

Genomes and genome size

60 minutes • A3.1.8 to A3.1.11 • Chapters 6, 7, 8 • The dry lab

What a genome is, SNPs, why genome size is not complexity, and whole genome sequencing

BY THE END, STUDENTS CAN

- ☐ Describe a genome, how SNPs give diversity within a species, and why variation between species is much larger
A3.1.8, A3.1.9
- ☐ Compare genome sizes of different groups from a database and judge whether size measures complexity A3.1.10
- ☐ Describe how whole genome sequencing has become faster and cheaper, and give current and future uses A3.1.11

TIMING

0-6	6 min	Do now: how different are we?	
6-18	12 min	One genome, many versions	
18-40	22 min	Order the genomes	
40-52	12 min	Reading a whole genome	
52-60	8 min	Exit: size and complexity	
	60 min	One lesson	

STARTER

- 6 min** **Do now: how different are we?**
- Students write a guess, as a percentage, for how much of two unrelated people's DNA is the same. Collect the guesses on the board without comment. Return to them after [chapter 6's](#) predict box.

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.

06 One genome, many versions

CHAPTER 06 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.

- One short stretch of the genome in three people. Bases that differ from person 1 are **pink**: very few.
- A difference at a single base is a **single nucleotide polymorphism**, or SNP. Together, SNPs make each person's genome their own.
- The same stretch in another species: **far more** differences. (Simplified: real differences are much rarer in both cases, but the pattern holds.)

Predict box: Two unrelated people have their whole genomes read and compared. About how different are they? Hands up or mini whiteboards first.

Answer B: One base in a thousand differs: they share about 99.9%

07 Big genome, small organism

CHAPTER 07 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. A bacterium's genome is millions of base pairs. A human's is about **three billion**. (Mb is millions, Gb billions of base pairs.)
2. The Australian lungfish's genome is more than **ten times** a human's.
3. The flowering plant *Paris japonica* has one of the biggest genomes known. Size is **not** a measure of how complex an organism is.

Show the figure: The same four genes can sit in a small genome or a large one. The difference is mostly DNA that does not code for a protein.

Predict box: A student says: "The organism with the biggest genome must be the most complex." Which fact shows this is wrong? Hands up or mini whiteboards first.

Answer A: A fish and a flowering plant have genomes bigger than ours

08 Reading a whole genome

CHAPTER 08 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. The first human genome was a huge international effort: **years** of work and **billions** of dollars.
2. Sequencing machines improved, and the cost and the time **fell steeply**. (The shape is drawn to show the trend, not exact values.)
3. Cheap, fast genomes bring uses within reach: **comparing species** now, and **personalised medicine** in the future.

Predict box: How has the cost of sequencing a human genome changed since the first one was done? Hands up or mini whiteboards first.

Answer C: It has fallen steeply, and sequencing has become far faster

THE LESSON

12

min

One genome, many versions

Chapter 6's figure, step by step: first within a species, then between two species. Define genome and SNP. Ask where the pink cells would be if the second species were the chimpanzee, and whether there would be more or fewer. Then [chapter 6's](#) predict box.

22

min

Order the genomes

Eight minutes on the genome-size order activity below, then reveal with [chapter 7's](#) figure. Fourteen minutes in [the dry lab](#): students look up ten organisms, plot genome size against group, switch to gene count, and judge the four statements. [Chapter 7's](#) predict box comes after.

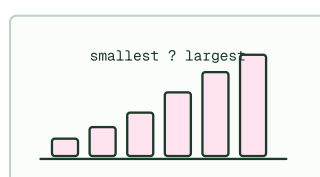
12

min

Reading a whole genome

[Chapter 8's](#) figure: the falling cost and the two uses. Then a two-minute talk with a partner: who should be allowed to see your genome, and why? Collect three views. Land on the guide's uses: evolutionary relationships now, personalised medicine in the future.

ACTIVITIES



DATA

Order the genomes

Cards of eight organisms (a bacterium, baker's yeast, a nematode worm, a human, an onion, the Australian lungfish, *Paris japonica* and thale cress). Pairs put them in the order they predict, smallest genome to largest, and say why. Then [the dry lab](#) reveals the sizes. Which prediction was furthest out, and what made it wrong?

Needs: eight organism cards per pair; [the dry lab](#) on a device.

Genome size explorer

The [dry lab](#) above, with the tasks and questions under it. Students look up organisms from a table the way a scientist uses a genome database, plot what they find, and judge four statements. It works on a phone as well as a laptop, and the look-ups download as a CSV.

Needs: one device per pair.

PLENARY

8 Exit: size and complexity

min

Using two organisms from [the dry lab](#) as evidence, explain in two sentences why genome size is not a measure of complexity. Check [chapter 7](#)'s second figure for the reason: non-coding and repeated DNA.

WHAT STUDENTS GET WRONG

A genome is just the genes. It is all the genetic information: genes, the DNA between them and the DNA in organelles. Most of a large genome is not genes.

A bigger genome means a more complex organism. The largest genomes in the lab belong to a plant and a fish. Size counts DNA, not complexity or genes.

A SNP is a disease mutation. A SNP is a one-base difference found in many people. Most have no known effect.

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.

Stretch: use a public genome database to look up three organisms of your own choice and add them to the class graph, with the source.

Support: give a sentence frame for the exit: "Organism A has a bigger genome than organism B, but...."

IN THE GUIDE

- 6 [One genome, many versions](#)
- 7 [Big genome, small organism](#)
- 8 [Reading a whole genome](#)
- Lab [Dry lab: Genome size explorer](#)
- 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 A3.1, built from its key terms and ready to print
- A [pub quiz](#) with rounds on A3.1, to present or run with no projector
- An [escape room built from the question bank](#) on A3.1

ALREADY ON THE SITE FOR A3.1

- Quiz: [Diversity of Organisms](#)
- Revision map: [A3.1 Diversity of organisms](#), to fill in
- Exam questions: [A3.1 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.
- [A3.1 Diversity of Organisms](#)



EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on A3.1 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=A3.1&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.