

The Haplodiploid System in Honey Bees



Female (Queen or Worker)

Diploid

32 Chromosomes



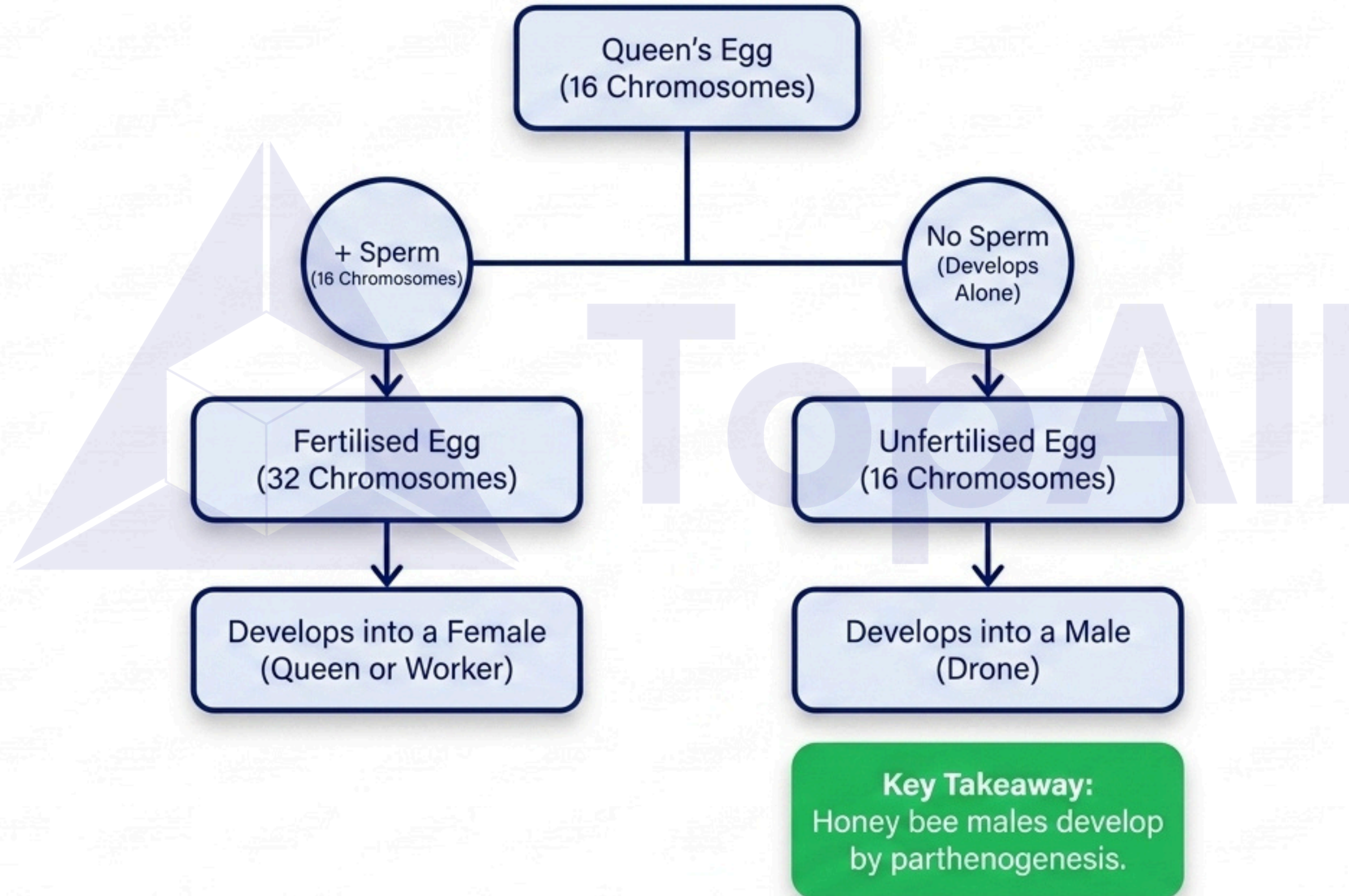
Male (Drone)

Haploid

16 Chromosomes

Sex determination in the honey bee is based purely on the number of sets of chromosomes an individual receives—a mechanism known as the **haplodiploid** sex-determination system.

Two Developmental Fates of an Egg





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The Cellular Exception in Gamete Formation

Female Gametogenesis

Starting State: Queen (Diploid, 32)



Meiosis
(Reduction division)

End State: Egg (Haploid, 16)

Male Gametogenesis

Starting State: Drone (Haploid, 16)



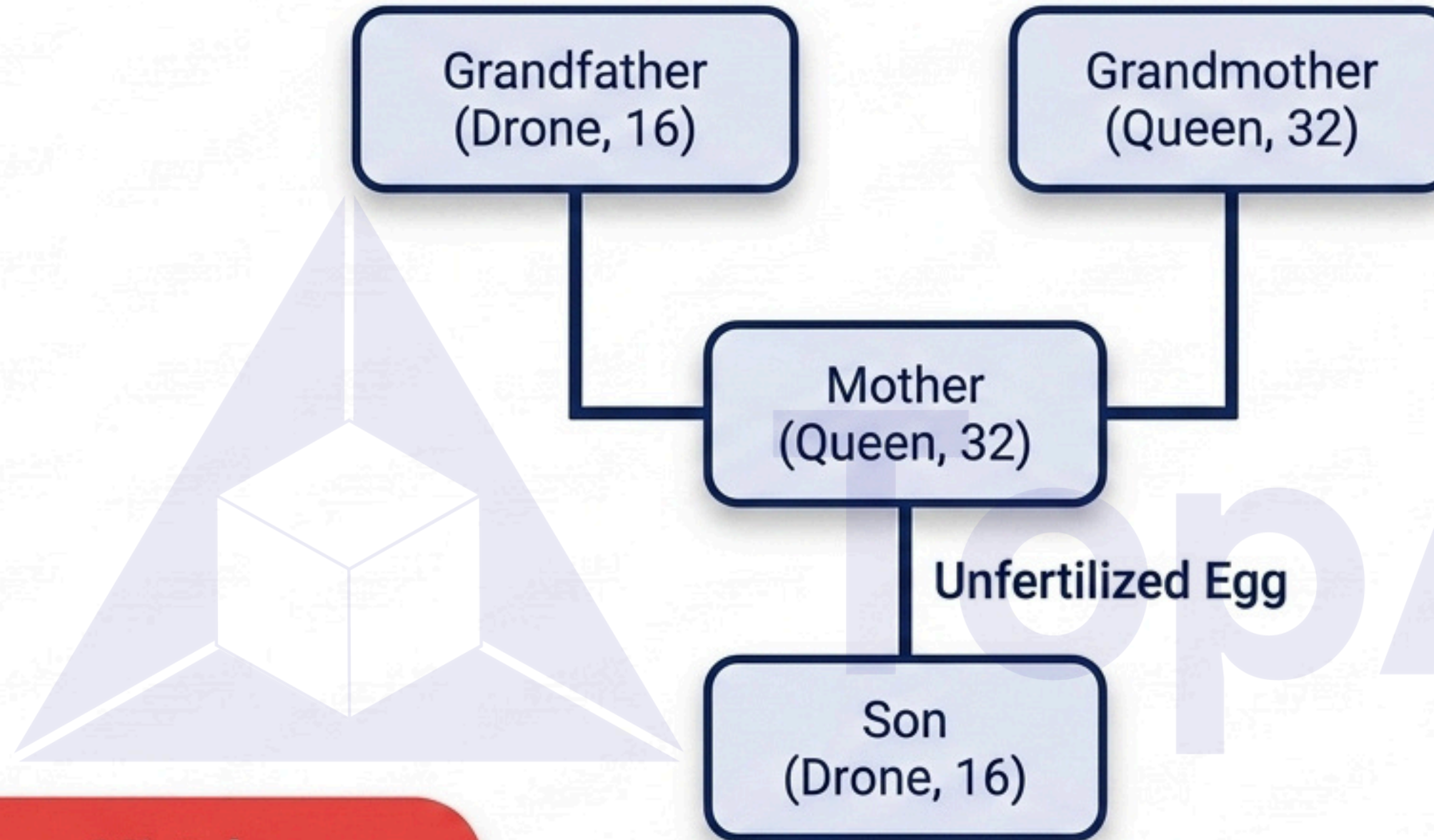
Mitosis
(Equational division)

End State: Sperm (Haploid, 16)

Quick Tip: Why Mitosis?

Because drones are already haploid (16 chromosomes), they cannot halve their genetic material further to 8. Therefore, male honey bees are forced to produce sperm via mitosis.

The Fatherless Pedigree Paradox



Common Mistake

Assuming drones are exact clones of the queen. They are not! Because the queen produces eggs via meiosis, her genetics are shuffled. Drones inherit a randomized half of her genes.

Takeaway

The Genetic Paradox Solved: A male honey bee has no father and cannot have sons, but he has a grandfather and can have grandsons.



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