

# Why sort life, and when the boxes fail HL

60 minutes • A3.2.1 to A3.2.3 • Chapters 1, 2, 3

Why classification is needed, why the traditional ranks do not always follow evolution, and what a classification by ancestry lets you predict

## BY THE END, STUDENTS CAN

- ☐ Explain why classification is needed, and what it makes possible A3.2.1
- ☐ Describe why the traditional hierarchy of taxa does not always match evolution, and why a fixed ranking is arbitrary A3.2.2
- ☐ Explain why a classification that follows evolutionary relationships lets you predict the features of its members A3.2.3

## TIMING

|       |        |                                     |                        |
|-------|--------|-------------------------------------|------------------------|
| 0-8   | 8 min  | Do now: sort it your way            | <div><div></div></div> |
| 8-18  | 10 min | Why classify?                       | <div><div></div></div> |
| 18-30 | 12 min | When the boxes do not fit           | <div><div></div></div> |
| 30-40 | 10 min | Questions on a paradigm shift       | <div><div></div></div> |
| 40-52 | 12 min | What does ancestry let you predict? | <div><div></div></div> |
| 52-60 | 8 min  | Exit: two groups                    | <div><div></div></div> |
|       | 60 min | One lesson                          |                        |

## STARTER

- 8 min** **Do now: sort it your way**
- Each pair gets a set of organism cards (the card sort below) and two minutes to make groups with any rule. Pairs then say their rule, and the class notes how many different rules there were. Leave the rules on the board.

## 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 Why sort life at all?

CHAPTER 01 IN THE SLIDES

**Step through the figure** (3 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

- Six organisms, to sort **any way you like**.
- Rule one: **flies**. The bat, the bird and the butterfly go together.
- Rule two: **has a backbone**. Now the bat sits with the fish and the frog, and the butterfly has left it. Same six, different groups.

**Predict box:** Which is the best reason for classifying organisms? Hands up or mini whiteboards first.

**Answer B:** There are too many species to study one by one, and a group lets what we know about one guide the rest

## 02 When the boxes do not fit

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. The traditional ranks: each one **nest**s inside the next, from kingdom down to species.
2. Now the branching tree of descent for four vertebrates, built from DNA (simplified).
3. The old classes. **Reptilia** holds the crocodile and the lizard, and **Aves** holds the bird on its own.
4. But the crocodile and the bird share an ancestor that the lizard does not. The old class **cuts that family in two**.

**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. **Normal science**: a framework everyone shares. For classification, the ranks.
2. Cases that **do not fit** build up, such as groups that split a family in two.
3. A **new idea** replaces the rule for grouping: use the branching tree, and group only whole clades.
4. The new idea becomes the new normal. A change in the basic ideas of a field is a **paradigm shift**.

**Predict box**: A taxonomist finds that a group in the old system leaves out one species that descends from the same common ancestor as the rest. What does that show? Hands up or mini whiteboards first.

**Answer C: The group does not follow the pattern of divergence**

**Remember it**: King Philip Came Over For Good Soup (Kingdom, Phylum, Class, Order, Family, Genus, Species).

## 03 Groups that are family trees

CHAPTER 03 IN THE SLIDES

**Step through the figure** (3 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. Hair and milk appeared once, on the branch leading to the **mammals**. Every descendant of that ancestor inherits them, unless a line loses them.
2. A newly found animal. Its DNA says it is the mouse's closest relative: it **joins the tree** there (a made-up animal).
3. It sits inside the mammal clade, so you can **predict** its features before you have studied it.

**Predict box**: A newly found frog falls inside a clade whose other members all make a toxin in their skin. Which statement is best? Hands up or mini whiteboards first.

**Answer C: It probably makes the toxin, but a feature can be lost, so the prediction needs testing**

### THE LESSON

#### 10 Why classify?

min

Chapter 1's figure on the board, step by step. Pairs answer "Why do scientists classify organisms?" and "What could a biologist do with a group that she could not do with a heap?" Collect two answers and write the key ideas: too many species, and a broad range of further study. Then the predict box.

#### 12 When the boxes do not fit

min

Chapter 2's first figure, stopping on each caption. Students sketch the tree of the bird, crocodile, lizard and mouse, then draw the old class Reptilia round the lizard and crocodile and say what is wrong with it. Add "arbitrary": ask whether a family of beetles and a family of mammals are the same kind of thing. Turn over the mnemonic tiles for the seven ranks.

#### 10 Questions on a paradigm shift

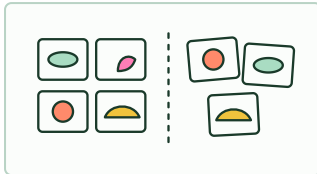
min

The paradigm shift questions below, in pairs, using chapter 2's second figure. Take one answer to each question, and land on the nature of science point: cladistics replaced fixed ranks with unranked clades, which is a paradigm shift.

#### 12 What does ancestry let you predict?

min

Chapter 3's figure: follow hair and milk down the tree, then add the new species. Students write one prediction they could make about a member of a clade and one way it could fail (a feature lost along a branch). Then the chapter's predict box.



## CARD SORT

**Sort it your way**

Pairs get twelve cards, each with a picture and name of an organism: for example a bat, a bird, a butterfly, a fish, a frog, a lizard, a crocodile, a mushroom, an oak leaf, a bacterium, a mouse and a spider. They sort the cards into groups by any rule, write the rule, then sort again by a different rule. Pairs compare rules around the room. Ask which rule told them the most about each organism, and which would still work if a new species turned up.

**Needs:** printed cards, one set per pair (or the six organisms in [chapter 1](#)'s figure on a screen).

## DISCUSSION

**Questions on a paradigm shift**

Four questions to answer from [chapter 2](#): (a) Outline why it is hard to classify flying animals, such as birds and insects, by the features that make traditional groups. (b) Why does the traditional hierarchy not always match the pattern of divergence in evolution? (c) What does it mean to say that a fixed ranking of taxa is arbitrary? (d) Suggest why a classification that follows evolutionary relationships has an advantage over the ranks. Then ask which of the four stages of the cycle in [chapter 2](#)'s second figure each answer belongs to.

**Needs:** [chapter 2](#)'s figures on screen; the four questions on the board.

## PLENARY

**8**

min

**Exit: two groups**

On a slip: "A group of look-alike animals has members from two different clades. Give one reason this group is less useful than a clade for predicting."

## WHAT STUDENTS GET WRONG

**"Classification is just naming."** A name is a label. A group tells you what to expect from an organism, which is why it is useful.

**"Look-alikes are close relatives."** Convergent evolution gives unrelated lines similar structures: wings, and the flowers of the figworts.

**"A higher rank means older, or more different."** Ranks have no fixed meaning, which is why a fixed ranking is arbitrary.

## 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 two mnemonics (King Philip Came Over For Good Soup; Rabbits Nibble Tasty Carrots Slowly) as a starter, with the tiles turned over for the answers.

## IN THE GUIDE

- 1 [Why sort life at all?](#)
- 2 [When the boxes do not fit](#)
- 3 [Groups that are family trees](#)
- 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 A3.2, built from its key terms and ready to print
- A [pub quiz](#) with rounds on A3.2, to present or run with no projector
- An [escape room built from the question bank](#) on A3.2

### ALREADY ON THE SITE FOR A3.2

- Quiz: [Cladistics \(HL\)](#)
- Revision map: [A3.2 Classification and cladistics](#), to fill in
- Exam questions: [A3.2 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.

- [A3.2 Classification and Cladistics \(HL\)](#)

## EXAM PRACTICE

### Check yourself

Set it for homework: a fresh paper of exam-bank questions on A3.2 at higher level each time, marked as students go and saved to their Exam practice when they are signed in.

[biologybybradford.com/exam-maker/sit?topics=A3.2&level=HL&paper=quiz&marks=15&src=ep](https://biologybybradford.com/exam-maker/sit?topics=A3.2&level=HL&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.