The attached images and references will give you insight into the transformations occurring in each of the hexagonal wax brood cells in the warm darkness of the hive, as late winter turns to early spring.

image sources and additional references: <http://imageessays.com/#/hox/>

