

Variation, pressure and ICE AGE

60 minutes • D4.1.1 to D4.1.4 • Chapters 1, 2, 3

Natural selection as the mechanism of evolution, and its first three ingredients: variation, overproduction and the pressures that sort the winners

BY THE END, STUDENTS CAN

- ☐ Explain natural selection as the mechanism of evolution, and why Darwin's explanation replacing Lamarck's was a paradigm shift D4.1.1
- ☐ Explain how mutation makes new alleles and sexual reproduction makes new combinations of them D4.1.2
- ☐ Explain how overproduction of offspring and competition for limited resources promote natural selection D4.1.3
- ☐ Explain how abiotic factors such as a hard frost act as density-independent selection pressures D4.1.4

TIMING

0-8	8 min	Do now: Who am I?	
8-18	10 min	Four claims	
18-28	10 min	Watch ICE AGE	
28-40	12 min	Where variation comes from	
40-55	15 min	Too many young, and the frost	
55-60	5 min	Exit: ICE AGE on a new case	
	60 min	One lesson	

STARTER

- 8 min** **Do now: Who am I?**
- Each student wears a card with a key word on a headband (variation, mutation, carrying capacity, abiotic factor, paradigm shift, selection pressure, competition, adaptation) and finds out what it is by asking the class yes or no questions. The class may not say the word. Keep the words on the board; students use them all lesson.

ON THE BOARD, FROM THE GUIDE

Open the guide on the projector at each chapter (the links work in this PDF). Every figure plays from its own buttons, and the lesson's slides have the same figures, step by step, in the order of this plan.

01 Evolution has a mechanism

CHAPTER 01 IN THE SLIDES

Step through the figure (5 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

- Lamarck's idea: a giraffe stretches for leaves, its **neck lengthens**, and it passes the change on.
- In fact the calf hatches with an ordinary neck: a change gained in life is **not inherited** (chapter 4).
- Darwin's idea starts with **variation**: the necks in a population are not all the same.
- Long necks feed best in the lean season and **leave more young**. The alleles go with them.
- Generations later, long necks are commoner. The explanation was **replaced**: a paradigm shift.

Play the animation, Watch it happen: ICE AGE in one population. It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. **Inherited variation.** Jaws differ, set by the two versions of a jaw gene that each beetle carries (the pips): pink large, green slender.
2. **Competition.** Twelve beetles leave thirty-six young, three times as many as the ground can feed.
3. **Environmental pressure.** A drought leaves only tough seeds. Large jaws crack them; slender jaws cannot, and those beetles starve.
4. **Adaptation.** The twelve survivors all have large or medium jaws, the trait that suits a dry year. Every one carries the large-jaw version.
5. **Genotype frequencies change.** Only survivors breed, so the large-jaw version of the gene is more common in generation 2.
6. **Evolution.** The dry years go on. By generation 5 nearly every beetle has large jaws: no beetle changed, the population did.

Predict box: Claim 1: "Natural selection gives organisms what they need to survive." Hands up or mini whiteboards first.

Answer B: False: it favours only variation that already exists, and it cannot know what is needed

Remember it: Icy Cubs Eat Anything Growing Enormous (Inherited variation, Competition, Environmental pressure, Adaptations, Genes (alleles), Evolution).

02 Variation to select from

CHAPTER 02 IN THE SLIDES

Step through the figure (4 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. A gene is a sequence of **bases**. This version is one allele of the gene.
2. A copying error changes **one base**. The changed sequence is a **new allele**: mutation makes new alleles.
3. In meiosis, **crossing over** swaps pieces between a pair of chromosomes that carry the alleles A, B and a, b.
4. The gametes carry **combinations** that neither chromosome had before: sexual reproduction makes new combinations of alleles.

Predict box: Where does the very first copy of a new allele come from? Hands up or mini whiteboards first.

Answer B: A mutation in the DNA of a cell that goes on to make gametes

03 More offspring than the world can feed

CHAPTER 03 IN THE SLIDES

Step through the figure (5 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. A habitat has **four places** with enough food, and four adults hold them.
2. The adults raise **twelve young**: far more than the places can hold.
3. The young **compete**. Only four find a place; eight find none. The limit is the food, not the number born.
4. A different pressure: two patches of seedlings, one **sparse** and one **crowded**.
5. A cold snap kills half of each. It is **density-independent**: the share lost does not depend on the crowd.

Predict box: A late frost kills 60% of the seedlings in a sparse patch. How will a crowded patch of the same plant fare? Hands up or mini whiteboards first.

Answer C: About the same share will die: the frost does not count heads

THE LESSON

10
min

Four claims

Chapter 1's four predict boxes, in pairs. Students decide true or false and say why before opening each answer. Collect the wording of each slip on the board: "needs", "for the good of the species", "trying to", "strongest". Say once that ICE AGE is a teaching aid, not an IB term.

10

min

Watch ICE AGE

Chapter 1's ICE AGE film, paused at each of the six letters. Students write one sentence a letter on a six-box strip, using the film's population. Finish by turning over chapter 1's Remember it tiles. Land on the paradigm shift: Darwin replaced Lamarck's idea because his explained more.

12

min

Where variation comes from

Chapter 2's figure, step by step, and its predict box. Students sketch the two sources, new allele and new combination, in two boxes. Ask: why does a new allele need a mutation, and why can sexual reproduction not make one?

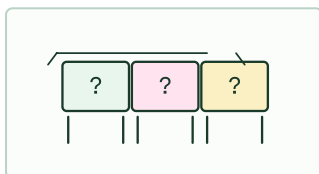
15

min

Too many young, and the frost

Chapter 3's figure: the four places and twelve young, then the two patches of seedlings. Take the frost predict box before step 5. Then ask for one resource that could limit a population of your choice and one abiotic factor. Link: what mechanisms minimise competition (B4.2).

ACTIVITIES

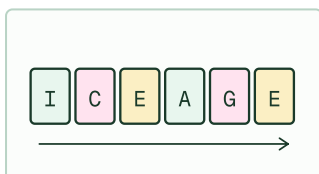


GAME

Who am I?

Each student wears a card with a key word on a headband and finds out what it is by asking the class yes or no questions. Use variation, mutation, carrying capacity, abiotic factor, paradigm shift, selection pressure, competition and adaptation. The class may answer only yes, no or "sort of". Replay with a partner who must give a hint when you are stuck.

Needs: eight headbands or sticky notes, the key words written on cards.



WRITING

ICE AGE on a fresh example

Give a new population, not one from the guide, such as an island population of lizards whose food changes (invent the details, and make clear it is invented). On six strips, pairs write what happens at each of Inherited variation, Competition, Environmental pressure, Adaptations, Genes and Evolution, then order and read them aloud. Check that each strip is about the example, not just the definition, and that "Genes" is about allele frequencies.

Needs: six blank strips per pair, the invented case on a card.

PLENARY

5

min

Exit: ICE AGE on a new case

Give a short invented case (beetles on a dark lava flow, say). Students write one line for I, C and E. Collect on the way out.

WHAT STUDENTS GET WRONG

"Animals adapt because they need to." The variation is already there, produced by chance; the environment sorts it. Make students say "individuals with the allele left more offspring".

"Natural selection is for the good of the species." It favours whatever raises an individual's reproductive success, even if it costs the species later.

"Individuals evolve." A population evolves across generations. Ask "what changed, and in whom?".

Mutations happen because they are needed. They are chance changes in the base sequence; the environment only decides whether they help.

"Natural selection makes perfect organisms." It sorts what variation exists, under current conditions, so every organism is a compromise.

STRETCH AND SUPPORT

Support: give the captions of each figure as a cut-up storyboard to put in order, and use the key terms (tap the dotted words) as a glossary.

Support: the ICE AGE tiles (Icy Cubs Eat Anything, Growing Enormous) on the board for every lesson.

Stretch: why can natural selection not make a trait the population has no allele for, and what would have to happen first?

IN THE GUIDE

- 1 [Evolution has a mechanism](#)
- 2 [Variation to select from](#)
- 3 [More offspring than the world can feed](#)
- A11 [The whole guide, with the figures that play](#)
- PPTX [This lesson's slides, in the order of this plan](#)

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- [Tarsia puzzle](#), [dominoes](#) and [picture reveal](#) on D4.1, built from its key terms and ready to print
- A [pub quiz](#) with rounds on D4.1, to present or run with no projector
- An [escape room](#) built from the [question bank](#) on D4.1

ALREADY ON THE SITE FOR D4.1

- Lesson: [Hardy-Weinberg & Chi-Squared](#)
- Quiz: [Natural Selection \(HL\)](#)
- Quiz: [Natural Selection](#)
- Revision map: [D4.1 Natural selection](#), to fill in
- Exam questions: [D4.1 in the exam maker](#), a paper with its markscheme

CARD SETS ON SPLYCR

Open a set to host it as a class game, or make a copy to edit.

- [D4.1 Natural Selection](#)

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on D4.1 at standard level each time, marked as students go and saved to their Exam practice when they are signed in.

biologybybradford.com/exam-maker/sit?topics=D4.1&level=SL&paper=quiz&marks=15&src=ep



How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.