Unit 28 · Animal Behavior

STUDY NOTES

WHAT NEB'S GRADE 11 EXAM ASKS

- **CDC's grid (2077):** Biota and Environment (Units 27–29 together): 6 of 75 marks, 1 short; in one group with Units 1–3, 11–12, 17, 30–31 (21 marks)
- **The paper:** 11 MCQs × 1 · 8 short × 5 · 3 long × 8; 3 hours; 1 mark per expected point
- **MCQ (1 mark)**
  - innate behavior (a young fish swims); receptors; what isn't a reflex; a spinal reflex; habituation (the snail)
  - a toad active at night; a cockroach drawn by pheromones (chemotaxis); moles burrowing (geotaxis); sperm to egg
  - menotaxis (light compass); fishes facing a current (rheotaxis)
  - potamodromous; anadromous; catadromous (*Anguilla*); a latitudinal migrant
- **Short and long (in parts)**
  - behavior and its types
  - **label** the **reflex arc** (A–G)
  - dominance; leadership
  - taxes by the stimulus, with examples
  - bird migration: why, types; advantages and disadvantages
  - fish migration: factors; types

Key terms

Stimulus: a change an organism detects; **response**: what it does.

Behavior: what an animal does in response to a stimulus; **ethology**: its study.

Innate: inherited, right the first time; **learned**: from experience.

Reflex action: automatic, rapid, involuntary response.

Reflex arc: receptor → sensory neuron → center → motor neuron → effector.

Taxis: whole-organism movement towards (+) or away from (−) a stimulus.

Tropism: directional growth (plants); **kinesis**: change of speed or turning, not direction.

Dominance: control of others by aggression, threat or display.

Leadership: leading and guiding the group.

Migration: regular, periodic movement from one place to another and back.

Behavior

- founders of ethology: **Konrad Lorenz** (father), **Niko Tinbergen**, **Karl von Frisch** (Nobel 1973)
- stimuli: heat, cold, touch, pain, chemicals, light, sound
- *Euglena* to glucose; *Mimosa pudica* folds; mosquitoes flee a coil

Innate	Learned
controlled by **genes**	by **experience**, practice
right the first time	improves with practice
same in the whole species	differs between animals
not changed	not passed in genes
young fish swims; spider's web; silkworm's cocoon; baby sucks	song, dance, language
reflex, taxis, kinesis, migration, courtship, dominance	habituation, conditioning, imprinting

- **habituation**: stops responding to a harmless repeated stimulus (scarecrow; tapped snail)
- **conditioning**: links two things (Pavlov's dogs)
- **imprinting**: goslings follow the first moving object (Lorenz); short early window
- **trial and error**; **insight** (chimpanzee stacks boxes)

Reflex action

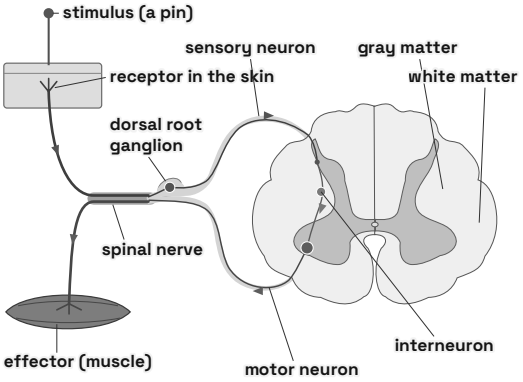
- automatic, rapid, involuntary; innate; protective
- e.g. mouth waters, hand off a flame, blinking, coughing

Kind	Center	Examples
spinal	spinal cord	**knee jerk**, hand off fire
cranial	brain (brainstem)	blinking, sneezing, salivation, pupil
both	brainstem + spinal nerves	**coughing**, **hiccups**

- **hunger** is a feeling (hypothalamus), not a reflex

Reflex arc

1. **receptor**: sense organ; starts **sensory impulses**
2. **sensory (afferent) neuron**: cell body in the **dorsal root ganglion**
3. **modulator (center)**: gray matter; **synapse** with an **interneuron**; knee jerk: no interneuron (**monosynaptic**)
4. **motor (efferent) neuron**: cell body in the **ventral horn**; axon out by the **ventral root**
5. **effector**: **muscle** or **gland**



The reflex arc of pulling the hand from a pin.

- steps: **reception** → **conduction** → **modulation** → **effect**
- pain is felt **after** the hand moves
- significance: **protects** (fast); saves the brain work; keeps routines going (blinking, swallowing, pupil)

Taxes

By the stimulus

Taxis	Stimulus	Examples
phototaxis	light	− earthworm, cockroach; + moth, housefly, *Euglena*
chemotaxis	chemical	*Euglena*: − strong acid, + weak; mosquito to CO_2; sperm to egg
thermotaxis	temperature	*Paramecium* at 24–28 °C; *Hydra* leaves warm water
thigmotaxis	touch	− *Paramecium*, *Amoeba*; + earwigs, cockroaches in cracks
geotaxis	gravity	+ earthworm burrows; − *Paramecium*, fruit flies climb
rheotaxis	water current	+ fishes face the current
anemotaxis	wind	moth upwind to a mate's scent
galvanotaxis	electric current	*Paramecium* to the **cathode**

- **kinesis**: woodlice move fast and straight in dry air, slow and turn in damp; end up in damp

By the way the animal orients

- **klinotaxis**: one receptor at the front; swings its head, compares **one side after the other**; **wavy** path (housefly maggots, *Euglena*)
- **tropotaxis**: **paired** organs compare **at the same time**; straight path; one eye painted: **circus movement** (woodlice, beetles)
- **telotaxis**: of two equal sources, heads for **one** (honeybee to a flower)
- **menotaxis**: **fixed angle** to the sun; **light compass response** (ants, bees, *Geotrupes*; Santschi's mirror, 1911)
- **mnemotaxis**: **memory** of landmarks (Tinbergen's digger wasp and pine cones)

Dominance

- depends on age, sex, experience, size, strength, condition
- **dominance hierarchy**; **pecking order** in hens (Schjelderup-Ebbe, 1920s)
- examples:
  - songbirds hold territory by **singing**
  - dog **snarls**, bares teeth; the loser lowers its tail
  - dominant cattle take the **middle** of the herd
  - ring-tailed **lemurs**: **females** dominate
  - **buffaloes**: paw, butt, shove, charge until one gives way
- significance: more food, mates, shelter; survival, reproductive success; genes passed on; **less fighting**, stable group

Leadership

- leader starts, keeps steady and coordinates the group: moving, food, migration, defense
- often the oldest, most experienced; not always the most aggressive
- examples:
  - **red deer**: an old **hind** leads; **stags** join only to mate
  - **Asian elephants** (Chitwan): the **matriarch**
  - **geese** in a V; birds take turns at the front (ibis studies, 2014–15)
  - **honeybees**: the queen's **pheromones** hold the colony; workers decide the work
  - **rhesus monkeys**: the dominant male leads

Migration

- regular, periodic movement and back; mostly innate
- for **food**, **weather**, **mates**, **shelter**, **breeding**

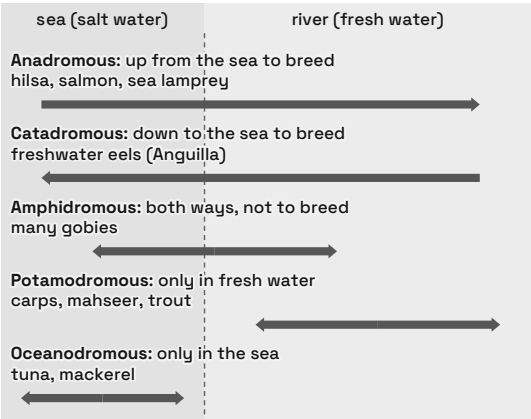
Fish migration

- resident fishes don't migrate
- movement: **drifting**, **random swimming**, **oriented swimming**

- factors:
  - **physical**: light, temperature, currents, **turbidity**, depth
  - **chemical**: salinity, smell (salmon's home river), pH, oxygen
  - **biological**: **gonads** ripen under pituitary **gonadotropins** (FSH); food; predators

Type	Movement	Examples
anadromous	sea → fresh water, to **breed**	salmon, hilsa, lamprey, shad
catadromous	fresh water → sea, to **breed**	eel (*Anguilla bengalensis*)
amphidromous	both ways, **not** to breed	gobies
potamodromous	within **fresh water**	carps, trout, golden mahseer
oceanodromous	within the **sea**	tuna, mackerel, herring
alimental	for **food**	sharks, carps
shoreward	to the shore, bank	*Anabas*
vertical	deep ↔ surface, daily	swordfish, lanternfish
latitudinal	north ↔ south	swordfish, hammerheads
climatic	with the season	—

- **diadromous** = anadromous, catadromous, amphidromous (sea ↔ fresh water)
- on the way: stop feeding, gonads ripen, gut shrinks; eel turns silvery



Types of fish migration.

- advantages: food, breeding grounds, shelter; young grow up safer; escape cold, drought, low oxygen

Bird migration

- between **breeding** and **feeding** (wintering) grounds; same time, same routes (Cahn, 1935)
- causes: **day length** acts on hormones and gonads; food scarcity, cold; they lay down **fat** and grow restless

Type	Movement	Examples
latitudinal	north ↔ south (commonest)	golden plover; ducks, bar-headed geese to Koshi Tappu
longitudinal	east ↔ west	starlings
altitudinal	up in summer, down in winter	**Himalayan monal** (डाँफे), snow partridge
vagrant	irregular, all directions	young herons
seasonal	summer or winter visitors	cuckoos, swifts; ducks, wagtails
daily	roost ↔ feeding place	sparrows, crows, egrets

- **nocturnal** migrants: thrushes, warblers; **diurnal**: crows, swallows, cranes
- record: **Arctic tern**, ~70,900 km a year
- steer by landmarks, **sun**, **stars**, Earth's **magnetic field**; follow **flyways**
- advantages: escape winter, food shortage; good breeding grounds; no overcrowding; young safer
- disadvantages: exhaustion; enemies; storms; parasites and diseases

COMMON MISTAKES

✗ Hunger is a reflex
✓ a feeling (hypothalamus); give coughing, hiccups for brain + cord.

✗ Motor neuron's cell body in the ventral root
✓ in the **ventral horn** of gray matter.

✗ The queen bee runs the hive
✓ her pheromones **coordinate**; workers decide the work.

✗ "Potadromous"
✓ **potamodromous** (potamos, river).

✗ Taxis is directional growth
✓ that's **tropism**; taxis is movement of the whole body.

✗ Kinesis changes direction
✓ it changes **speed** or turning only.