Structure & Function of the Nervous System

The Senses

The Antennae

The Eyes

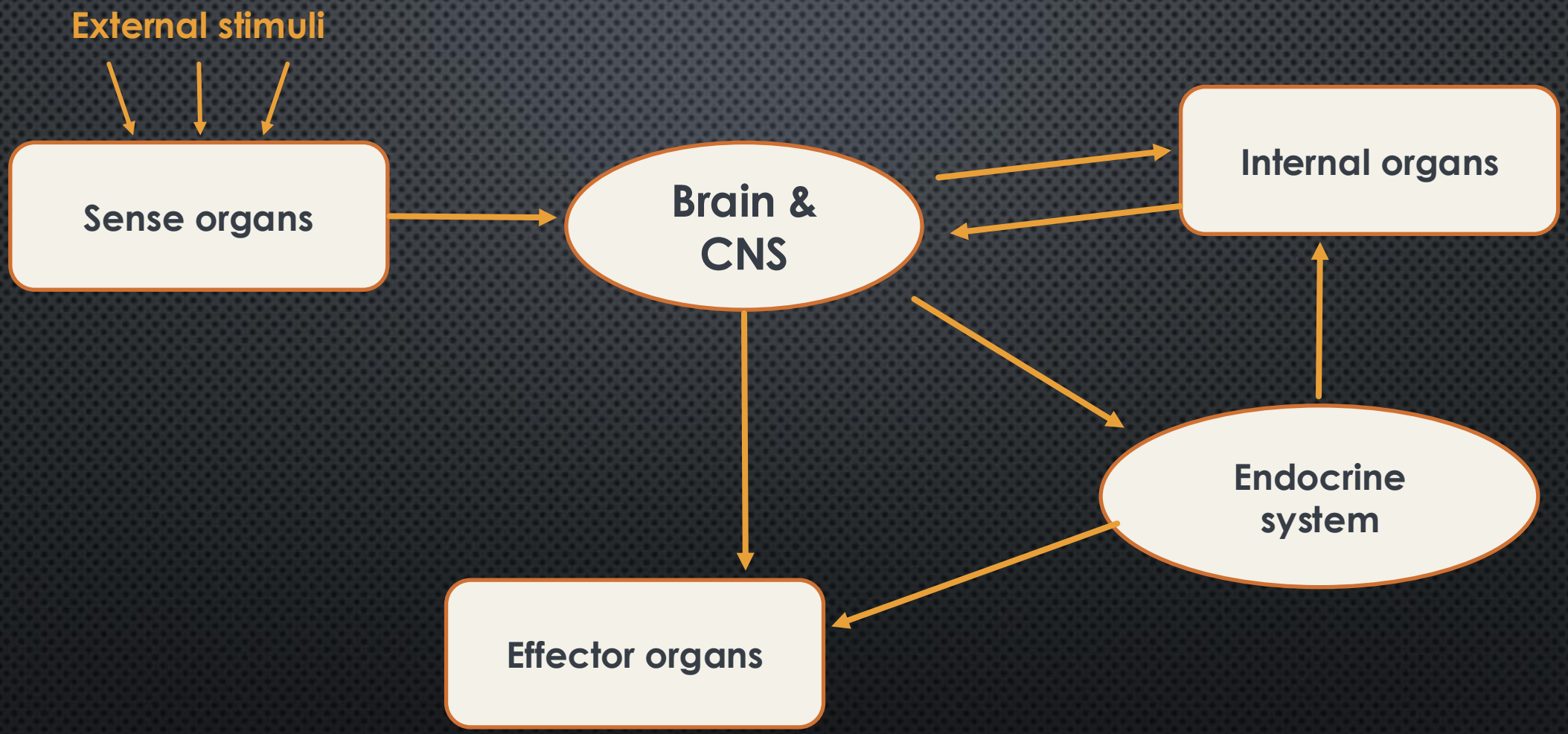
In order to live and reproduce all organisms need to be able it to read and react to the world around it.

To do this it has a complex system of different specialist sense organs to receive, analyze and interpret the incoming stimuli.

These inputs have an interconnected system of command and control to coordinate and carry out the response.

In most animals this is in the form of a brain and a Central Nervous System (CNS)

How control systems work



THE BRAIN

Largest of all insects

Control centre for all activities

Receives stimuli from sensors

Directs them by sending nervous inpulses to relevant part of the brain

Interprets them as smell, taste, pressure, temperature etc..

Interacts with the Central Nervous System (CNS) and the Endocrine System

Site of the most complex learning processes



Let's start with the main driver of the network, the brain

Divided into 3 main parts:

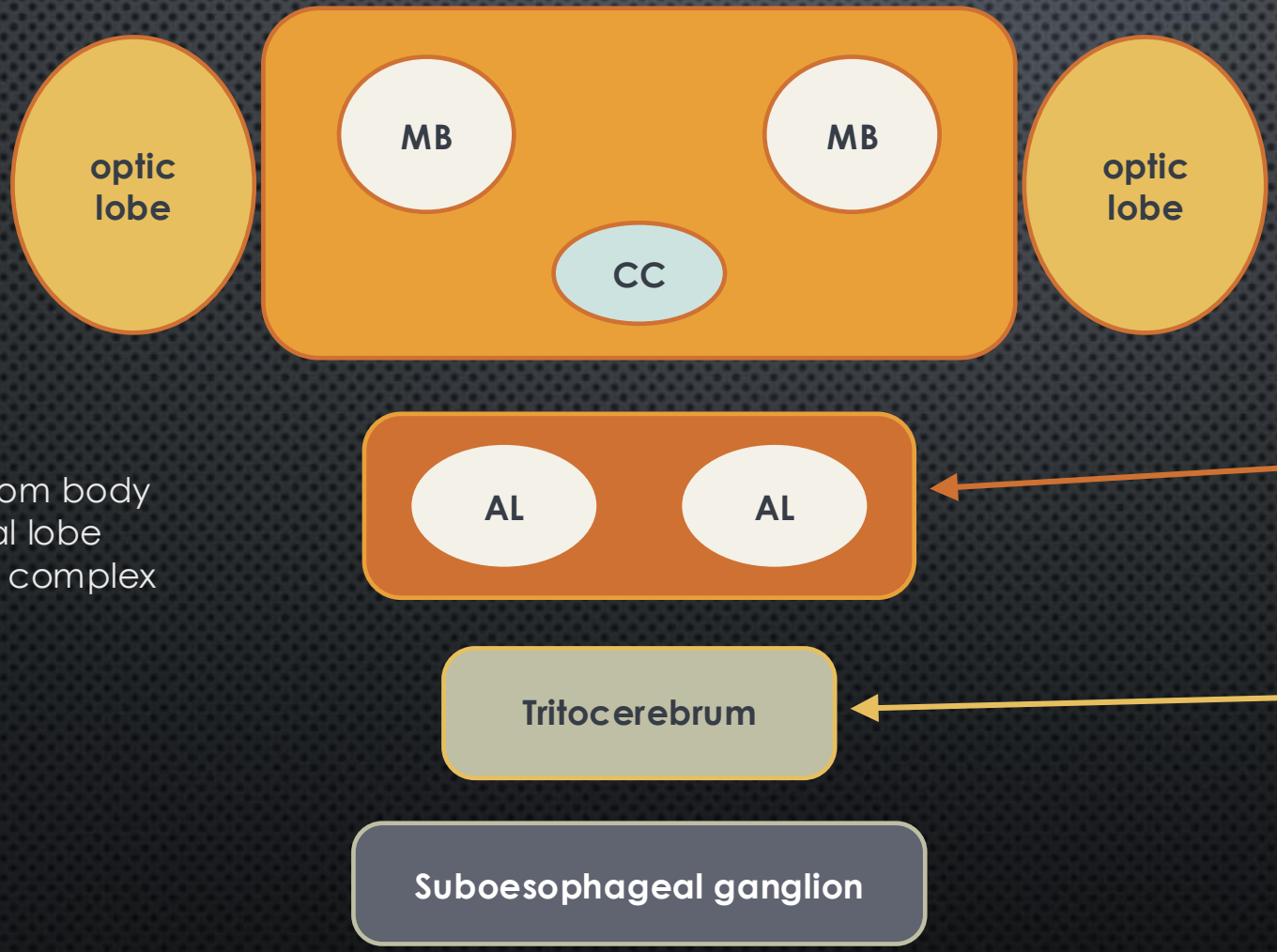
Protocerebrum

Deutocerebrum

Tritocerebrum

The brain: three main regions

A complex, highly sophisticated organ divided into three fused parts



MB = mushroom body
AL = antennal lobe
CC = central complex

Protocerebrum

optic lobes (vision), mushroom bodies (learning, memory), central complex

Deutocerebrum

antennal lobes: smell, taste and touch from the antennae

Tritocerebrum

two small lobes; serve the labrum and gut, and link the brain to the suboesophageal ganglion

Honeybee brain

3-D reconstruction, frontal view

MC — medial calyx

LC — lateral calyx

mushroom bodies: learning, memory

AL — antennal lobe: smell

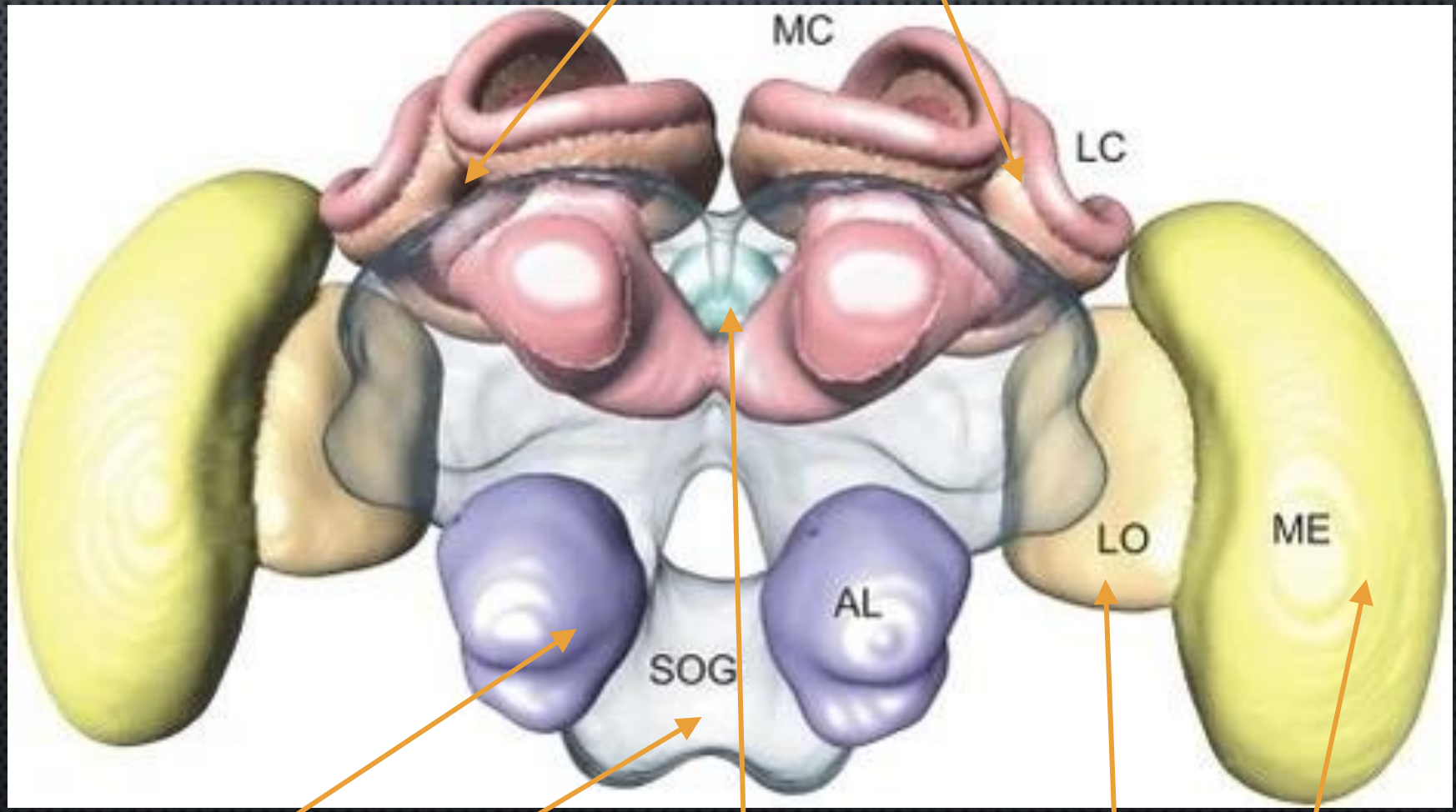
ME — medulla

LO — lobula

optic lobes: vision

SOG — suboesophageal ganglion: taste

CC — central complex: navigation



Honeybee brain: what each region does

Region	Function
Lamina	First visual relay: brightness and contrast from the compound eye
Medulla	Second visual neuropil: colour and motion processing
Lobula	Third visual neuropil: relays visual features to the central brain
Optic lobes	Lamina, medulla and lobula together — about a third of the brain
Antennal lobes	First olfactory relay: glomeruli encode odour identity
Mushroom bodies	Learning and memory: calyces take input, lobes drive behaviour
Central complex	Spatial orientation, sky-compass navigation and motor coordination
Protocerebrum	Higher integration: links sensory input to motor commands
Subesophageal ganglion	Controls mouthparts, feeding and proboscis extension

Honey Bee Brain — Key Regions

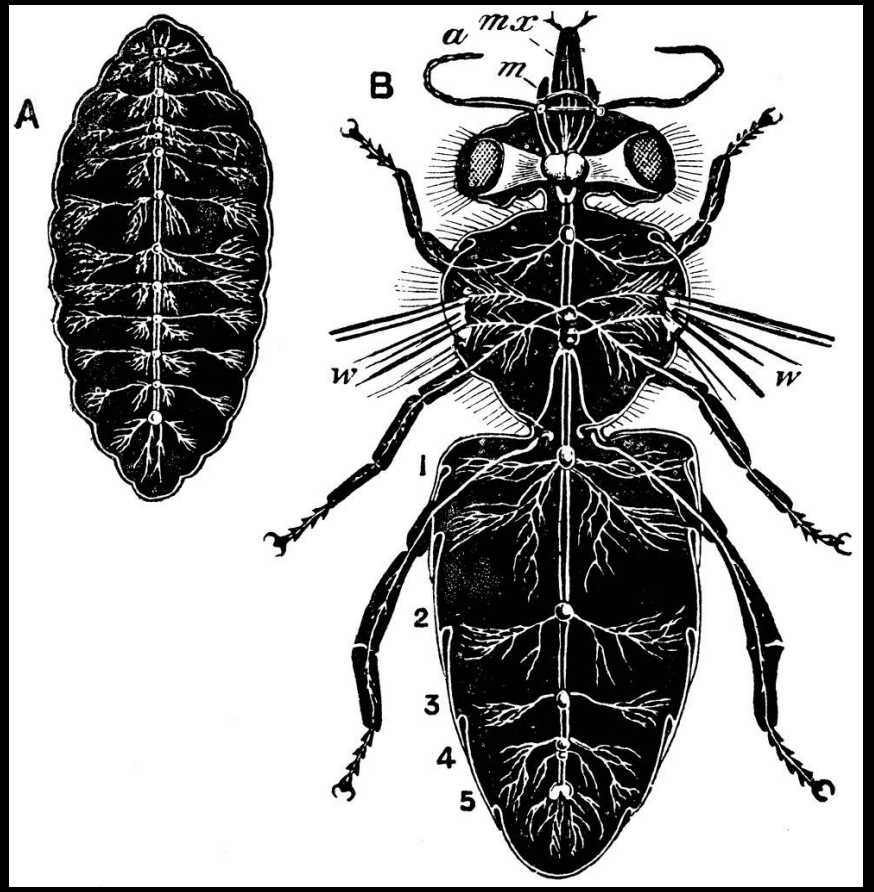
Simplified schematic (dorsal view). Structures are paired; only the left side is labelled — the right mirrors it.

Impulses from the brain transmitted through a network of nerves, called neurons throughout the body

Connected through a series of structures called ganglia.

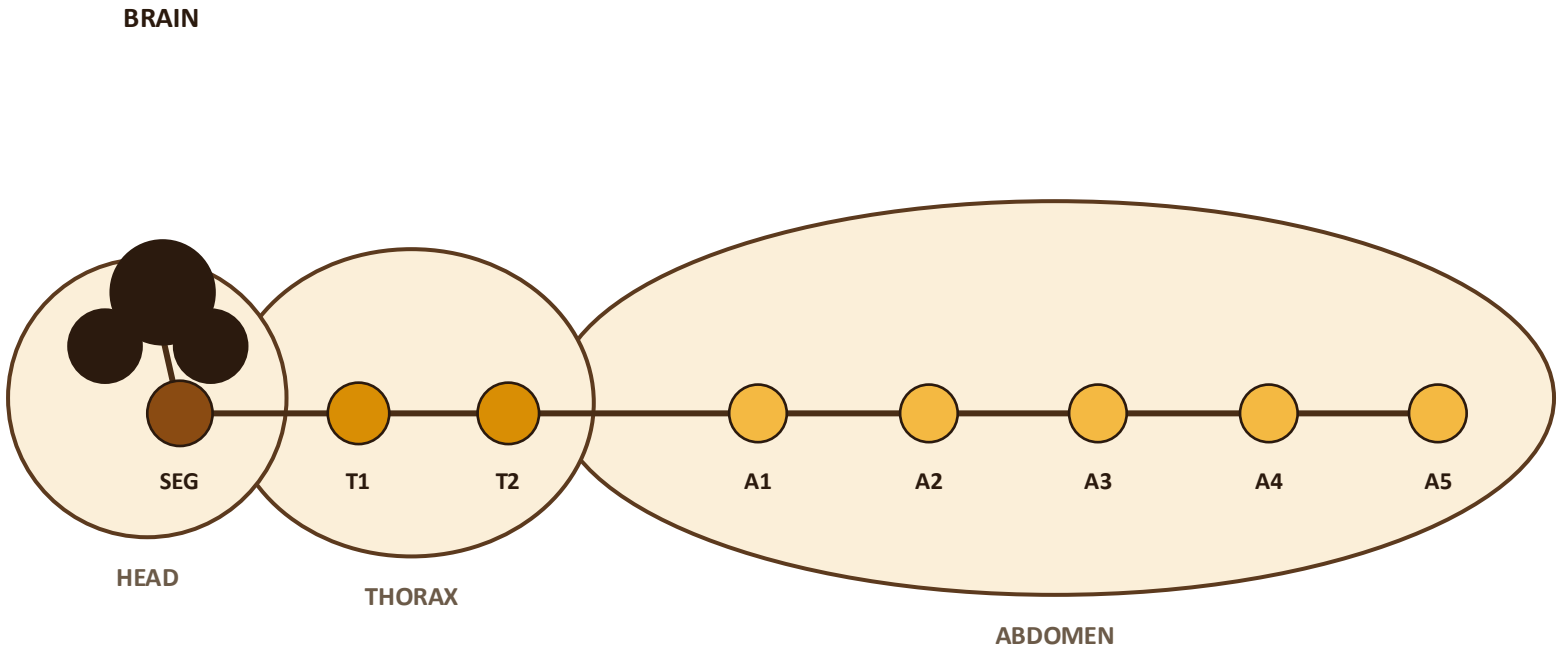
Ganglia control activities in each segment of the CNS, in some cases in dependently of the brain.

They act as relay stations between the neurons



Central Nervous System of the Honey Bee

Schematic ventral view — brain, suboesophageal ganglion (SEG), and the ganglia of the nerve cord



KEY

Brain

Protocerebrum, deutocerebrum & tritocerebrum — vision, olfaction, learning and memory.

Suboesophageal ganglion

Controls mandibles, antennae and salivary glands; relays to the nerve cord.

Thoracic ganglia (2)

Drive the legs and the flight muscles of the wings.

Abdominal ganglia (5)

Control abdominal movement, the sting, and reproductive organs.

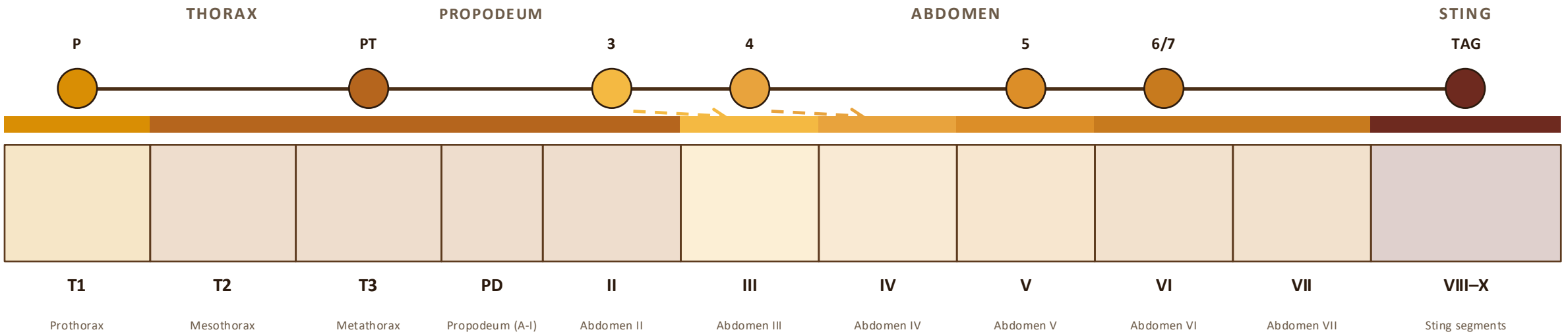
Ventral nerve cord

Paired connectives & commissures linking every ganglion in the chain.

Ganglion count and layout reflect the typical adult worker bee; some segmental ganglia are fused.

Ganglia Mapped to Exoskeleton Segments

Where each ganglion physically sits versus the segment(s) its nerves actually control



Dot on the line — where the ganglion itself physically sits inside the body.
Coloured bar under the line — how far that ganglion's nerves reach, i.e. the segments (pale boxes below) it controls.
Dashed arrow — the two ganglia that sit one segment forward of the segment they serve, so dot and bar do not line up.

Prothoracic ganglion

Sits in T1 · controls only T1 (forelegs).

Pterothoracic ganglion

Sits in T3 · controls T2, T3, propodeum & A-II (mid/hind legs, both wing pairs).

Ganglion → A-III

Sits in A-II, displaced forward · controls A-III.

Ganglion → A-IV

Sits in A-III, displaced forward · controls A-IV.

Ganglion A-V

Sits in & controls A-V only — not displaced.

Ganglion A-VI/VII

Sits in A-VI · controls A-VI & A-VII together.

Terminal ganglion (TAG)

Fusion of segments VIII–XI · controls the sting, hindgut & reproductive organs.

Segment numbering follows Snodgrass (Anatomy of the Honey Bee); the propodeum develops as abdominal segment I but fuses to the thorax.

Ganglion-to-Segment Reference Table

Physical location and segmental innervation of each ganglion in the worker honey bee nerve cord

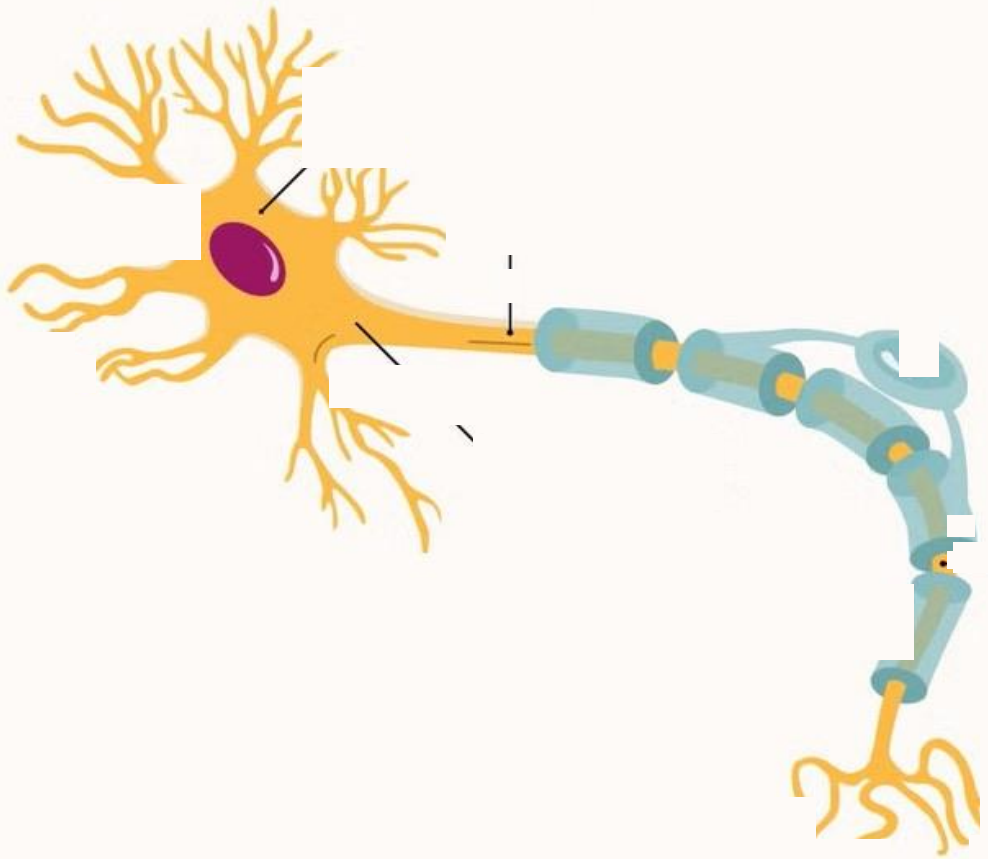
Ganglion	Physically sits in	Controls segment(s)	Structures / functions
Prothoracic ganglion	T1 (prothorax)	T1 only	Foreleg muscles
Pterothoracic ganglion	T3 (metathorax)	T2, T3, propodeum (A-I), A-II	Mid & hind legs, both fore- and hindwings — flight control
Ganglion → A-III	A-II (displaced forward)	A-III	Segment III muscles & sensory relay
Ganglion → A-IV	A-III (displaced forward)	A-IV	Segment IV muscles & sensory relay
Ganglion A-V	A-V	A-V only	Segment V muscles & sensory relay
Ganglion A-VI/VII (fused)	A-VI	A-VI & A-VII	Abdominal movement, spiracles/breathing
Terminal ganglion (TAG)	Posterior tip (fusion of VIII–XI)	A-VIII – A-X	Sting apparatus, hindgut, reproductive organs

Seven ganglia (SEG + 2 thoracic + 5 abdominal) form the nerve cord below the brain; some sit one segment ahead of, or fuse across, the region they innervate.

Source: Snodgrass, Anatomy of the Honey Bee (1910/1956); Smith (in Fischer et al. 2023, iScience) on abdominal ganglion fusion.

What do these individual components look like?

Structure of a neuron

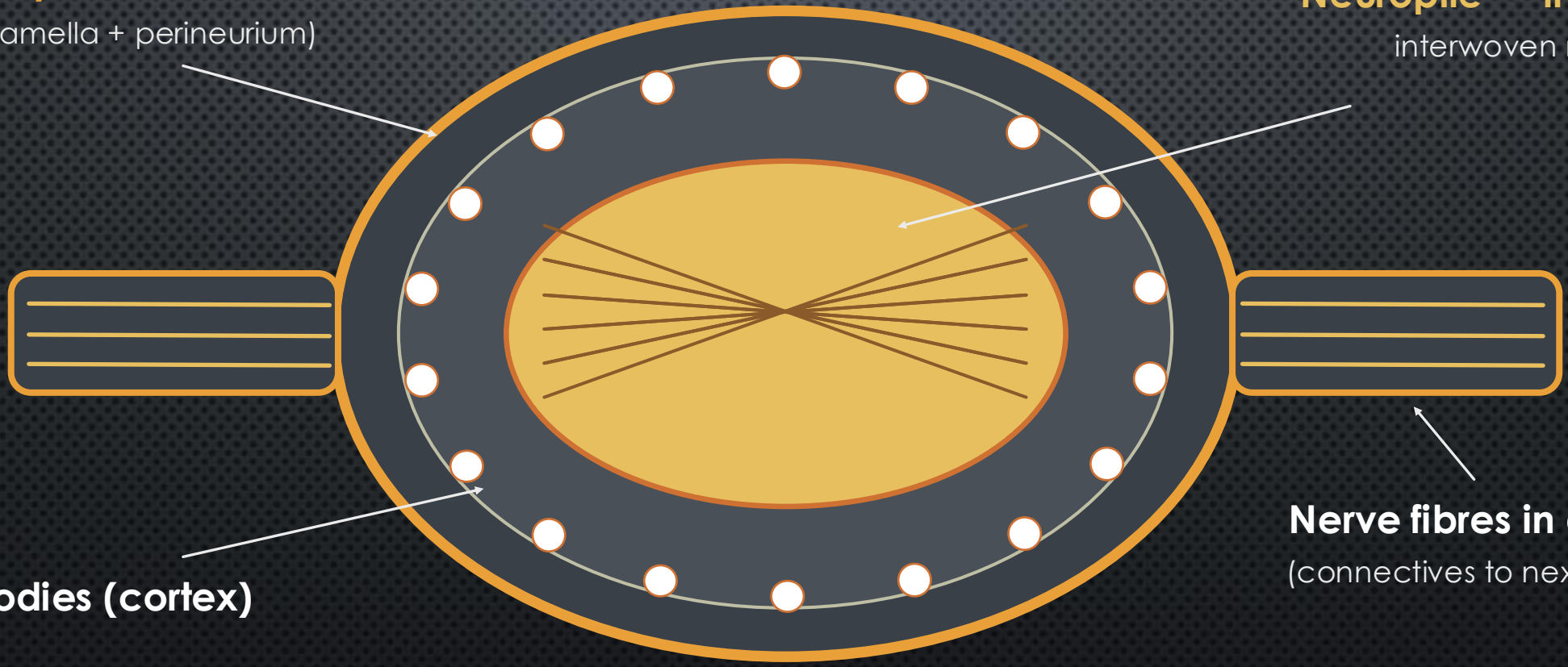


healthline

Structure of a ganglion

Outer layer
(neural lamella + perineurium)

Neuropile — inner core
interwoven nerve fibres



Cell bodies (cortex)

Nerve fibres in a bundle
(connectives to next ganglion)

Function of a ganglion

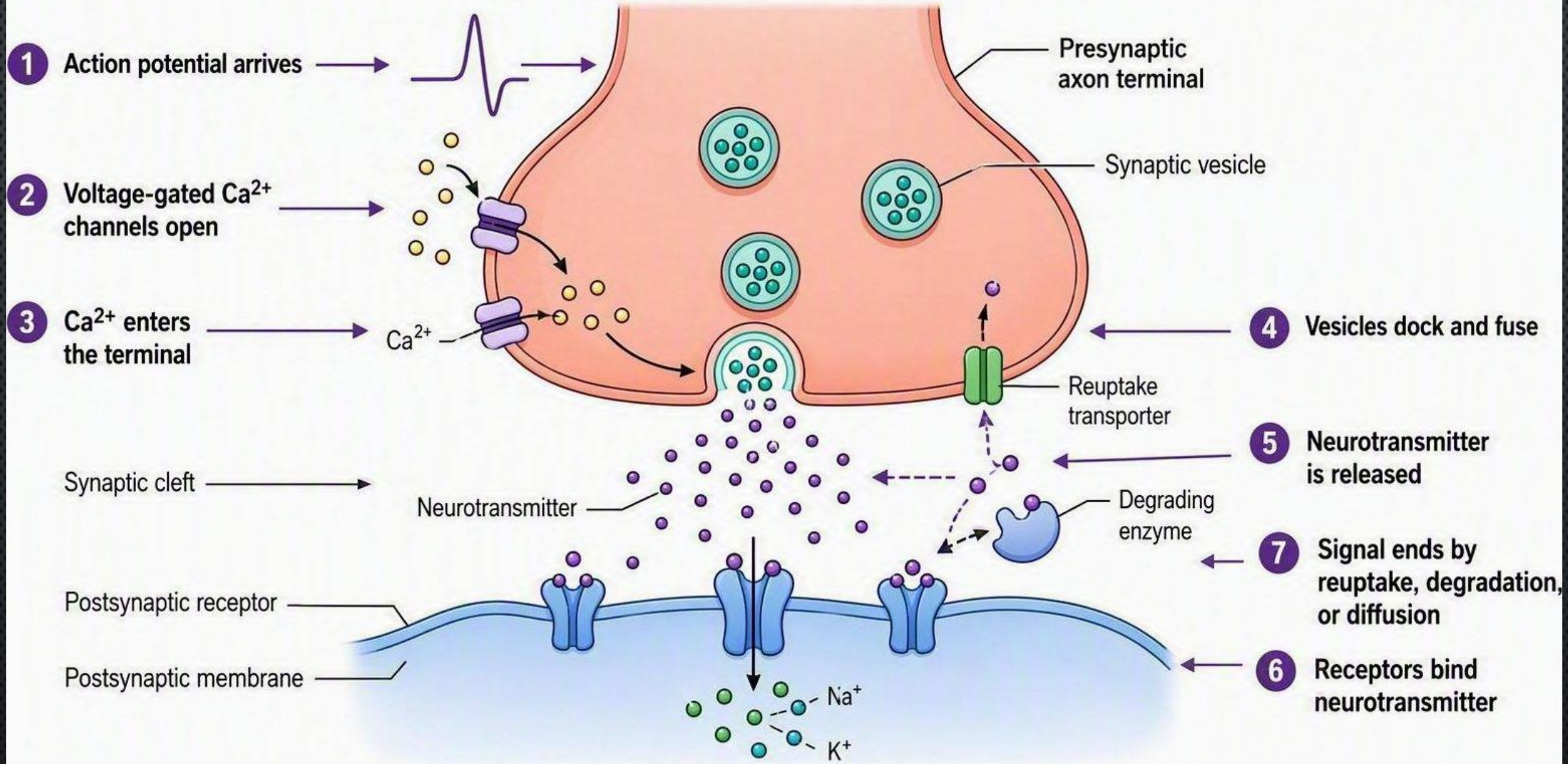
Control activities in each segment of the CNS, in some cases independently of the brain.

Act as relay stations between the neurons

Unlike electrical transmission where the components must be joined together in a continuous circuit the neuron and ganglia are separated by gaps called synapses

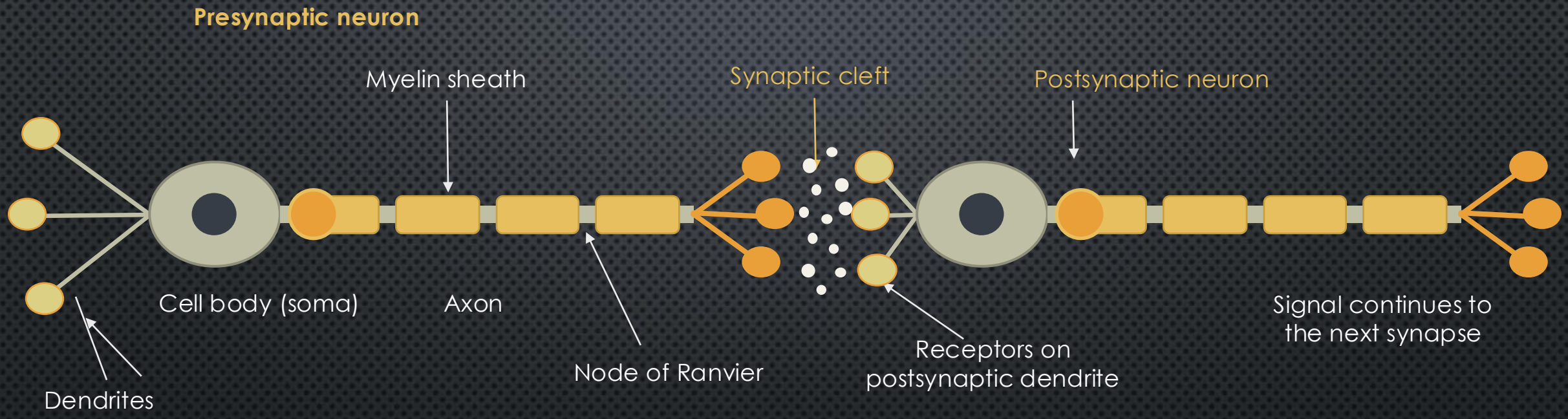
They bridge the gap with a complex series of electro-chemical impulses called synaptic transmission

Chemical Synapse: Steps of Synaptic Transmission

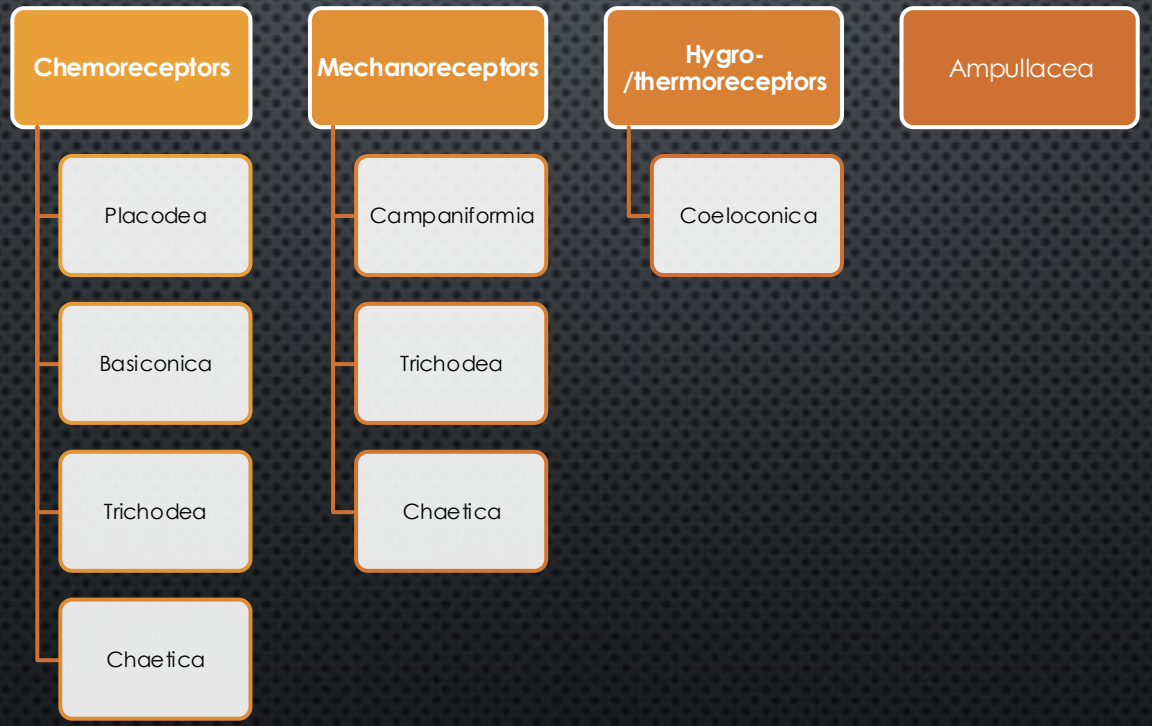


Electrical signal → chemical signal → electrical response

SYNAPTIC TRANSMISSION: FROM DENDRITE TO DENDRITE

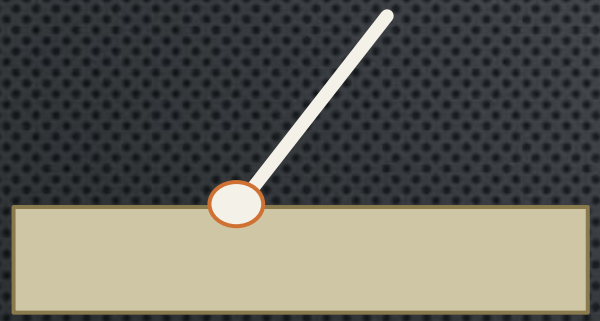


External stimuli are received through specialist sensory receptors called sensilla (singular sensillum) of four main categories. Within each category there are several different types:

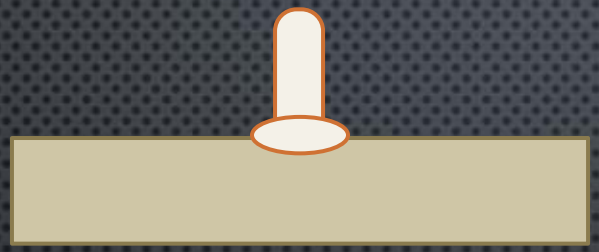


Types of sensilla

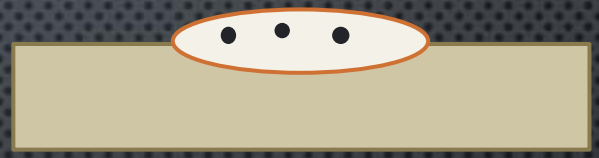
Profile through the antennal cuticle — shape follows function



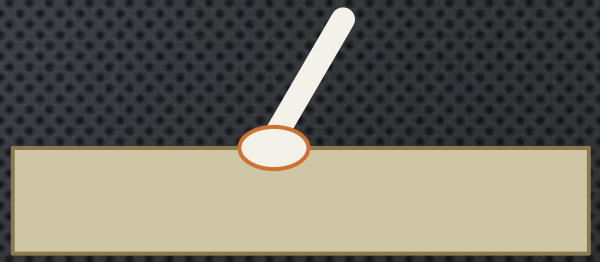
Trichoid
long hinged hair — smell, taste, touch and air movement



Basiconic
short blunt peg — contact chemoreception (taste)



Placoid
flat pore plate set in the surface — the main smell receptor



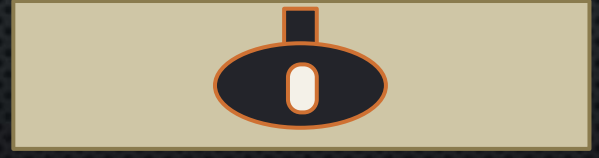
Chaetic
stout bristle in a flexible socket — touch and taste



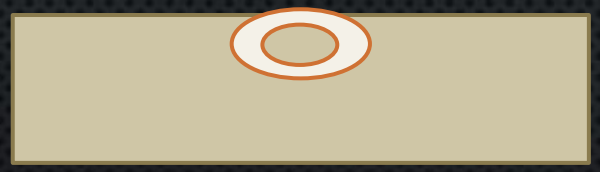
Coeloconic
peg sunk in a pit — humidity and temperature



Coelocapitular
tiny knob in a pit — humidity and temperature



Ampullaceous
peg in a flask-shaped cavity — carbon dioxide



Campaniform
dome set in the cuticle — senses strain and load

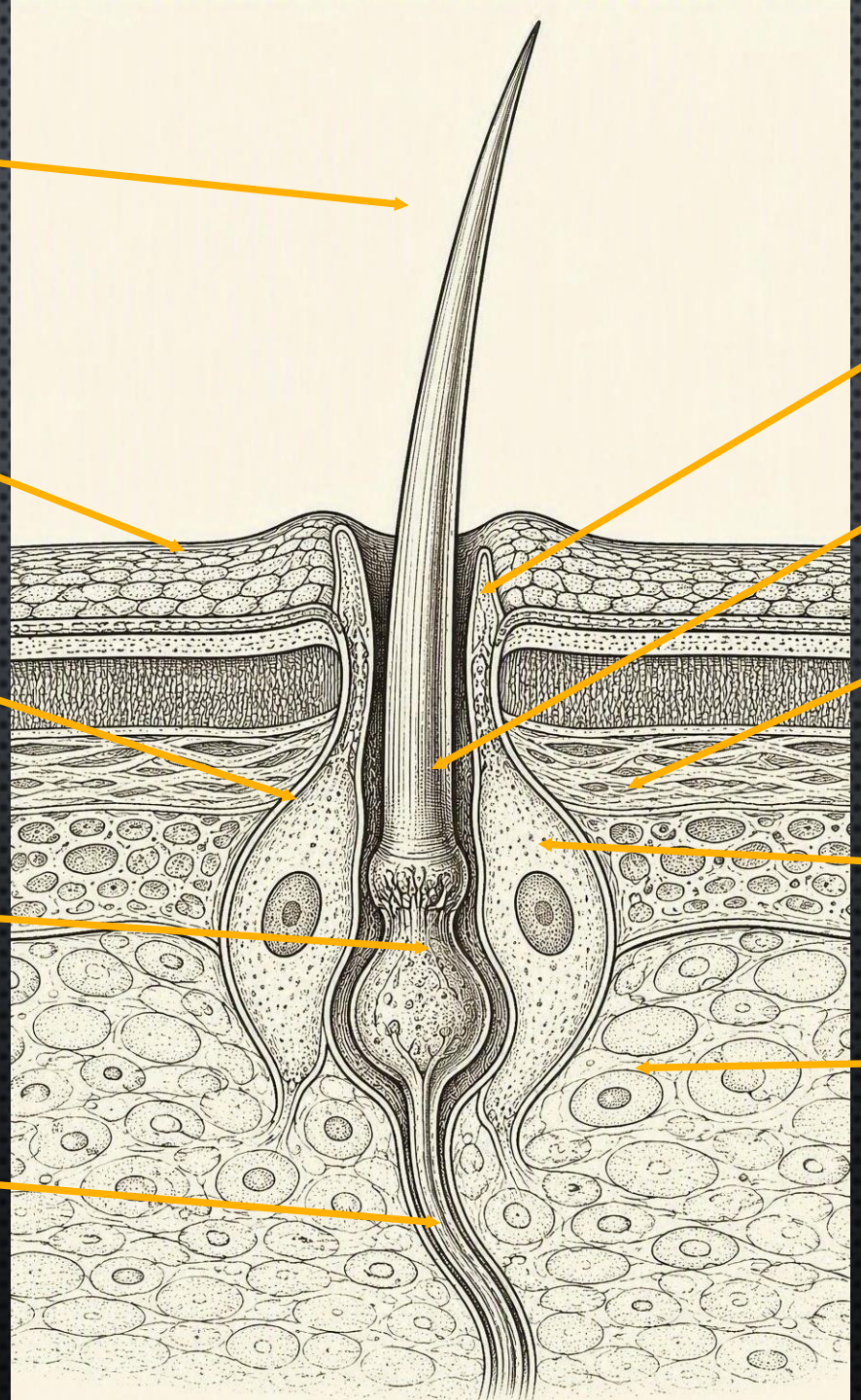
The antennae carry the widest mix of sensilla

Taste sensing extends to the mouthparts and forefeet; strain sensing extends to the wings and legs

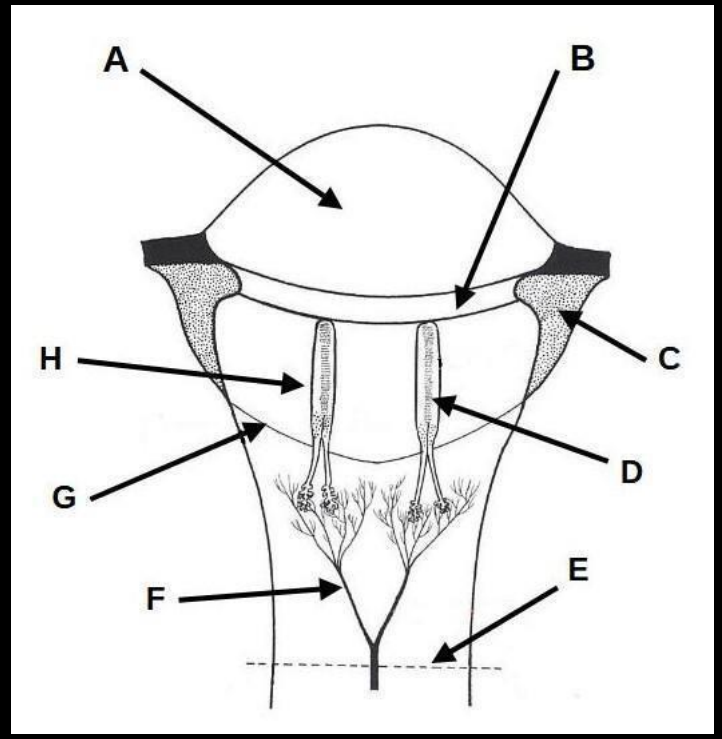
Sensillum type	Principal location(s)	Primary role
Trichoid	Antennal flagellum	Smell, touch and air movement
Placoid	Antennal flagellum — pore plates	Olfaction; the main smell receptors
Basiconic	Distal antennae; mouthparts; foreleg tarsi	Taste / contact chemoreception
Chaetic	Distal antennae; mouthparts; foreleg tarsi	Taste and touch
Coeloconic + coelocapitular	Antennal flagellum	Humidity and temperature
Ampullaceous	Antennal flagellum	Carbon dioxide / nest microclimate
Campaniform	Wing and leg cuticle, especially bases and joints	Strain, load and movement feedback

Principal sites only — distributions overlap. Sources: Esslen & Kaissling (1976); de Brito Sanchez (2011); Fialho et al. (2014); Paoli & Galizia (2021).

Structure of a sensillum trichodium



A campaniform sensillum



A cuticular cap — the dome

B tubular body — dendrite tip fixed to the cap

C surrounding cuticle and collar

D dendritic sheath

E axon, running to the central nervous system

F sensory neuron cell body

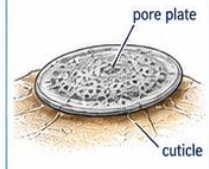
G sheath (enveloping) cells

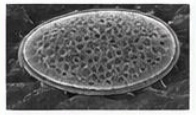
H dendrite

Sensilla of the Honey Bee (*Apis mellifera*)

Types, structure, location and functions

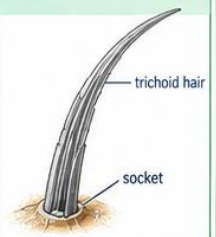
1. Sensillum placodeum (olfaction)

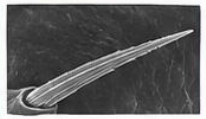




- **Shape:** flat, oval plate with pores
- **Location:** mainly on flagellum (also on scape)
- **Function:** olfaction (detection of volatile chemicals)

2. Sensillum trichodeum A (olfaction / mechanosensation)

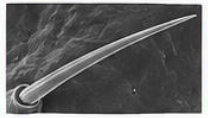




- **Shape:** long, hair-like (often with grooves)
- **Location:** mainly on flagellum
- **Function:** olfaction (volatile compounds); mechanosensation (touch, vibration)

3. Sensillum trichodeum B (mechanosensation)





- **Shape:** long, hair-like (smooth)
- **Location:** mainly on flagellum
- **Function:** mechanosensation (touch, airflow, vibration)

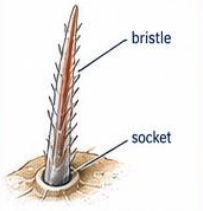
4. Sensillum basiconicum (olfaction / chemoreception)





- **Shape:** short, peg or cone
- **Location:** mainly on flagellum (also scape)
- **Function:** olfaction; chemoreception (non-volatile chemicals)

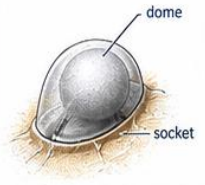
5. Sensillum chaeticum (taste + mechanosensation)

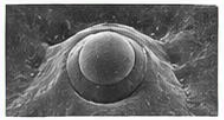




- **Shape:** slender bristle with surface structures
- **Location:** mainly on mouthparts, legs, tarsi
- **Function:** gustation (taste); mechanosensation (contact, vibration)

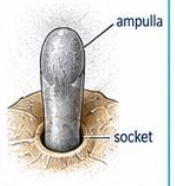
7. Sensillum campaniformium (mechanoreception)





- **Shape:** dome or cap-like
- **Location:** on antenna, legs, wing base
- **Function:** mechanoreception (strain, pressure, vibration)

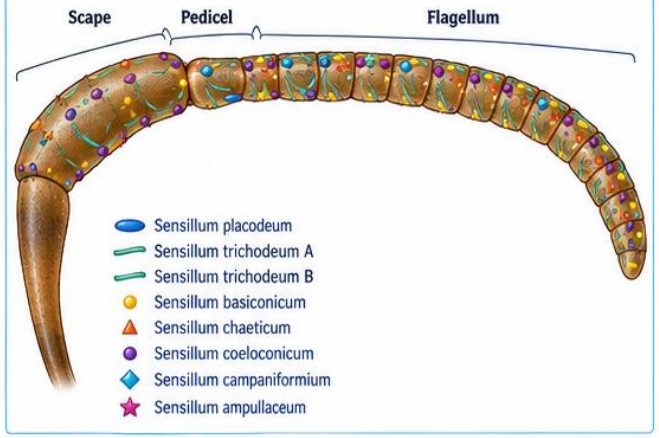
8. Sensillum ampullaceum (specialised environmental sensing)



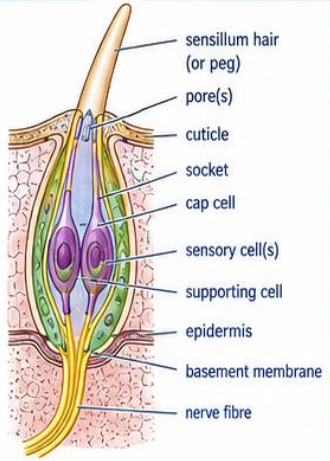


- **Shape:** bulbous ampulla in a cavity
- **Location:** mainly on flagellum (rare)
- **Function:** humidity, temperature, possiblly chemicals

Distribution of sensilla on the honey bee antenna



Structure of a sensillum (generalised)



Summary of functions and locations

Sensillum type	Main function(s)	Main location
Placodeum	Olfaction	Flagellum (mainly) (also scape)
Trichodeum A	Olfaction, mechanosensation	Flagellum
Trichodeum B	Mechanosensation	Flagellum
Basiconicum	Olfaction, chemoreception	Flagellum (also scape)
Chaeticum	Taste, mechanosensation	Mouthparts, legs, tarsi
Coeloconicum	Temperature, humidity, CO_2 (and other cues)	Flagellum
Campaniformium	Mechanoreception	Antenna, legs, wing base
Ampullaceum	Humidity, temperature, possibly chemicals	Flagellum (rare)

The honey bee's sensilla provide a sophisticated sensory system, enabling it to detect odours, tastes, temperature, humidity, CO_2, mechanical stimuli and other environmental cues essential for foraging, navigation and colony life.

THE ANTENNAE

Many thousands of sensilla are found on the antenna

Connected to the head with a ball and socket joint

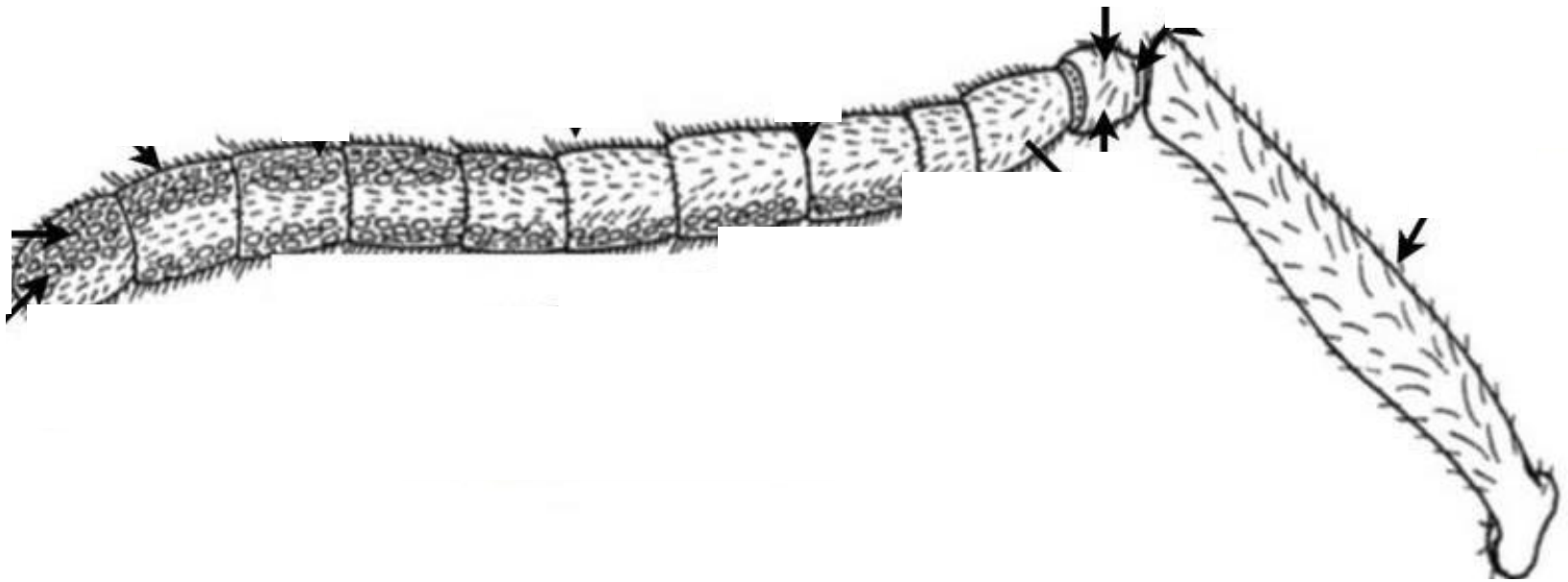
Constructed in 3 parts:

- Scape
- Pedicel
- Flagellum

Each flagellum contains smaller sub-segments

- Flagellomeres

  10 in females
  11 in males



The antenna: segments and sensilla

Worker antenna, lateral view — not to scale

Flagellum
10 flagellomeres in the worker and queen, 11 in the drone

Pedicel
houses Johnston's organ — detects antennal vibration, flight speed and wingbeat

Scape
ball-and-socket articulation with the head; moved by muscles



Placoid sensilla
olfactory pore plates — the main smell receptors

Trichoid sensilla
smell, taste and touch

Basiconic sensilla
contact chemoreception — taste on touching

Coeloconic & coelocapitular sensilla
humidity and temperature

Ampulliform sensilla
carbon dioxide

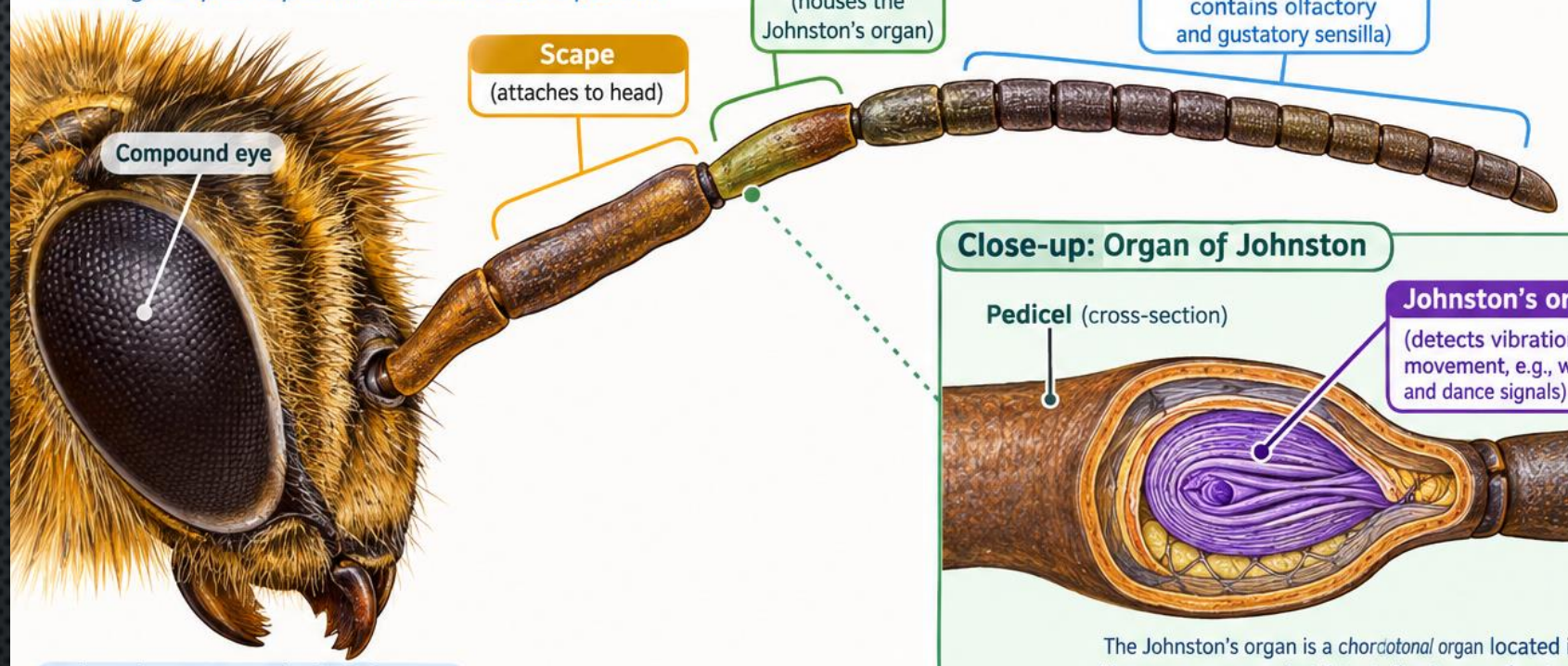
Contained at the distal end of the pedicel is the Organ of Johnstone

Can be compared to a wind speed indicator on an aircraft

Used to assess the bee's speed of flight

Honey Bee Worker Antenna
(with Organ of Johnston)

The antenna is a key sensory organ, helping the worker bee smell, taste, feel and detect the hive's environment — including the queen's pheromones and the sun's position.



Close-up: Organ of Johnston

The Johnston's organ is a *chordotonal* organ located in the pedicel, with sensory neurons that detect vibrations and antennal movement.

What the antenna helps the worker bee do:

Smell & taste
- Detects floral scents
- Identifies nestmates and queen pheromones

Detect vibrations
- Via the Johnston's organ
- Senses wing beats, movement and dance signals

Sense the environment
- Helps with orientation
- Detects light direction (for sun compass)

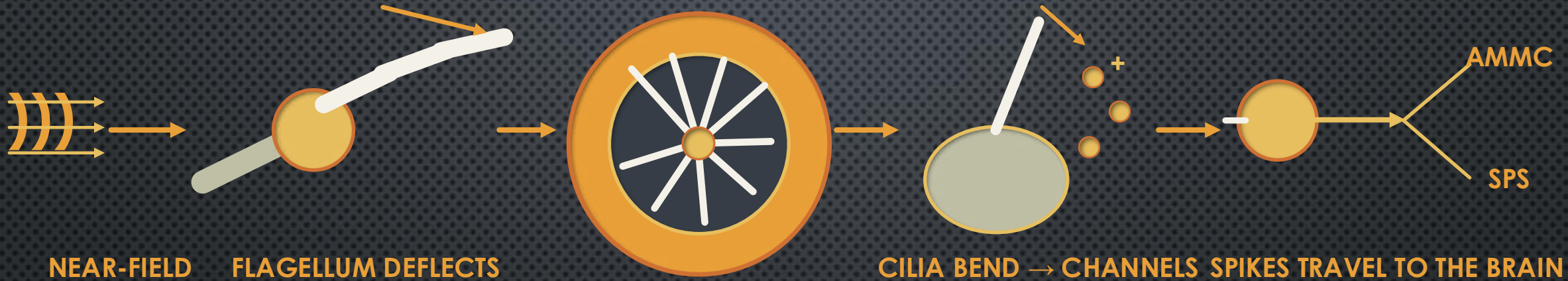
Touch & explore
- Finds food, flowers and hive
- Helps with navigation and recognition



A small organ... with a big job!

From antennal motion to nerve signals

How Johnston's organ detects airflow and waggle-dance vibrations—and converts movement into spikes.



NEAR-FIELD VIBRATION + AIRFLOW
265–350 Hz dance signals and flight air currents

FLAGELLUM DEFLECTS
The flagellum pivots relative to the pedicel

SCOLOPIDIA ARE LOADED
Cuticular attachments stretch the sensory units

CILIA BEND → CHANNELS OPEN
Mechanotransduction depolarizes receptor neurons

SPIKES TRAVEL TO THE BRAIN
Parallel processing in primary mechanosensory centres

antennal motion → stretch + cilium bending → electrical receptor signal → vibration / airflow processing

The honeybee JO contains about 300–320 scolopidia attached around the pedicel.

Sources: Tsujiuchi et al., PLOS ONE (2007); Ai, Front. Syst. Neurosci. (2010).

Johnston's organ

A ring of scolopidia inside the pedicel — the bee's ear and airspeed meter

Flagellum base
swings in the airstream

Joint membrane

Scolopidia
stretch-sensitive sensory units, ~300 in the worker



Airflow and flight speed
measures how far the flagellum is pushed back by the airstream

Near-field sound
picks up the 250–300 Hz air vibrations of the waggle dance

Gravity and antennal position
feedback on how each antenna is being held

Vibration and touch
substrate-borne and air-borne vibration from nestmates

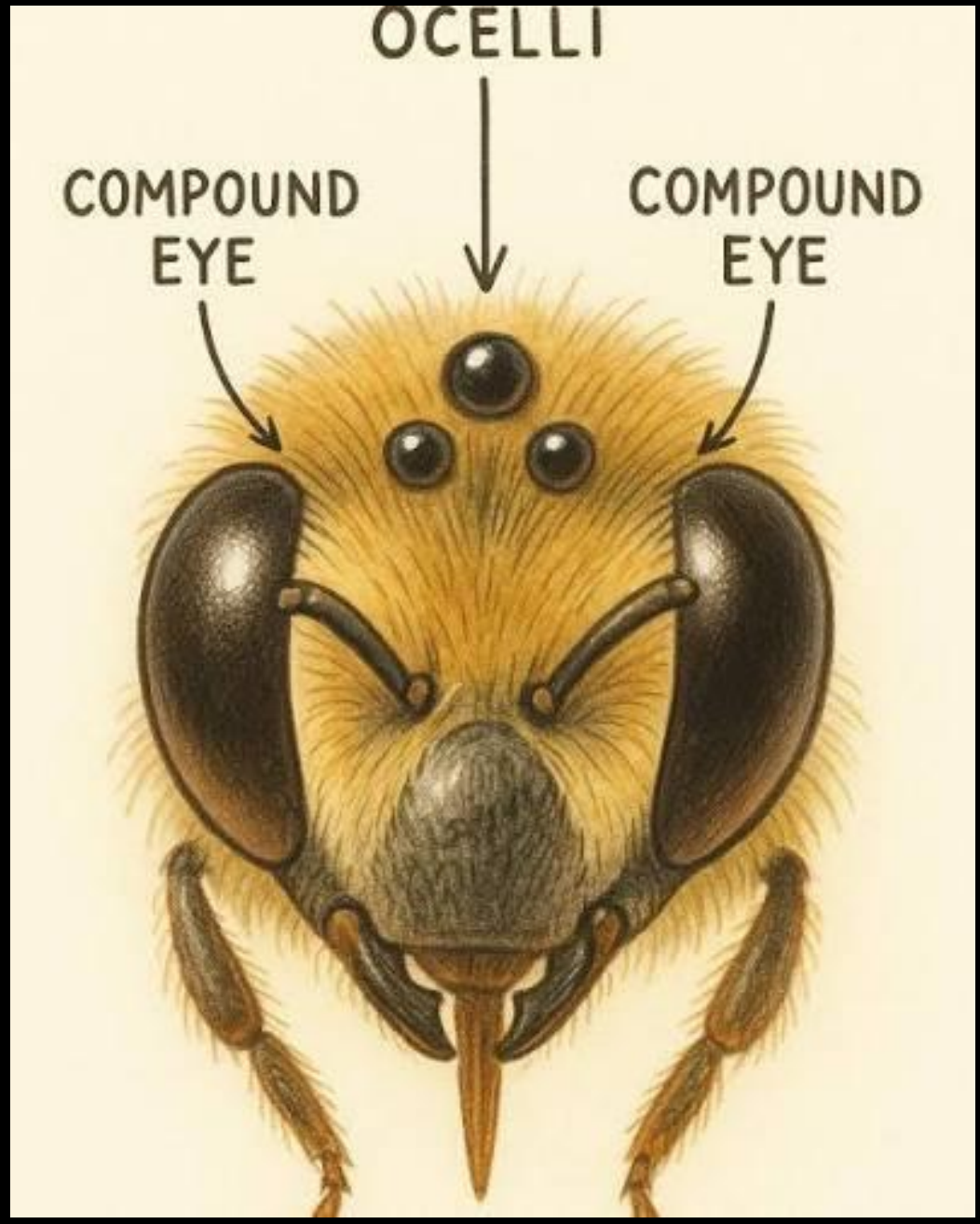
We've seen how the honey bee can touch, feel, smell, taste and navigate

Let's discover how it can see

EYES

2 Compound eyes

3 Ocelli



Outer Surface of the Compound Eye

Hexagonal corneal lenses, branched hairs and the iridescent sheen of a worker's eye

- **A mosaic of hexagonal lenses**

  Every facet is the cuticular lens of one ommatidium. In a worker they tile the whole curved surface — roughly 5,500 of them per eye.

- **Branched hairs between the facets**

  Fine setae emerge from the junctions between lenses. They register air flow for flight-speed control and help keep pollen off the optics.

- **Curved array, panoramic view**

  Because the mosaic wraps around the head, each eye covers a near-hemispheric field; the bee never needs to move its eyes to look around.

- **Iridescent corneal sheen**

  Layered cuticle in the lens surface refracts light, producing the blue-violet shimmer visible across the eye in the photograph.



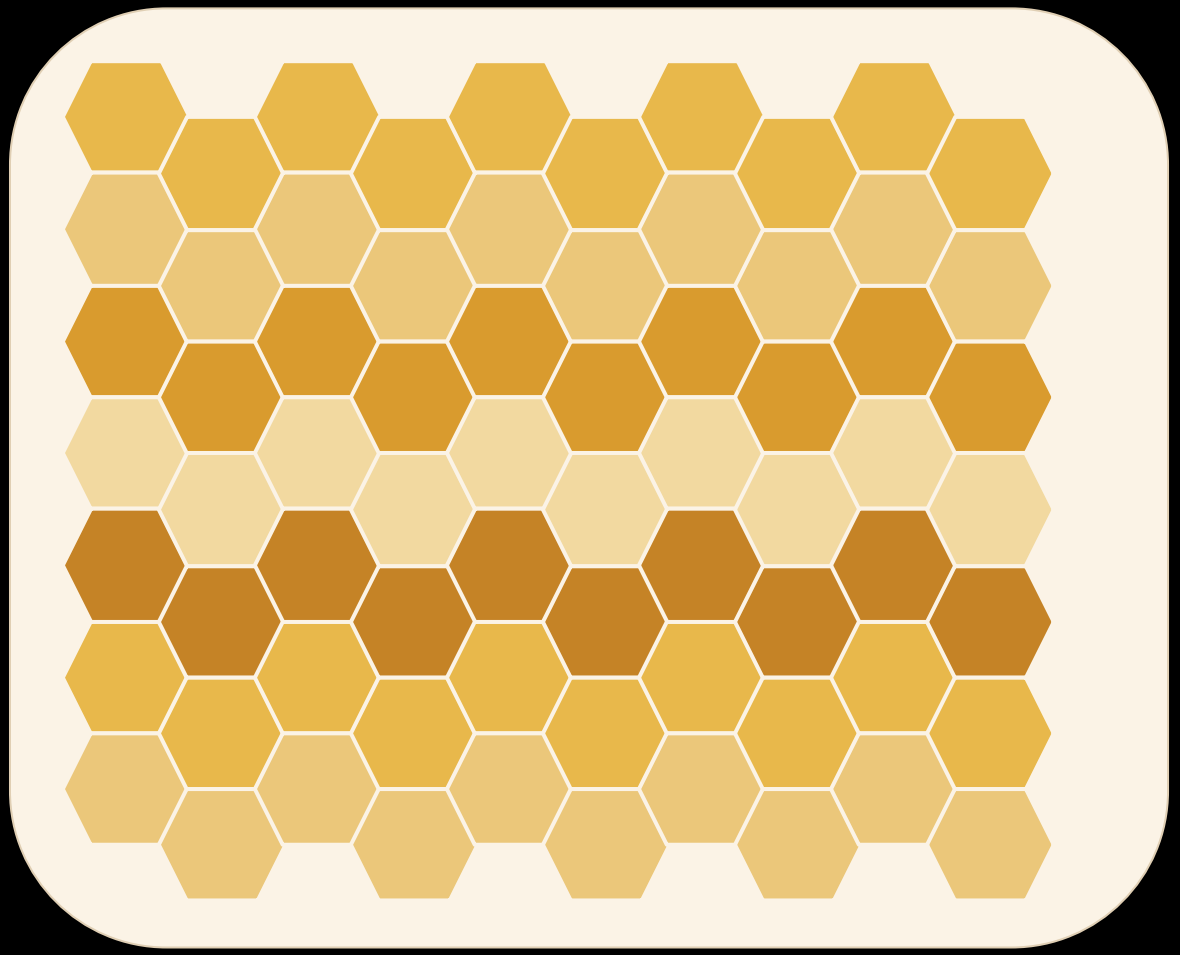
Worker honeybee compound eye, lateral close-up.

Where the sensilla are found

Sensillum	Where it is found	What it does
Trichoid	Antennal flagellum, mouthparts, legs, whole body surface	Smell, taste, touch, air movement
Chaetic	Antennae, legs, mouthparts, body surface	Touch and taste on contact
Basiconic	Antennal flagellum, galea and palps, tarsi	Contact chemoreception (taste)
Placoid	Antennal flagellum only — thousands per worker antenna	Smell — the main olfactory receptor
Coeloconic	Antennal flagellum, mostly the distal segments	Humidity and temperature
Coelocapitular	Antennal flagellum	Humidity and temperature
Ampullaceous	Antennal flagellum	Carbon dioxide
Campaniform	Antennal joints, wing bases, leg joints, sting base, petiole	Strain and load in the cuticle

The Compound Eye

Roughly 5,500 hexagonal facets per worker eye — each one a self-contained light-collecting unit



Facet surface, schematic — one hexagon = one ommatidium

- **About 5,500 facets per eye**

  Workers carry roughly 5,500 ommatidia per eye; drones up to about 8,600, densely packed towards the front for pursuing queens.

- **Sees ultraviolet, blue and green**

  Trichromatic but red-blind. UV sensitivity reveals nectar-guide patterns on petals that are invisible to us.

- **Flicker fusion about 200 Hz**

  Around five times faster than the human eye — essential for resolving flowers and landmarks during fast flight.

- **Reads polarised skylight**

  Specialised dorsal rim ommatidia detect the polarisation pattern of the sky, providing the compass used in the waggle dance.

Facet counts after Snodgrass, Anatomy of the Honey Bee; drone eyes are enlarged dorsally.

Ommatidium: Structure and Function

A: cut-away of the compound eye. B: one ommatidium in longitudinal section, with a cross-section through the rhabdom.

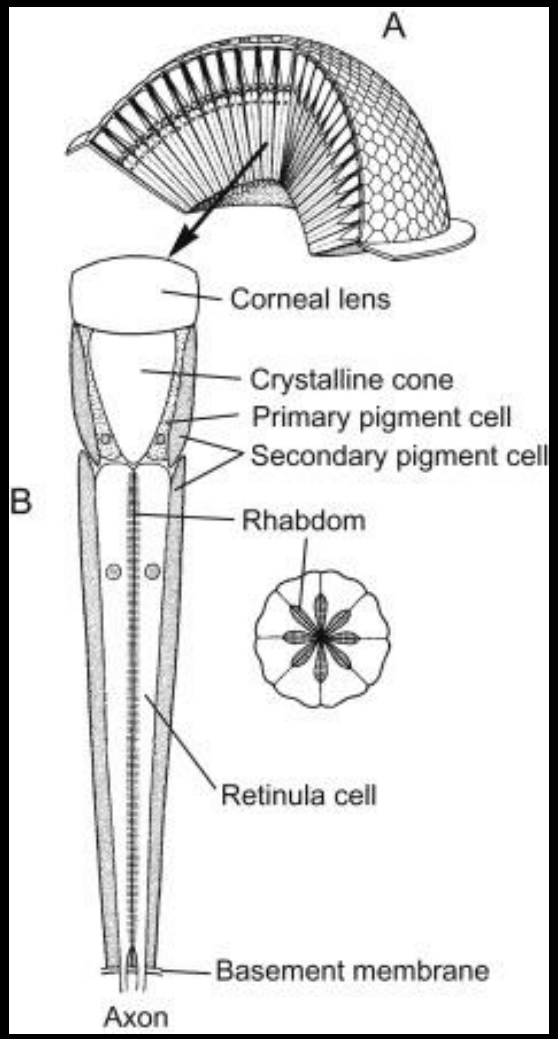


Plate after Snodgrass; labels as printed on the figure.

- **Corneal lens**
  Transparent cuticle: the outer window that gathers and focuses light.
- **Crystalline cone**
  Funnels the focused light down into the light-guiding core below.
- **Primary pigment cell**
  Sleeves the cone and screens the unit from its neighbours, keeping the image sharp.
- **Secondary pigment cell**
  Dark outer sheath running the length of the shaft; optically isolates each ommatidium.
- **Rhabdom**
  Central rod of microvilli that traps the light and holds the visual pigment.
- **Retinula cell**
  Nine photoreceptors around the rhabdom; their pigments turn light into nerve signals.
- **Basement membrane**
  Floor of the eye; the photoreceptor axons pass through it towards the brain.
- **Axon**
  Carries the signal to the lamina, the first relay station of the optic lobe.

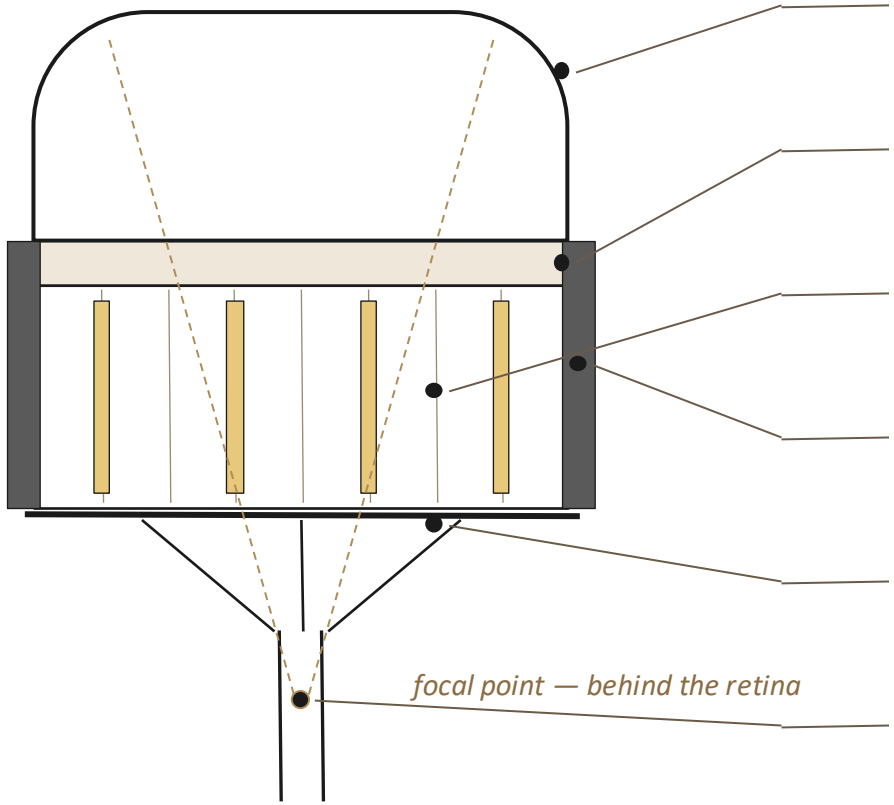
Ocelli

3 simple eyes



Inside an Ocellus

One of the three simple eyes on the vertex, in section — a light-level and horizon detector, not an image former



Schematic vertical section — not to scale

Corneal lens

A single thick cuticular lens covering the whole retina, not a mosaic of facets.

Corneagenous cells

Transparent layer beneath the lens that secretes and maintains it.

Retinula cells

About 800 photoreceptors, grouped in pairs; their rhabdoms sit in the retinal layer.

Pigment sheath

Dark cells wrapping the retina, screening it from stray light.

Basement membrane and nerve

Axons converge onto a few giant L-neurons that carry the signal straight to the brain.

Deliberately out of focus

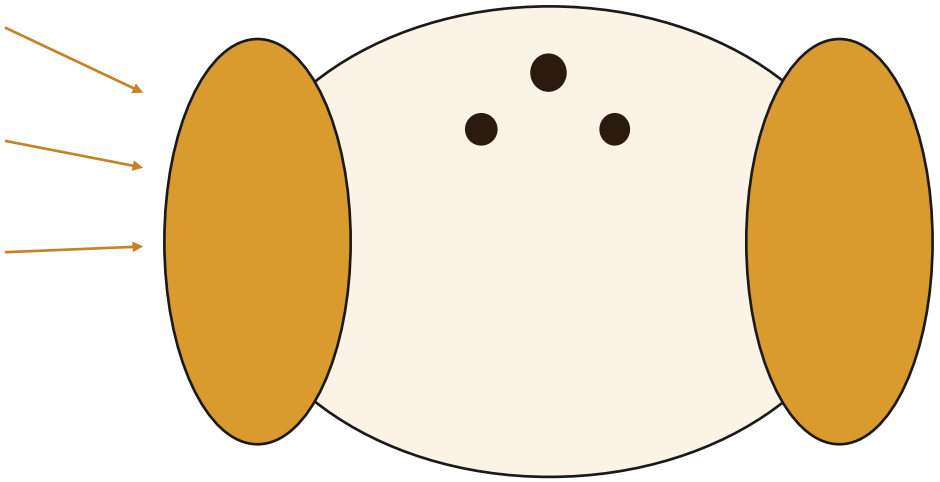
Focus falls behind the retina, so an ocellus reads light level, not detail.

Why three?

Two lateral and one median ocellus give fast, wide-field horizon cues that steady flight.

How Honeybee Vision Works

Two eye systems, three colour receptors, and where the signals travel



Worker head, front view — two compound eyes and three ocelli

Compound eyes

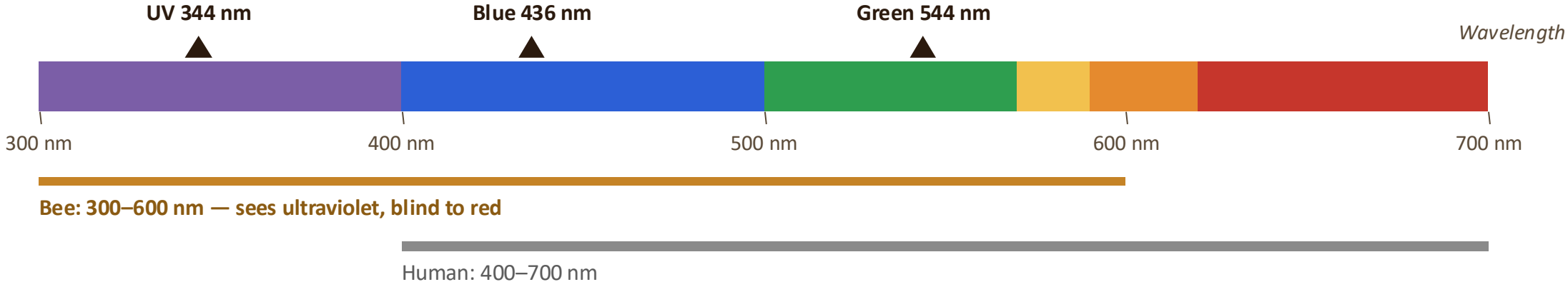
About 5,500 facets per eye build a wide-field mosaic of shape, motion and colour, refreshed near 200 Hz.

Ocelli — three simple eyes

Under-focused, so they read overall light level and the horizon; they stabilise flight rather than form images.

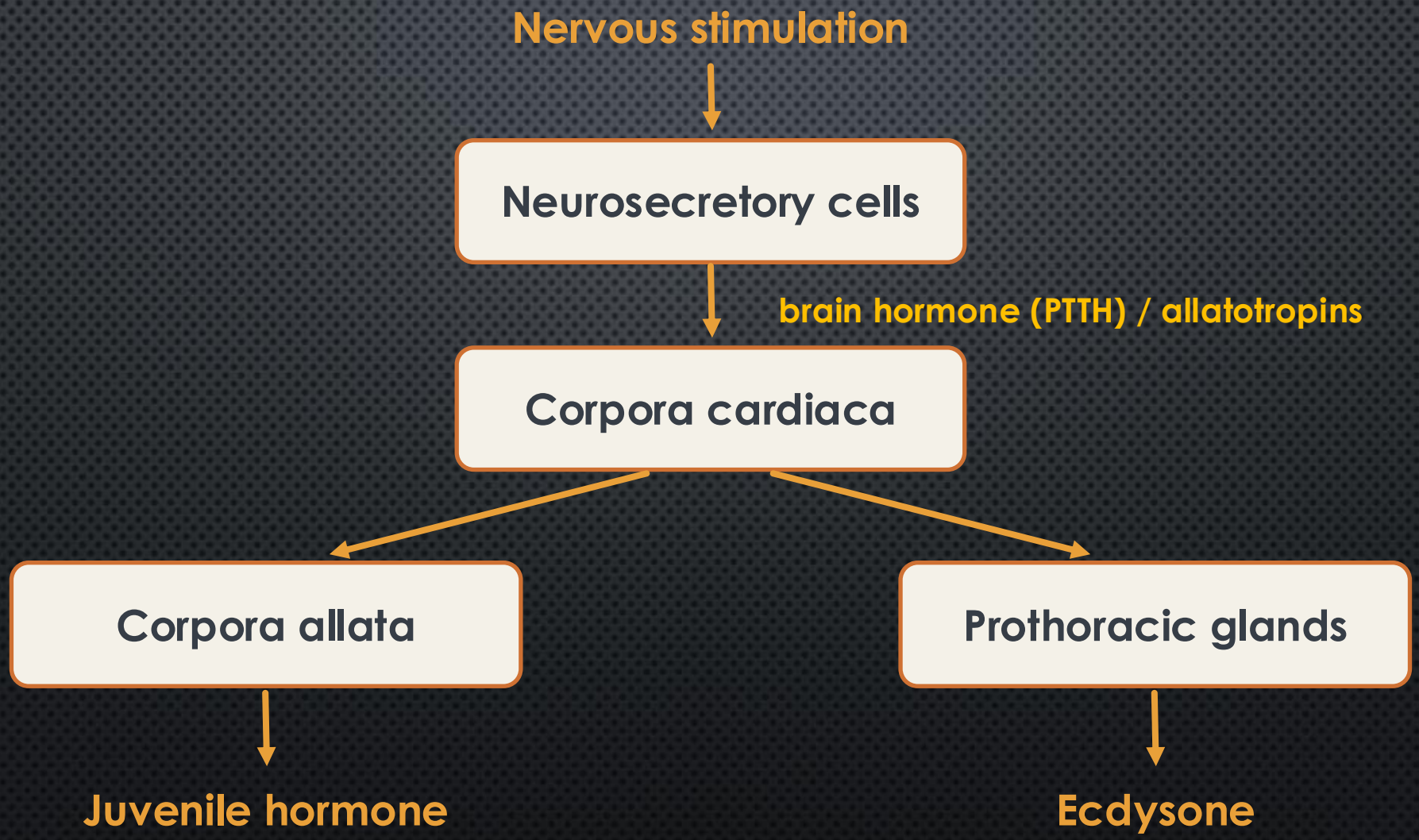
Dorsal rim area

A band of specialised facets at the top of each eye reads the polarisation pattern of the sky as a compass.





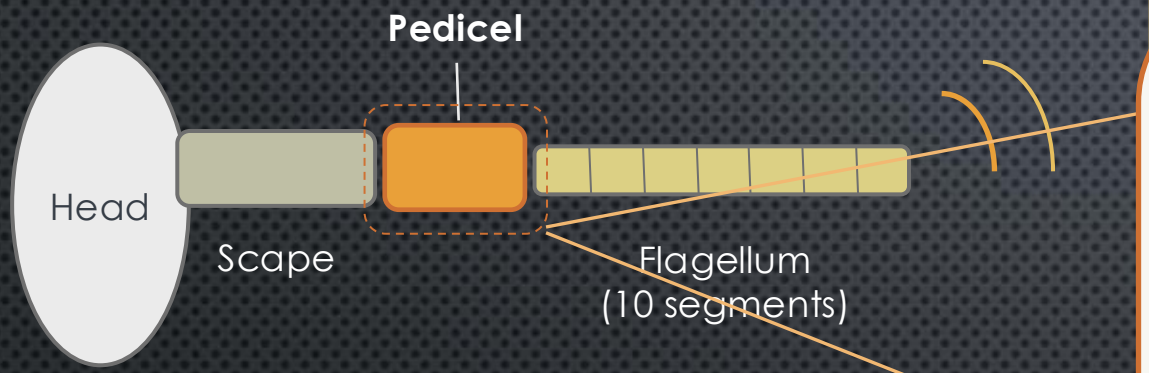
Interaction between the CNS and the the Endocrine System



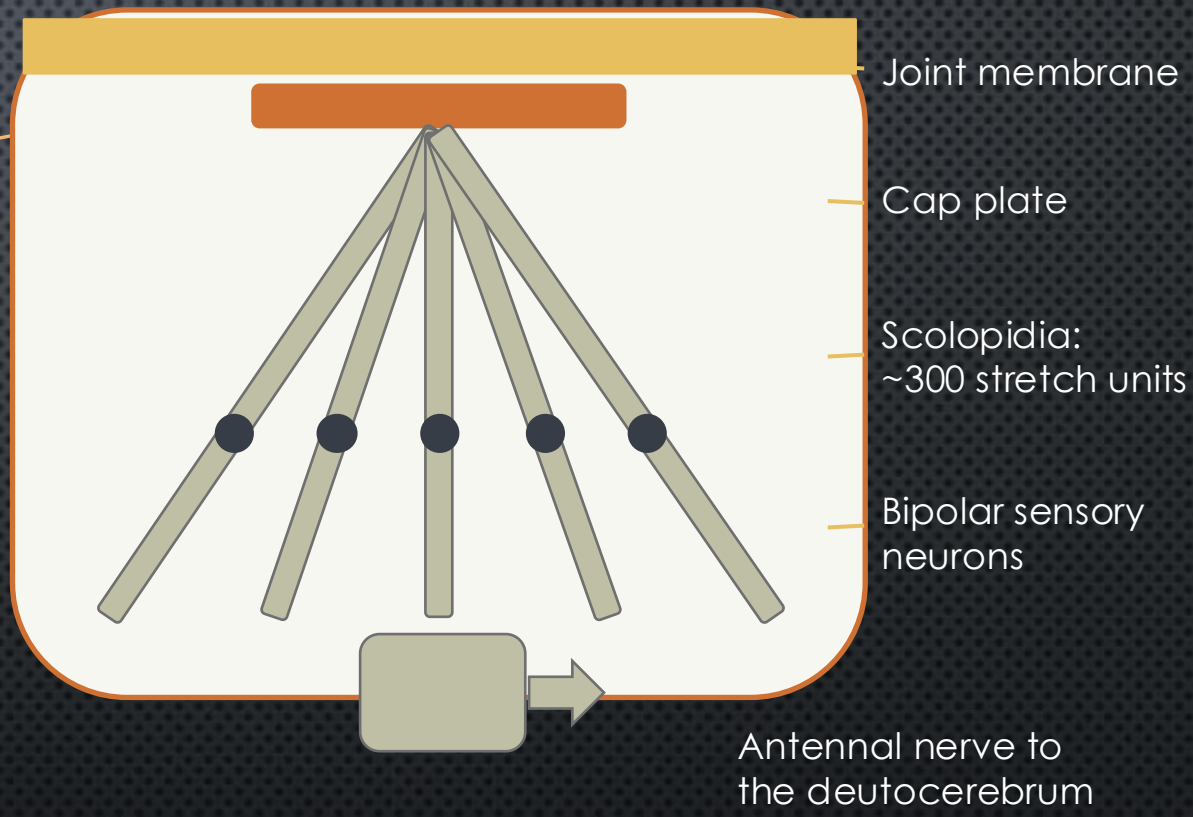
PTTH = prothoracicotropic hormone

JOHNSTON'S ORGAN: THE HONEYBEE'S ANTENNAL EAR

1 · Whole antenna



2 · Johnston's organ inside the pedicel



Flagellar vibration rocks the pedicel-flagellum joint; the membrane pulls on the cap plate and stretches the scolopidia, whose bipolar neurons fire in phase with the stimulus. Johnston's organ therefore encodes waggle-dance vibration (~250-300 Hz), wing-beat sound, air flow during flight and antennal contact.

An ommatidium in longitudinal section

A retinula-cell axons, to the lamina

B rhabdom — the light-guiding core

C crystalline cone

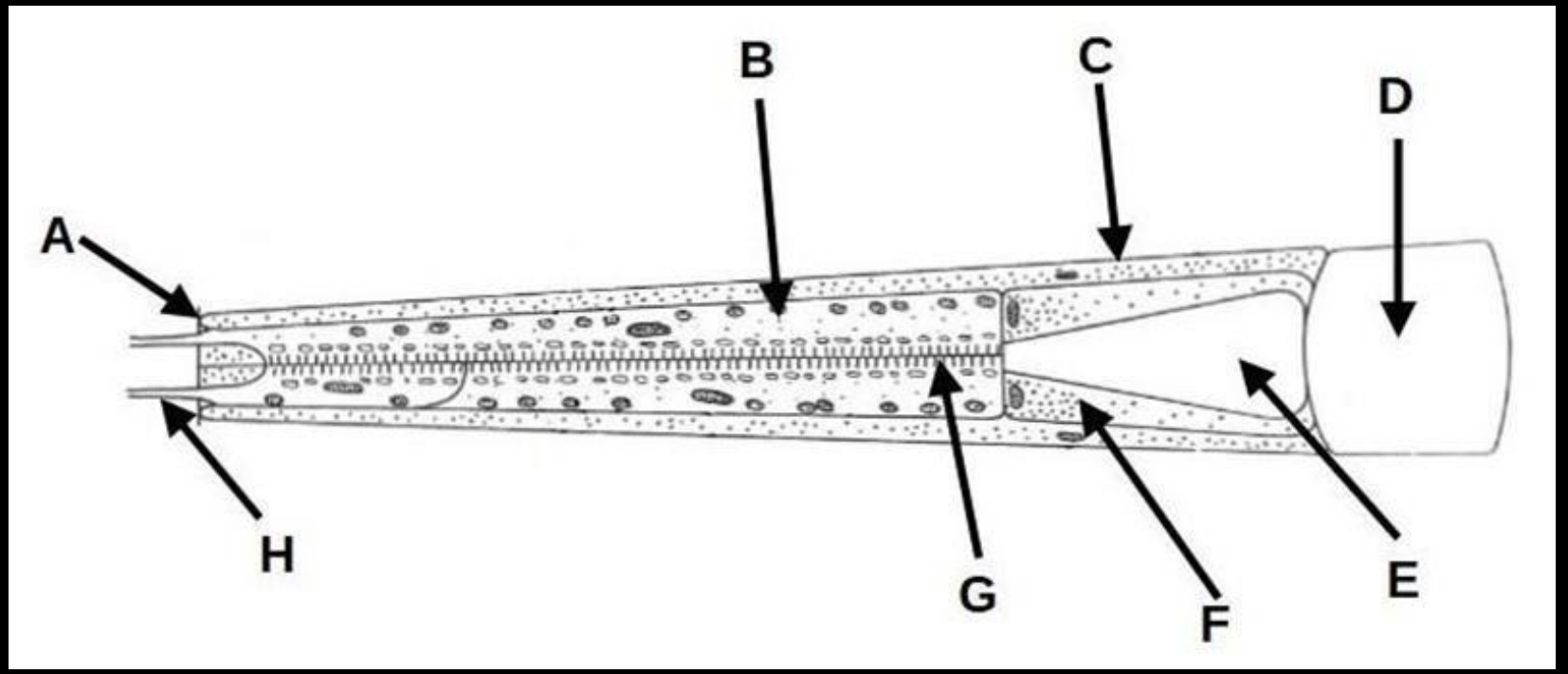
D corneal lens (cornea)

E primary pigment cells around the cone

F secondary (accessory) pigment cells

G retinula cells — eight per ommatidium

H basement membrane



Summary of the talk

Honeybees turn environmental cues into coordinated behaviour through linked sensory, neural and hormonal systems.

01 **Sensilla begin the process**
Specialised receptors convert chemical, mechanical, temperature and humidity cues into nerve signals.

02 **The antennae are multisensory**
Their sensilla detect smell, taste, touch and microclimate; Johnston's organ reads vibration, airflow and antennal movement.

03 **Two eye systems divide the visual work**
Compound eyes build colour, motion and panoramic detail, while the three ocelli monitor overall light level and the horizon.

04 **The CNS integrates and distributes information**
Specialised brain regions interpret signals; neurons, synapses and segmental ganglia relay commands and support local control.

05 **Neural and endocrine control work together**
Fast nerve impulses coordinate immediate responses, while neurosecretory pathways regulate longer-term physiological change.

STIMULUS → RECEPTOR → NEURAL INTEGRATION → COORDINATED RESPONSE

NEXT WEEK

Honey Bee Sensilla

Types, simple morphology and main sensory functions



Microscopic sensory structures that help bees detect odors, tastes, touch and environmental conditions.

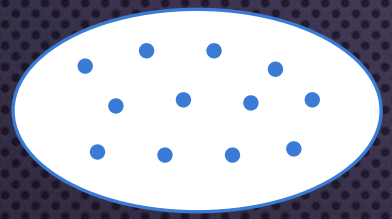
Major Types in Honey Bees

Pore plate	**Placodea** Main olfactory	**Hair**	**Trichodea** Olfaction / touch
Peg	**Basiconica** Olfaction / taste	**Peg in pit**	**Coeloconica** Humidity / temperature
Dome / disk	**Campaniformia** Mechanical strain	**Peg in opening**	**Ampullacea** Likely CO_2 / environmental
Bristle / peg	**Chaetica** Taste / touch	**Knob in pit**	**Coelocapitular** Humidity / temperature

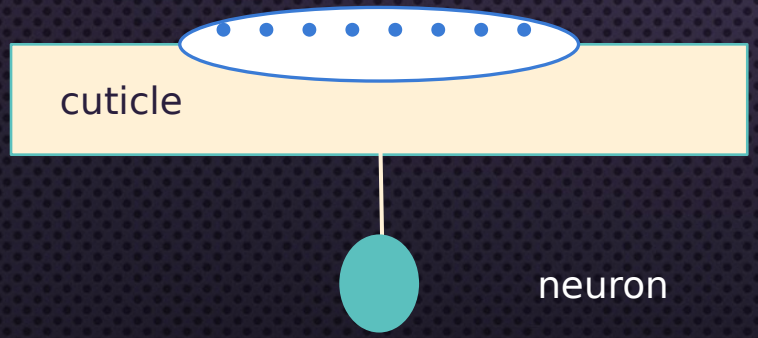
1. Sensilla Placodea

Pore-plate sensilla

Surface view



Side view

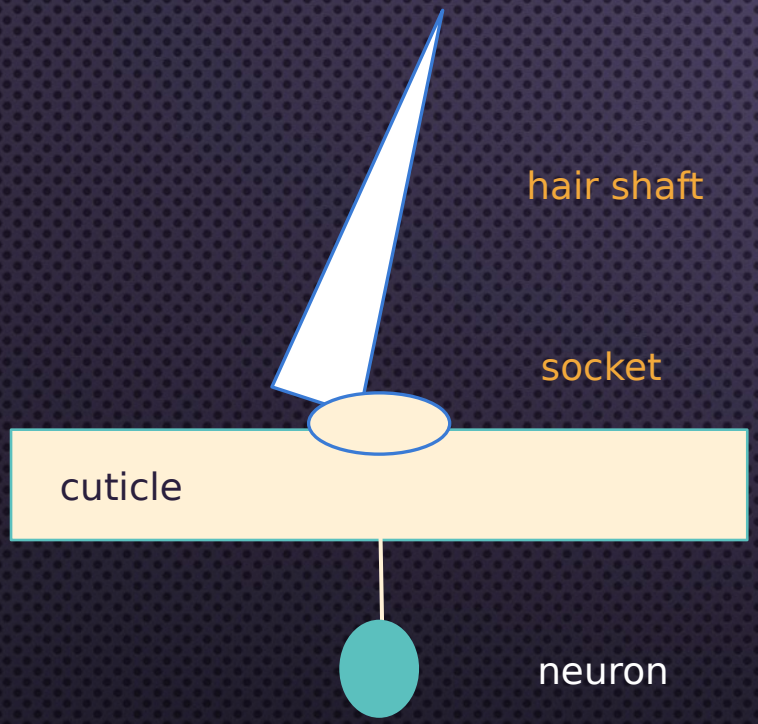


Flat multiporous plate (~10–15 µm) set flush in the cuticle — the dominant olfactory sensillum.

- Thin oval cuticular plate with many tiny pores.
- Located mainly on distal antennal segments.
- Major olfactory sensillum in honey bees.
- Important for odors and pheromone detection.

2. Sensilla Trichodea

Hair-like sensilla

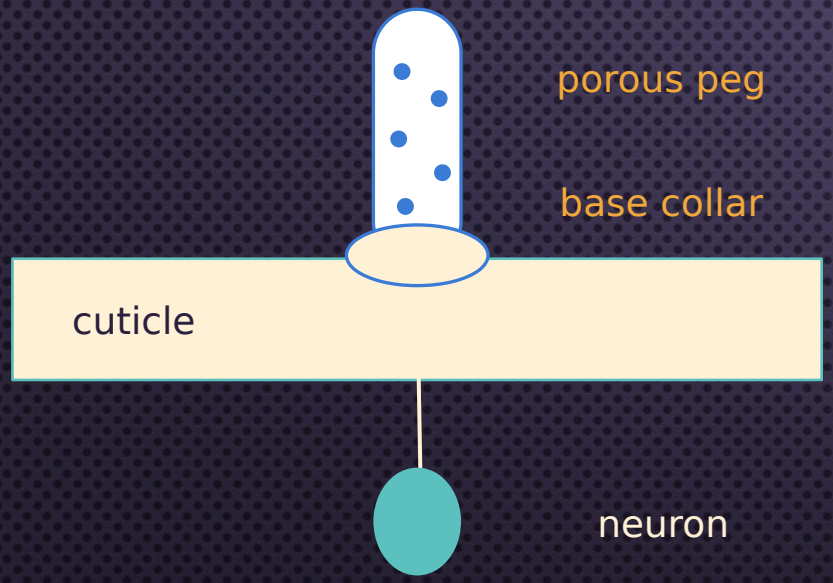


Long tapered hair (up to ~150 µm) hinged in a flexible socket; subtypes serve olfaction and mechanoreception.

- Long hair-like projections; several subtypes occur.
- Some subtypes participate in olfaction.
- Others are involved in touch, airflow or mechanosensation.
- Their abundance differs between workers and drones.

3. Sensilla Basiconica

Peg-like sensilla

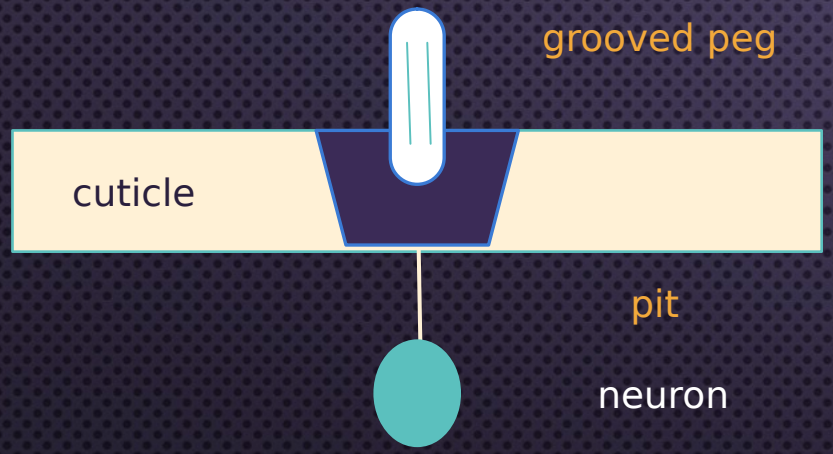


Short blunt peg (~10 µm) with a porous wall; carries both olfactory and gustatory neurons.

- Short peg/cone, often with numerous pores.
- Associated with olfactory and gustatory reception.
- Distribution varies with caste and antennal segment.
- Typical worker basiconica are absent in drones.

4. Sensilla Coeloconica

Pit-associated sensilla

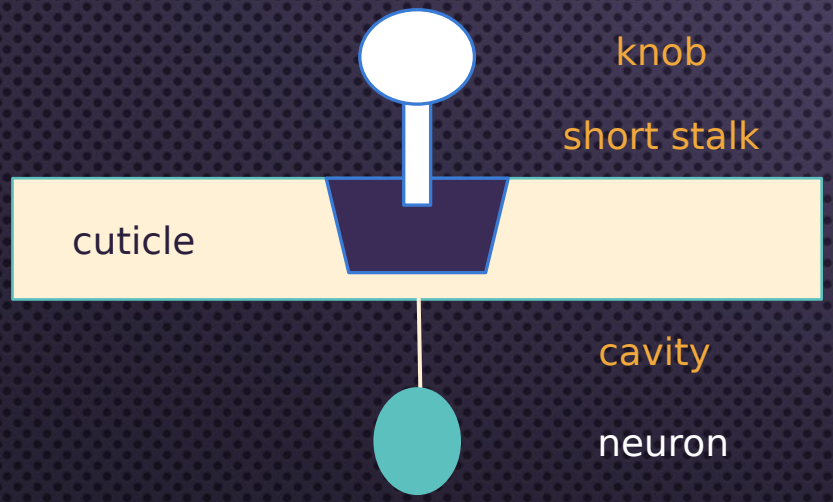


Grooved peg recessed in a cuticular pit on the distal flagellomeres; thermo- and hygroreceptive.

- Grooved projection located in a circular pit.
- Mainly associated with humidity and temperature sensing.
- Located on distal flagellomeres.
- Often grouped with other environmental sensory organs.

5. Sensilla Coelocapitular

Mushroom-like pit sensilla

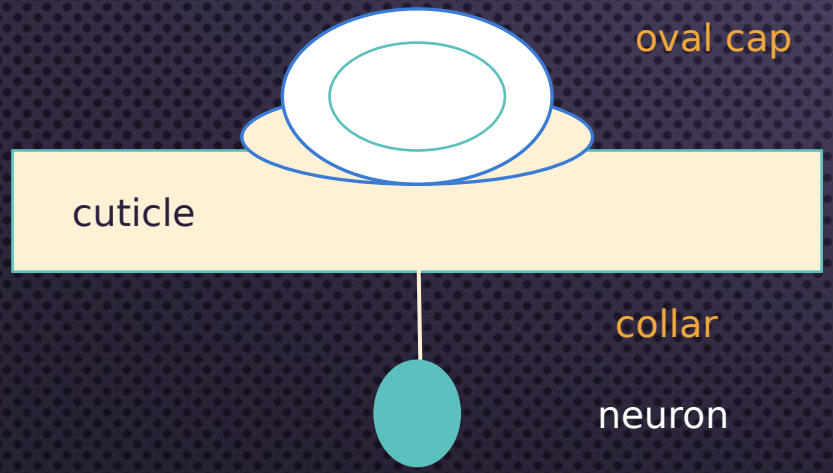


Mushroom-shaped knob on a short stalk in a shallow cavity near the antennal tip; hygro- and thermoreceptive.

- Mushroom-like structure within a small cuticular cavity.
- Associated with humidity and temperature sensing.
- Found near the antennal tip.
- Simple visual: a knob recessed in a pit.

6. Sensilla Campaniformia

Mechanical strain receptors

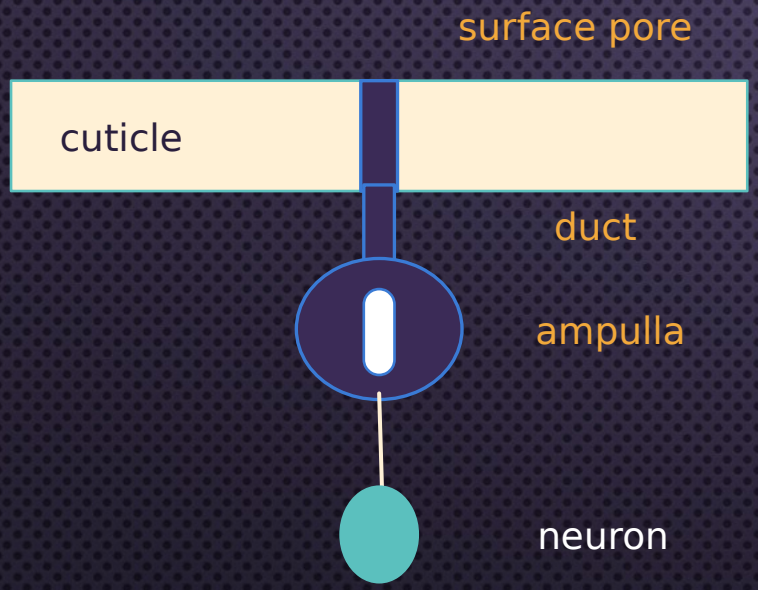


Oval cuticular dome encircled by a collar, flush with the surface; registers strain and deformation of the cuticle.

- Flattened oval or dome-like structure.
- Detects deformation or strain of the cuticle.
- Provides mechanosensory information.
- Helps detect mechanical forces acting on the antenna.

7. Sensilla Ampullacea

Specialized pit/peg sensilla

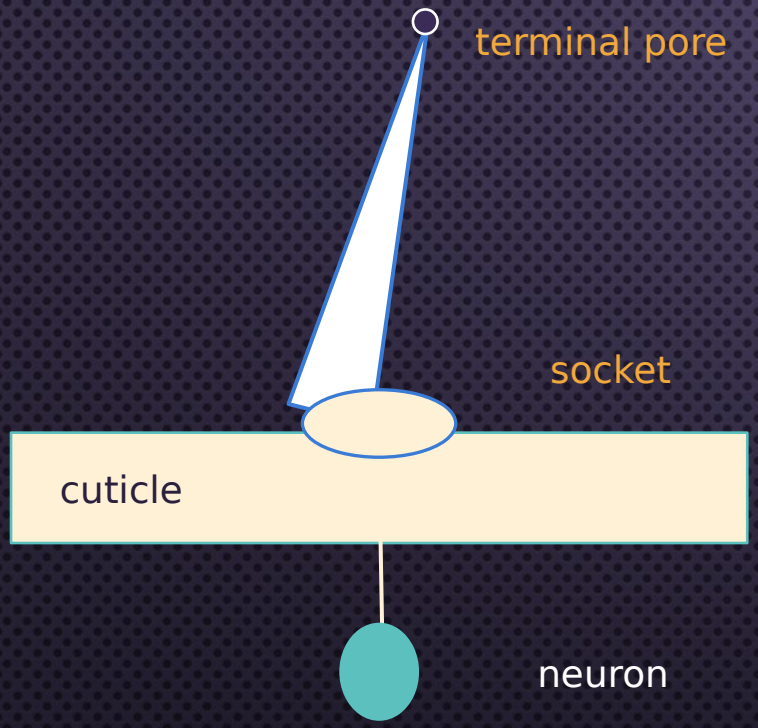


Peg enclosed in a subcuticular ampulla linked to the surface by a long duct; implicated in CO_2 and environmental sensing.

- Small peg-like structure inside an opening.
- Associated with environmental chemical cues.
- Often discussed as a possible CO_2-sensing organ.
- Located on distal antennal segments.

8. Sensilla Chaetica

Bristle-like sensilla



Stout bristle seated in a socket, with a terminal pore at the tip; gustatory plus mechanosensory.

- Bristle/peg-like sensillum with a terminal pore.
- Associated with gustatory reception.
- Can also provide mechanosensory information.
- Useful for detecting contact-related chemical cues.

Quick Comparison

Simple study guide

Type	Appearance	Main role
Placodea	Pore plate	Main olfactory
Trichodea	Hair	Olfaction / touch
Basiconica	Peg	Olfaction / taste
Coeloconica	Peg in pit	Humidity / temperature
Campaniformia	Dome / disk	Mechanical strain
Ampullacea	Peg in opening	Likely CO_2 / environmental
Chaetica	Bristle / peg	Taste / touch
Coelocapitular	Knob in pit	Humidity / temperature

Key References

Sensilla types, numbers and function

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- Olfactory coding in honeybees — review of antennal sensilla and olfactory sensory neurons.
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- Scientific Beekeeping — Apis mellifera antennae and sensillum terminology.

Morphology behind the schematics

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