

Co-ordination in Plants and Animals

Unit 3 Lesson Plan · Biology · Secondary 4

This Lesson Plan is a teacher delivery guide for Unit 3 — objectives, timing, materials, and step-by-step lesson structure for all 8 sections. Use it alongside the companion Topic Note, which carries the full learner-facing content, diagrams, and practice questions in depth.

Note on timing: as with Unit 1, the official NCDC periods-per-week figure for S4 Biology was not available to confirm. Period allocations below assume a standard 40-minute period and are a planning estimate based on section complexity — confirm against your school's timetable.

Sections and Suggested Periods

Section	Title	Periods
3.1	Co-ordination in plants	1
3.2	Role of auxin in controlling shoot growth	2
3.3	Other forms of plant responses	1
3.4	Co-ordination in animals	1
3.5	Structure of the nervous system in vertebrates	2
3.6	Structure and functions of neurones	2
3.7	Reflex arcs and reflex actions	2
3.8	Chemical co-ordination and the endocrine system	2
Total		13

Total: 13 periods across Unit 3 (~40 minutes each).

3.1 Co-ordination in Plants

Learning Objectives	• Define tropism and distinguish positive from negative responses. • Name and describe the five types of plant tropism. • Predict tropic responses in unfamiliar scenarios.
Materials	Two potted seedlings; a box with a single hole cut in one side; a climbing plant sample if available (e.g. passion fruit cutting)

Starter (5 min)

Ask: "If you place a plant on its side, what do you think happens to how it grows?" Take a few guesses before starting.

Main Teaching — Experiment — Testing for Phototropism and Geotropism (full steps in the Topic Note)

1. Set up the boxed seedling and the sideways-laid pot at the start of the lesson (or the day before, so results are visible this lesson).
2. Introduce all five tropism types using the table from the Topic Note, asking students to guess the stimulus for each name before revealing it (the Greek roots are a useful hint: photo=light, geo=gravity, hydro=water, thigmo=touch, chemo=chemicals).
3. Discuss the passion fruit vine local example, or bring in a real climbing plant cutting if available.

Guided Practice / Check for Understanding

Ask pairs to predict, for a seedling placed sideways in a dark cupboard with water only on one side, which way the root would grow and why.

Plenary (5 min)

Check the boxed seedling and sideways pot set up earlier — confirm or revise predictions from the starter.

Homework

Students complete the vine-observation Research & Discussion prompt at home.

3.2 Role of Auxin in Controlling Shoot Growth

Learning Objectives	• Explain how auxin causes differential growth. • Explain why roots and shoots respond oppositely to the same auxin concentration. • Relate auxin to a real agricultural application (herbicides).
Materials	Three seedlings for the tip-removal experiment; agar jelly (or a substitute such as a small piece of damp cotton wool if agar is unavailable); a blade for cutting tips

Starter (5 min)

Ask: "If I cut the very tip off a growing shoot, do you think it will still grow? Why or why not?" Collect predictions before running the experiment.

Main Teaching — Experiment — Testing Whether the Tip Controls Bending (full steps in the Topic Note)

1. Set up the three seedlings (intact tip, removed tip, removed tip + agar block) — note this needs 2 days to show results, so either run it days ahead or treat it as an ongoing observation across the week.
2. Teach the mechanism: auxin produced at the tip diffuses down and controls elongation; explain the opposite root/shoot response using the table from the Topic Note.
3. Introduce the auxin-based herbicide local example, connecting the low-concentration/high-concentration distinction to why weed killers work selectively.

Guided Practice / Check for Understanding

Ask: "Why does a shoot bend toward light but a root bend away from it, if both build up more auxin on the same (shaded) side?" — checks whether students understand the opposite sensitivity, not just the direction.

Plenary (5 min)

Check on the tip-removal experiment if enough time has passed; otherwise, ask the class to predict the eventual result once more before dismissing.

Homework

Students complete the hard question on selective herbicide effects from the Topic Note.

3.3 Other Forms of Plant Responses

Learning Objectives	• Define a nastic response and distinguish it from a tropism. • Explain the mechanism behind nastic movement (turgor pressure change). • Identify real examples of nastic responses in local plants.
Materials	A live <i>Mimosa pudica</i> plant if locally available; alternatively, images/description if not

Starter (5 min)

Ask: "Have you ever seen a plant move almost instantly, without waiting days to grow?" Let students share any experiences with touch-sensitive plants before naming *Mimosa pudica*.

Main Teaching — Experiment — Observing Nastic Movement in a Sensitive Plant (full steps in the Topic Note)

1. If a *Mimosa pudica* plant is accessible nearby, take the class out (or bring a potted sample in) to directly observe the touch response.
2. Introduce the tropism-vs-nastic comparison table from the Topic Note, emphasising speed and reversibility as the key distinguishing features.
3. Discuss the groundnut leaf-folding local example as a second, slower-cycle nastic response (daily, not a one-off touch reaction).

Guided Practice / Check for Understanding

Ask pairs to explain, in their own words, why the *Mimosa*'s response is not a tropism even though it's triggered by a stimulus.

Plenary (5 min)

Quick show of hands: which of today's two plant examples (*Mimosa* touch response, groundnut folding) is faster, and why does that make sense given their different triggers?

Homework

Students complete the timing-observation Research & Discussion activity on *Mimosa pudica*.

3.4 Co-ordination in Animals

Learning Objectives	• Define receptor and effector with correct examples. • Explain why animals need faster coordination than plants. • Identify the receptor and effector in a real scenario.
Materials	A ruler per pair; open space for the reaction-time test

Starter (5 min)

Ask: "Plants can coordinate their growth using hormones alone — so why can't animals just do the same thing?" Use answers to set up the need for speed.

Main Teaching — Demonstration — Measuring Simple Reaction Time (full steps in the Topic Note)

1. Run the ruler-drop reaction time test in pairs, recording each student's average catch distance.
2. Introduce receptor/effector vocabulary, using the just-completed experiment as the worked example (eye = receptor, hand muscles = effector).
3. Discuss the snake-in-the-field local example, walking through the full chain: stimulus → receptor → nervous system → effector → response.

Guided Practice / Check for Understanding

Ask each pair to identify the receptor and effector in a new scenario the teacher gives verbally (e.g. "a loud drumbeat makes you turn your head").

Plenary (5 min)

Compare reaction-time results across the class — ask if anyone can suggest why results varied between students.

Homework

Students complete the Research & Discussion prompt about a fast reaction they've personally experienced.

3.5 Structure of the Nervous System in Vertebrates

Learning Objectives	• Distinguish the CNS from the PNS. • Name the main brain regions and state one function of each. • Relate brain region damage to specific functional loss.
Materials	Clay, string, or rolled paper for the CNS/PNS model; the brain diagram from the Topic Note (printed or drawn on the board)

Starter (5 min)

Ask students to place a hand on the back of their neck and ask: "What do you think runs down inside your spine, connecting your brain to the rest of your body?"

Main Teaching — Demonstration — Modelling the CNS and PNS (full steps in the Topic Note)

1. Build the CNS/PNS model as a class or in small groups, labelling the brain, spinal cord, and peripheral nerves.
2. Teach the five brain regions and their functions using the table from the Topic Note, pairing each with a simple everyday action (e.g. cerebellum = balance while walking).
3. Discuss the cerebral malaria local example, reinforcing why knowing which region controls which function has real medical relevance.

Guided Practice / Check for Understanding

Ask: "If a person's heartbeat and breathing suddenly became irregular after a head injury, which brain region would you suspect was affected, and why?"

Plenary (5 min)

Trace a finger along the class's CNS/PNS model from a hand to the brain, naming each structure passed through.

Homework

Students complete the hard question distinguishing cerebrum vs cerebellum damage from the Topic Note.

3.6 Structure and Functions of Neurones

Learning Objectives	• Label the parts of a neurone. • Distinguish sensory, motor, and intermediate neurones by function. • Explain what happens at a synapse.
Materials	String or wool; beads or knots for cell bodies; a small object to pass hand-to-hand representing an impulse

Starter (5 min)

Ask: "If a neurone can be over a metre long in a giraffe's leg, what shape do you think its cells must be — round like most cells, or something else?"

Main Teaching — Demonstration — Modelling a Neurone and a Synapse Chain (full steps in the Topic Note)

1. Build the three-neurone string model (sensory–relay–motor) with visible synapse gaps, and pass an object along it to represent impulse transmission.
2. Introduce neurone structure vocabulary using the diagram from the Topic Note, and the three neurone types using the table.
3. Discuss the thorn-prick local example, tracing the full pathway from receptor to effector through all three neurone types.

Guided Practice / Check for Understanding

Ask pairs to correctly order a shuffled set of labels (receptor, sensory neurone, relay neurone, motor neurone, effector, synapse) for a stimulus-to-response pathway.

Plenary (5 min)

Ask: "Why does a signal need to cross a gap (synapse) instead of neurones just being one continuous cell?" — a stretch question for stronger students, previewed from the Topic Note's hard question.

Homework

Students complete the myelin sheath and synapse practice questions from the Topic Note.

3.7 Reflex Arcs and Reflex Actions

Learning Objectives	• Name the five components of a reflex arc in order. • Distinguish simple reflexes from conditioned reflexes. • Explain why reflex actions are faster than voluntary responses.
Materials	A raised surface/chair per pair; a ruler or small rubber-tipped object for the knee-jerk test

Starter (5 min)

Ask for a volunteer to try to consciously stop themselves from blinking when something is suddenly moved toward their eyes (safely, e.g. a hand). Use the likely failure to introduce involuntary reflex actions.

Main Teaching — Experiment — Testing the Knee-Jerk Reflex (full steps in the Topic Note)

1. Run the knee-jerk reflex test in pairs, recording observations.
2. Introduce the reflex arc pathway using the diagram from the Topic Note, emphasising why it bypasses the brain for speed.
3. Discuss simple vs conditioned reflexes using the livestock-training local example, and introduce Pavlov's dog experiment as the classic reference case.

Guided Practice / Check for Understanding

Ask: "Could your partner have stopped their knee from jerking on purpose?" Use the answer to reinforce that reflexes are involuntary and controlled below conscious brain level.

Plenary (5 min)

Ask the class to name one conditioned reflex from their own life (walking, cycling, a sport action) and justify why it counts as learned rather than inborn.

Homework

Students complete the hard question tracing the goat/bell conditioning scenario from the Topic Note.

3.8 Chemical Co-ordination in Animals and the Endocrine System

Learning Objectives	• Name at least four endocrine glands and one hormone each produces. • Explain why hormonal responses last longer than nervous responses. • Trace a cause-and-effect chain involving hormone feedback (e.g. iodine deficiency to goitre).
Materials	A watch or clock with a seconds display for pulse measurement; no other materials required

Starter (5 min)

Ask students to recall a moment they felt their heart racing before something stressful or exciting (a test, a match, a scare). Ask what they think caused that physical change.

Main Teaching — Experiment — Observing the Adrenaline Response (full steps in the Topic Note)

1. Run the pulse-rate experiment in pairs (resting pulse vs after an unexpected loud clap), with consent given beforehand.
2. Introduce the major endocrine glands and their hormones using the table and diagram from the Topic Note — ensure the named hormones (not just gland names) are covered, since this is exam-relevant detail.
3. Walk through the iodine-deficiency-to-goitre local example as a worked cause-and-effect chain, since it deliberately involves two different hormones (thyroxine and TSH) working in feedback.

Guided Practice / Check for Understanding

Ask pairs to explain, in order, the chain of events from low dietary iodine to a visible goitre, naming both hormones involved.

Plenary (5 min)

Compare the class's pulse-rate results from the experiment — ask what hormone is responsible for the increase and why that response would help in a genuine emergency.

Homework

Students complete the insulin/glucagon practice question and the iodized salt Research & Discussion prompt from the Topic Note.