

Grade 1 –

Introduction to beekeeping



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MODULE 1 REVISION - SAMPLE QUESTIONS FROM PAST PAPERS

- ❖ What is the difference between the type of foundation needed for extracted honey and that needed for cut comb honey?
- ❖ What name is given to the extra box(es) which the beekeeper puts on the hive for the storage of honey?
- ❖ Name two types of feeder used in beekeeping.
- ❖ To the nearest mm what size is bee space?
- ❖ What is the name given to the hive part where the queen lives?
- ❖ List the two most essential things to carry with you when inspecting a hive.
- ❖ List three different hive parts.
- ❖ Name 2 (two) types of hive in general use in Ireland
- ❖ What hive part prevents the queen from laying in the super?
- ❖ Why is the entrance of the hive reduced in winter?

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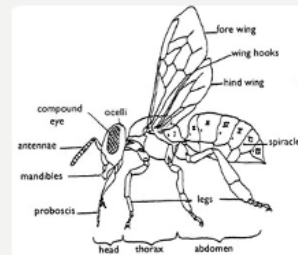
Before diving into the natural history of honeybees, it's important to review foundational knowledge from Module 1, as it covers essentials like hive structure and bee management tools. Key questions may include:

- Differences in foundation types for honey production (extracted vs. cut comb)
- Hive components and their functions, such as the honey super and queen excluder
- The purpose of various feeders
- Understanding bee space and its importance in hive design

MODULE 2 - NATURAL HISTORY OF THE HONEYBEE

BASIC BEE ANATOMY

- ❖ Bees are insects belonging to the order Hymenoptera which also includes ants and wasps
- ❖ 3 parts to their body: **Head, Thorax** and **Abdomen**
- ❖ 3 pairs of legs, and 2 pairs of wings attached to the thorax
- ❖ 2 compound eyes and 3 simple eyes (ocelli) on the head
- ❖ 2 antenna on the head



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Honeybees are insects belonging to the order Hymenoptera, which also includes ants and wasps. Their anatomy is divided into three main parts:

- **Head:** Contains sensory organs, such as two large compound eyes, three simple eyes (ocelli), and two antennae. Compound eyes help bees detect movement and colors.
- **Thorax:** Houses three pairs of legs and two pairs of wings. The thorax is the bee's center of movement.
- **Abdomen:** The largest section, containing digestive organs, reproductive organs, and the stinger in females.

These features support honeybees in complex tasks like foraging, defense, and colony communication.

CASTES

- ❖ The honeybee colony can be regarded as a **superorganism** – all bees are working together for the survival of the colony
- ❖ There are 3 castes of honeybees:
 - ❖ **Queen**
 - ❖ **Drones**
 - ❖ **Workers**

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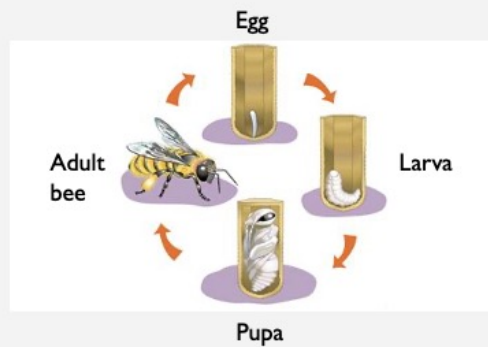
Slide 3: Castes in a Honeybee Colony

The honeybee colony functions as a superorganism with each bee working to ensure the colony's survival. There are three main castes:

- **Queen:** The sole reproductive female, responsible for laying eggs. The queen's pheromones help maintain colony harmony.
- **Drones:** Male bees whose primary role is to mate with a virgin queen. Drones do not gather food or participate in hive duties.
- **Workers:** Non-reproductive females who perform all hive tasks, from nursing larvae to foraging.

Each caste has a unique role, critical to the colony's overall function and health.

LIFE CYCLES



	EGG	LARVA	PUPA	ADULT BEE
QUEEN	Days 1-3	Days 4-9	Days 10-15	Day 16
WORKER	Days 1-3	Days 4-9	Days 10-20	Day 21
DRONE	Days 1-3	Days 4-9	Days 10-23	Day 24

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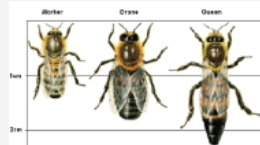
Honeybees go through four stages of development:

- Egg: Laid by the queen; develops into a larva within three days.
- Larva: Fed by worker bees with royal jelly and then bee bread. They undergo several molts.
- Pupa: The larva spins a cocoon and undergoes metamorphosis.
- Adult Bee: Emerges fully formed and begins its role in the colony.

The life cycle is completed in about 21 days for worker bees and differs slightly for queens and drones.

ANATOMICAL DIFFERENCES QUEEN VS WORKERS

- ❖ Queen has longer legs than the workers
- ❖ Queen has longer, more pointed abdomen than the workers
- ❖ Drones are slightly larger and much more burly than the workers. The end of their abdomen is square and they have two large compound eyes.



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THE QUEEN



- ❖ The queen is the only honeybee who can lay **fertilised eggs**
- ❖ The queen can lay both fertilised and unfertilised eggs, which will hatch and develop into adults:
 - ❖ Unfertilised eggs develop into **male drones**
 - ❖ Fertilised eggs develop into **female workers**
- ❖ In June, the queen can lay **1,500 eggs per day**
- ❖ The queen ensures **colony cohesion** as the pheromones she produces are passed around the colony as workers share food
- ❖ The queen can live 4-5 years
- ❖ The queen has a sting but only uses it against rival queens

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The queen is essential for the colony's survival. Key characteristics:

- **Egg Laying:** The queen can lay fertilized (female) or unfertilized (male) eggs. A healthy queen may lay up to 1,500 eggs daily during peak season.
- **Pheromones:** Her pheromones signal colony unity, preventing worker bees from raising new queens.
- **Longevity:** Queens can live 4-5 years but are often replaced earlier through a process called supersedure.
- **Sting:** Unlike workers, the queen's sting is only used to eliminate rival queens.

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DRONES

- ❖ The main role of the drone is to **mate** with a virgin queen
- ❖ They fly to **drone congregation areas** to mate with a virgin queen
- ❖ Act of mating **kills the drone**
- ❖ Drones cannot collect nectar/pollen
- ❖ Drones are evicted from the hive at the start of the winter cluster
- ❖ Drones do not have a sting



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Drones have a specialized role in the honeybee colony:

- **Mating:** Drones leave the hive to gather in drone congregation areas, where they await virgin queens. Mating ends the drone's life.
- **Dependence:** Drones do not collect food and are fed by worker bees. They are evicted from the hive in late autumn to conserve resources.
- **Lack of Sting:** Drones have no stinger and cannot defend the hive.

WORKERS

The vast majority of bees in a colony are female workers

Workers are responsible for:

- ❖ Cleaning cells
- ❖ Feeding larvae
- ❖ Secreting wax to make/repair comb
- ❖ Receiving nectar from incoming foragers
- ❖ Guard duty
- ❖ Foraging (nectar, pollen, water, propolis)



- ❖ Workers **have a sting**, which they use for protection of the hive
- ❖ In the summer, worker bees live for approximately **6 weeks**. Over-wintering worker bees live for approximately **6 months**.

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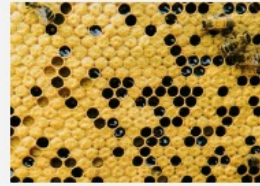


Worker bees make up the bulk of the colony and are responsible for nearly all tasks:

- Hive Maintenance: Clean cells, build and repair comb.
- Brood Care: Feed and nurse larvae with royal jelly and bee bread.
- Guarding: Protect the hive entrance and sting intruders if needed.
- Foraging: Collect nectar, pollen, water, and propolis.
- Lifespan: Summer workers live 6 weeks, while winter workers live 4-6 months to support the hive through colder months.

TYPES OF CELLS

- ❖ **Worker cells:** Hexagonal, sealed with flat or slightly raised beeswax cap
- ❖ **Drone cells:** Larger hexagonal cells than worker cells, often found at the edges of the comb. Sealed with a domed cap.
- ❖ **Queen cells:** Completely different from worker and drone cells. They hang down from the face or edge of the comb



Worker cells



Drone cells



Queen cell

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Cells in the hive serve various purposes:

- Worker Cells: Hexagonal cells with flat caps, used to rear worker brood.
- Drone Cells: Larger hexagonal cells with domed caps, found on comb edges.
- Queen Cells: Special elongated cells hanging down, reserved for raising new queens.

SWARMING

- ❖ Swarming is the **natural means of reproduction of honey bee colonies**
- ❖ Colony develops rapidly in the spring - **drones** are produced
- ❖ Bees start to build **queen cups** (Queen cell cups constructed in Spring resemble acorn cups and do not indicate a colony is preparing to swarm)
- ❖ Queen lays **eggs in queen cells** and the workers provision the cells with royal jelly (Note: workers sometimes move eggs to queen cells)
- ❖ The eggs develop into **larvae** – the queen cup where an egg that was laid first is the first one to be **sealed** (Day 8)

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Swarming is the colony's natural way of reproducing:

- Queen Cups: Workers build queen cups, which the queen lays eggs into.
- Larvae Development: Selected larvae are fed royal jelly to become queens.
- Swarm Formation: The old queen and half the colony leave to find a new home, while a new queen takes over.

Swarming usually occurs in late spring to early summer.

THE PRIME SWARM

- ❖ The **prime swarm does not fly far at first**. They may gather in a tree or on a branch only a few meters from the hive, where they **cluster** around the queen
- ❖ The most experienced foragers, '**scout bees**', are sent out to find suitable new nest locations
- ❖ The swarm can only survive for about **three days** on the honey on which they gorged themselves before leaving the hive
- ❖ When around **80%** of the scouts have agreed upon a single location, the whole cluster takes off and flies to it. A swarm may fly **a kilometre or more** to the scouted location



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The prime swarm is the first swarm a colony produces. It gathers nearby while scout bees search for a new nesting site. Scout bees communicate their findings, and the swarm moves once they've decided on a location. This process can take up to three days, sustained by honey reserves.

VIRGIN QUEENS

- ❖ Virgin queens are produced as a result of **swarming, supersedure** (replacement of an old queen), **death/loss of queen**
- ❖ An **elongated queen cup** is prepared by the workers. Workers place **egg in the queen cell**, and the sides of the cup are elongated as the larva develops
- ❖ The **larva is fed royal jelly uniquely**
- ❖ The cell is sealed on the 8th day after the egg is laid. The **colony swarms when the queen cell is sealed**
- ❖ The adult virgin queen chews round the end of the sealed queen cup and emerges into the colony. After about 4 days, she is mature and ready to fly.
- ❖ The virgin queen has a **limited time frame of about 3 weeks to take her mating flight(s)** before she becomes 'stale' and may commence laying unfertilised eggs

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Virgin queens are produced under specific circumstances like swarming or supersedure. Key points:

- **Development:** Workers feed larvae royal jelly, and the queen emerges after about 16 days.
- **Mating:** After maturing, the virgin queen must mate within three weeks.
- **Supersedure:** Colonies may raise new queens to replace an aging queen without swarming.

MATING WITH THE DRONES

- ❖ Virgin queens and drones from neighbouring colonies fly to **Drone Congregation Areas** (DCAs)
- ❖ The drones investigate any moving object that might be a queen
- ❖ The drones form a '**comet**' flying behind the queen and then mate in the air
- ❖ The **act of mating kills the drone** who falls away to be replaced by the next one
- ❖ The virgin queen can **mate with 10-20 drones**

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Mating occurs in Drone Congregation Areas (DCAs), where drones gather. Drones form a comet-like shape following the queen, mating mid-air. Each queen typically mates with multiple drones, ensuring genetic diversity within the colony.

BEE DANCES

- ❖ **Scout bees**, which make up about 5% of a colony, go out looking for new sources of food (nectar and pollen)
- ❖ They then have to **communicate its location** to the remaining foragers in the hive. They do this using a 'dance language' which is a combination of:
 - ❖ **scent**
 - ❖ **sound**
 - ❖ **movement**
- ❖ This 'dance language' takes two main forms
 - ❖ **Round dance**
 - ❖ **Waggle dance**

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Scout bees use dances to communicate food locations:

- Round Dance: For food within 10 meters; the bee moves in circles to direct others nearby.
- Waggle Dance: For food over 100 meters away; includes a “waggle” and return phase. The dance communicates distance, direction, and quality of the source.

ROUND DANCE

- ❖ In this dance, the scout bee runs around in a circle, and on completing the circuit, turns and runs back the other way
- ❖ Her followers pick up the scent of the forage source from her waxy exterior
- ❖ Her simple instruction is '*go out and find this within a radius of **10 metres***'
- ❖ Bees perform the round dance when taking syrup from a feeder – which can initiate robbing
- ❖ Variations of the round dance indicate food sources up to 100m from the hive

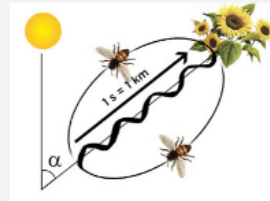


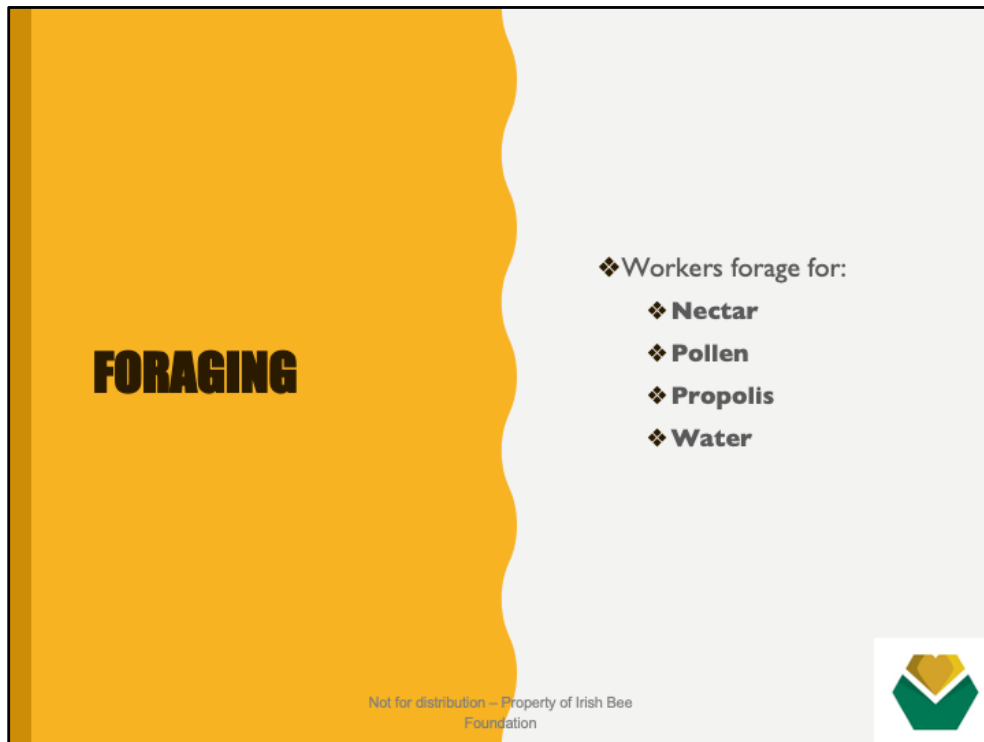
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WAGGLE DANCE

- ❖ This dance communicates the **direction**, **distance** and **nature** of food sources that are over **100 metres** away from the hive
- ❖ The bees which have followed the dance receive a **sample** of nectar or will smell the pollen load
- ❖ A waggle dance consists of a series of circuits, each of which consists of two phases: the **waggle phase** and the **return phase**. A worker bee's waggle dance involves running through a small figure-eight pattern: a waggle run (waggle phase) followed by a turn to the right to circle back to the starting point (return phase), another waggle run, followed by a turn and circle to the left





Worker bees forage for:

- Nectar: Main carbohydrate source, converted into honey.
- Pollen: Source of protein for brood rearing.
- Propolis: A resin used to seal hive cracks and polish cells.
- Water: For digestion, humidity control, and hive cooling.

Each foraging material plays a unique role in maintaining hive health.

NECTAR

- ❖ **Sugary secretion of plants** produced to attract insects for the purpose of **pollination**
- ❖ Nectar is the colony's **source of carbohydrate** for energy
- ❖ Bees use their proboscis (tongue) to suck nectar from the plant's nectaries. Nectar is carried back to the hive in the **honey crop**, situated in the bee's thorax
- ❖ The sugar content of nectar is variable, typically **40% sugar, 60% water**
- ❖ Nectar is converted to honey by action of **enzymes** and **reduction in water content**. Honey is 18 to 20% water
- ❖ Honey is stored in the comb and sealed with wax
- ❖ Important **sources of nectar** in Ireland includes oil seed rape, white clover, blackberry, lime, ling/bell heather, dandelions, sycamore, horse chestnut, apple, raspberry.

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Nectar is a sugary plant secretion that bees collect for energy. Bees use their proboscis to collect nectar, storing it in their honey crop. Once back in the hive, enzymes convert nectar into honey, reducing water content until it's about 18-20% water. Common nectar sources in Ireland include clover, blackberry, heather, and dandelions.

POLLEN

- ❖ Pollen is the colony's source of **protein** for bodybuilding and tissue repair
- ❖ Foraging workers pick up pollen grains on their **hairy bodies** when foraging for nectar
- ❖ Bees will specifically forage for pollen when needed
- ❖ Pollen is carried back to the hive on the **pollen baskets, 'corbiculae', located on the hind legs**
- ❖ Pollen can be stored in the comb for future use, close to the brood area
- ❖ Important **sources of pollen** in Ireland include willow catkins, dandelions, hawthorn, horse chestnut, apple, raspberry



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Pollen provides essential proteins and fats. Bees gather it on their corbiculae (pollen baskets on hind legs) and store it close to the brood. Pollen sources in Ireland include dandelions, horse chestnut, and apple trees.

PROPOLIS

- ❖ Propolis is a **resinous material** collected by bees from the opening buds of various trees and is often described as bee glue
- ❖ Bees pack it into their **pollen baskets (corbiculae)** and carry it back to the hive
- ❖ House bees help to unload it
- ❖ Propolis is **used to fill cracks** or strengthen the surface edge of the combs. Some colonies use propolis to control the size of the entrance
- ❖ It is also used to **polish the inside of brood cells** prior to re-laying by the queen

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Propolis, or bee glue, is a sticky substance bees collect from tree buds. They use it to fill cracks, strengthen comb edges, and polish brood cells, preventing disease. Propolis has antimicrobial properties, making it vital for hive hygiene.

WATER

- ❖ Bees need water to **digest and metabolise** their food
- ❖ Bees use water to **dilute stored honey** for consumption
- ❖ Bees spread water on the surface of the comb to **cool the nest** by evaporation
- ❖ Bees use water to **control humidity**
- ❖ Water is carried by specialist water carrying foragers **in their crops**. The number of carriers varies according to colony need
- ❖ Bees do not store water in the comb.

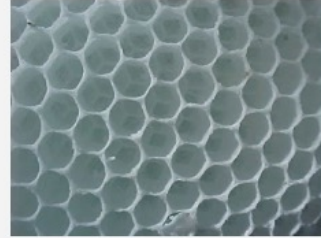
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Water is essential for colony functions. Bees use it to dilute honey, cool the hive, and control humidity. Specialized foragers collect water and distribute it as needed.

WAX

- ❖ Wax is **secreted by worker bees**. When workers are about 10 days old, they begin to secrete wax from 4 pairs of **wax-producing glands on the underside of their abdomens**.
- ❖ The **glands convert the sugar in the honey into wax**, which seeps through small pores in the bee's body leaving tiny white scales on its abdomen.
- ❖ These scales of wax are then chewed by the bees. The chewed wax is added to the **construction of the honeycomb** and sealing of cells.
- ❖ The wax of honeycomb starts off clear to white, but becomes progressively more yellow or brown with the incorporation of pollen, oils, honey and propolis.



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Worker bees secrete wax around 10 days of age from glands on their abdomen. The bees chew wax flakes, shaping them into hexagonal cells. Wax darkens over time due to contact with honey, pollen, and propolis.



PREPARED BY THE IRISH BEE FOUNDATION EDUCATION TEAM:
Brendan Murray, Daniel Hiney, Donal Cooper, Jim Agnew, Mairead Dineen Love, Michele O'Connor Connolly