

Nucleic acids

Three one-hour lesson plans, and two more at higher level

Three one-hour lessons cover the standard level statements, and two more add the higher level (the guide gives A1.2 three hours at SL and two more at HL). The plan follows the chapters, so a class can read the guide for homework and use the lesson for the activities. Every figure plays on a projector: step through it with the arrow keys and stop on each caption. The wet DNA extraction is an option, and the dry lab does the same job on a device.

LESSON	COVERS	FOCUS	CHAPTERS
1 The molecule	A1.2.1 to A1.2.3, A1.2.5, A1.2.6	DNA as the genetic material, the nucleotide, the backbone and the double strand, drawn the IB way and built as models	1, 2, 3, 5
2 Pairing, copying, DNA and RNA	A1.2.4, A1.2.7, A1.2.8	Complementary pairing and why it makes copies exact, DNA against RNA, and the extraction dry lab	4, 6, lab
3 Storing information	A1.2.9, A1.2.10	Why four bases can store limitless information, and why one shared code points to a common ancestor	7
4 Direction, width and packing HL	A1.2.11 to A1.2.13	Directionality, purine with pyrimidine, and the nucleosome, modelled and seen in molecular visualisation software	8, 9, 10
5 How we know HL	A1.2.14, A1.2.15	The evidence: Hershey and Chase's film and results, and Chargaff's data against the tetranucleotide hypothesis	11, 12

The guide, for the class to read and play: biologybybradford.com/guides/ib-biology-a1-2-nucleic-acids

The molecule

60 minutes • A1.2.1 to A1.2.3, A1.2.5, A1.2.6 • Chapters 1, 2, 3, 5

DNA as the genetic material, the nucleotide, the backbone and the double strand, drawn the IB way and built as models

BY THE END, STUDENTS CAN

- ☐ Explain why DNA is the genetic material of every living organism, and why RNA viruses do not break the rule A1.2.1
- ☐ Draw a nucleotide as a circle, a pentagon and a rectangle, each joined in the right place A1.2.2
- ☐ Explain how condensation builds a strand with a strong sugar–phosphate backbone, and draw a short strand of RNA A1.2.3, A1.2.5
- ☐ Draw two antiparallel strands joined by hydrogen bonds between A and T, and C and G A1.2.6

TIMING

0–8	8 min	Do now: Who am I?	
8–15	7 min	Where the genetic material is	
15–27	12 min	Draw it the IB way	
27–52	25 min	Two models, one Venn	
52–60	8 min	Exit	
60 min		One lesson	

STARTER

- 8 min** **Do now: Who am I?**
- Each student wears a card with a term or a scientist on it, unseen, and asks yes or no questions until they guess it. The keyword bank is in the activity below.

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 Every living thing keeps its instructions in DNA

CHAPTER 01 IN THE SLIDES

Tap the parts of the figure in turn: Bacterium, Yeast cell, Plant cell, Animal cell, Phage, Influenza virus and Coronavirus.

Predict box: A virus is found whose genes are made of RNA. Does that break the rule that DNA is the genetic material of all living organisms? Hands up or mini whiteboards first.

Answer B: No: viruses are not counted as living organisms

02 Three parts, one monomer

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 nucleotide is built from **three parts**.
2. The **sugar** sits in the middle, bonded to both of the others.
3. The IB draws them as a **circle**, a **pentagon** and a **rectangle**, in these positions.
4. Nitrogen comes from the base and **phosphorus** from the phosphate.

Predict box: How many different nucleotides does a cell use to build DNA? Hands up or mini whiteboards first.

Answer C: Four: the sugar and phosphate are the same, only the base differs

03 Building a strand with a strong backbone

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. One **nucleotide**.
2. **Condensation**: the phosphate bonds to the sugar above, and water leaves.
3. Each new bond releases one **water** molecule.
4. Sugar, phosphate, sugar, phosphate: a covalently bonded **backbone**.
5. One nucleotide is a circle, a pentagon and a rectangle **together**.

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. Two **nucleotides**, each a phosphate, a sugar and a base.
2. The phosphate of one and the sugar of the other face each other.
3. They leave as **water**, and a **sugar-phosphate bond** joins the sugar of one to the phosphate of the next: **condensation**, making a **dinucleotide**.
4. Add water and the bond splits again, the H to one nucleotide and the OH to the other: **hydrolysis**.

Predict box: How many water molecules are released when 10 nucleotides join into one strand? Hands up or mini whiteboards first.

Answer A: 9

05 Two strands, one helix

CHAPTER 05 IN THE SLIDES

Switch the figure through Flat: the ladder the exam asks for and Twisted into a double helix, and have the class say what will change before each.

Predict box: To be copied, the two strands of DNA must come apart. Why does pulling them apart not break the strands themselves? Hands up or mini whiteboards first.

Answer C: Weak hydrogen bonds join the two strands, while each strand is a chain of strong covalent bonds

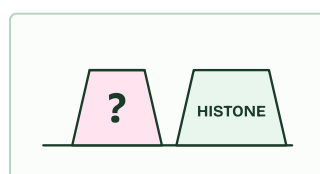
THE LESSON

7 min **Where the genetic material is**
Chapter 1's figure on the board: tap the cells and viruses. Take the virus predict box by vote before anyone opens the answer.

12 min **Draw it the IB way**
Chapter 2's and chapter 3's figures step by step, with students drawing on mini whiteboards at the same steps. Then the bond builder on the board: predict the water count for ten nucleotides first.

25 min **Two models, one Venn**
Pairs build a paper model and a sweet model of DNA, then complete the Venn diagram. Finish on "Watson and Crick built models too", chapter 5's aside.

ACTIVITIES

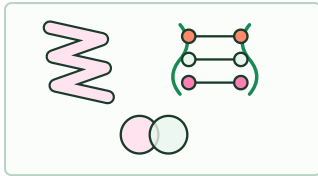


CARD GAME

Who am I?

Each student wears a card with a term or a scientist on it, unseen, and asks yes or no questions until they guess it. The keyword bank: nucleotide, phosphate group, deoxyribose, ribose, adenine, thymine, guanine, cytosine, uracil, hydrogen bond, sugar-phosphate backbone, antiparallel, double helix, complementary base pairing, condensation, DNA, RNA, virus. At higher level add purine, pyrimidine, histone, nucleosome, 5' end, bacteriophage, Chargaff, Hershey, Chase.

Needs: cards and sticky tape or headbands.

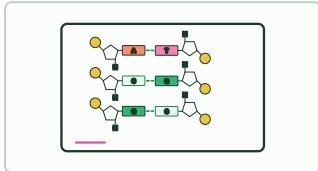


MODEL

Two models, one Venn

Pairs build a paper (origami) model and a sweet model of DNA, then draw a Venn diagram: what each shows, what it leaves out, what both get wrong, and how to improve one. Push for these: the origami shows the twist and the antiparallel strands; the sweets show pairing and the backbone; neither shows atoms, hydrogen bonds or scale.

Needs: a printed DNA origami sheet that you have permission to copy (the guide does not supply one); for the sweet model, two colours of liquorice laces, four colours of soft sweets and cocktail sticks; beads and pipe cleaners for anyone who cannot or will not use sweets.



DRAWING

Draw it the IB way

On mini whiteboards: one nucleotide, then a four-nucleotide RNA strand, then three antiparallel base pairs, each checked against the figure at the same step. Stress the corners the bonds leave from.

Needs: mini whiteboards and pens.

PLENARY

8

min

Exit

Draw three base pairs, antiparallel, and label a backbone, a hydrogen bond and one whole nucleotide.

WHAT STUDENTS GET WRONG

A nucleotide and a base are the same thing. A nucleotide is a phosphate, a sugar and a base.

Bases join to phosphates. Bases join to sugars; phosphates join sugar to sugar.

Hydrogen bonds hold a strand together. Within a strand, covalent; between strands, hydrogen.

Antiparallel means twisted. It means running in opposite directions.

STRETCH AND SUPPORT

Support: cut the figures' captions into cards to put in order, use the dotted key terms as a glossary, and give a drawing frame with the pentagon corners marked for the IB drawings.

Support: use the three mnemonics (Apples in the Tree, Some Bananas Split, Pure As Gold) as a starter in each lesson.

IN THE GUIDE

- 1 [Every living thing keeps its instructions in DNA](#)
- 2 [Three parts, one monomer](#)
- 3 [Building a strand with a strong backbone](#)
- 5 [Two strands, one helix](#)
- 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 A1.2, built from its key terms and ready to print
- A [pub quiz](#) with rounds on A1.2, to present or run with no projector
- An [escape room](#) built from the [question bank](#) on A1.2

ALREADY ON THE SITE FOR A1.2

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- Quiz: [Nucleic Acids \(HL\)](#)
- Quiz: [Nucleic Acids](#)
- Revision map: [A1.2 Nucleic acids](#), to fill in
- Exam questions: [A1.2 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.
- [A1.2 Nucleic Acids](#)

EXAM PRACTICE

Check yourself

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biologybybradford.com/exam-maker/sit?topics=A1.2&level=SL&paper=quiz&marks=15&src=ep



Pairing, copying, DNA and RNA

60 minutes • A1.2.4, A1.2.7, A1.2.8 • Chapters 4, 6 • The dry lab

Complementary pairing and why it makes copies exact, DNA against RNA, and the extraction dry lab

BY THE END, STUDENTS CAN

- ☐ Name the bases of DNA and RNA, and explain how complementary pairing lets DNA be copied and read A1.2.4, A1.2.8
- ☐ Give three differences between DNA and RNA, and sketch ribose against deoxyribose A1.2.7

TIMING

0-5	5 min	Do now	
5-20	15 min	Pair it	
20-30	10 min	DNA or RNA	
30-55	25 min	The dry lab	
55-60	5 min	Exit	
	60 min	One lesson	

STARTER

5
min

Do now

Turn over the Apples in the Tree tiles, then five quick base pairs on the board.

ON THE BOARD, FROM THE GUIDE

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04 Four letters that pair

CHAPTER 04 IN THE SLIDES

Switch the figure through Which base fits each slot?, Paired: only A with T and G with C form hydrogen bonds, Copy it: two molecules with the same sequence and Read it: messenger RNA, read by a transfer RNA, and have the class say what will change before each.

Predict box: One strand of a DNA molecule reads A A T G C. The strands separate and each is copied. What does the strand built against it read, and the strand built against that one? Hands up or mini whiteboards first.

Answer B: T T A C G, then A A T G C

Remember it: Apples Tree Cars Garage (Adenine, Thymine, Cytosine, Guanine).

06 DNA and RNA compared

CHAPTER 06 IN THE SLIDES

Switch the figure through DNA and RNA, and have the class say what will change before each.

Predict box: A sample of nucleic acid is single-stranded and contains thymine but no uracil. What is it most likely to be? Hands up or mini whiteboards first.

Answer A: DNA, from one of the few viruses with single-stranded DNA

Remember it: Some Bananas Split (Sugar, Bases, Strands).

THE LESSON

15

min

Pair it

Chapter 4's figure in pairs: get a wrong base to fail and say why, then Copy it and Read it. Then the copy predict box.

10

min

DNA or RNA

Chapter 6's switch. Students sketch ribose and deoxyribose and mark carbon 2. Some Bananas Split.

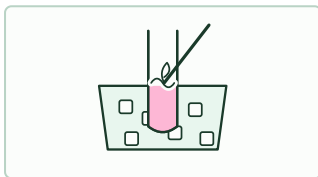
25

min

The dry lab

Pairs run the dry lab, Getting DNA out: the full method three times, then one step left out at a time, to find out which steps matter. Or run the wet extraction as a demonstration while pairs use the dry lab.

ACTIVITIES



PRACTICAL

DNA extraction, the wet version

Optional. The method of the dry lab on a real strawberry, as a demonstration or in pairs. Safety: eye protection; ethanol is highly flammable, so no flames in the room; wash hands after handling meat tenderiser. Afterwards ask what the white threads are: a tangle of millions of DNA molecules, with some RNA and protein, not one molecule.

Needs: strawberries, sealed bags, washing-up liquid, salt, a 60 °C water bath, ice, coffee filters, funnels, boiling tubes, ethanol from the freezer, wooden skewers.

DRY LAB

Getting DNA out

The dry lab, with its tasks and questions after it, and its results table as a CSV for a pooled class graph. One device per pair.

Needs: one device per pair.

PLENARY

5

min

Exit

The question under the dry lab on salt.

WHAT STUDENTS GET WRONG

Complementary means identical. The strands differ; the copies match.

Uracil replaces adenine. It replaces thymine.

Deoxyribose has no oxygen in its ring. It lacks the OH on carbon 2 only.

The white threads from the extraction are a DNA molecule. They are millions, tangled together.

STRETCH AND SUPPORT

Support: cut the figures' captions into cards to put in order, use the dotted key terms as a glossary, and give a drawing frame with the pentagon corners marked for the IB drawings.

Support: use the three mnemonics (Apples in the Tree, Some Bananas Split, Pure As Gold) as a starter in each lesson.

Stretch: why might RNA have come before DNA? (The linking question in chapter 6.)

IN THE GUIDE

- 4** [Four letters that pair](#)
- 6** [DNA and RNA compared](#)
- Lab** [Dry lab: Getting DNA out](#)
- 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

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- [A1.2 Nucleic Acids](#)

EXAM PRACTICE

Check yourself

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biologybybradford.com/exam-maker/sit?topics=A1.2&level=SL&paper=quiz&marks=15&src=ep



Storing information

60 minutes • A1.2.9, A1.2.10 • Chapter 7

Why four bases can store limitless information, and why one shared code points to a common ancestor

BY THE END, STUDENTS CAN

- ☐ Explain why DNA can store limitless information, and why one genetic code in all life points to a common ancestor
A1.2.9, A1.2.10

TIMING

0-8	8 min	Do now: How much DNA are you?	
8-20	12 min	Endless sequences	
20-30	10 min	One code, five readers	
30-45	15 min	The backbone question	
45-55	10 min	Exam question, timed	
55-60	5 min	Exit	
	60 min	One lesson	

STARTER

8
min**Do now: How much DNA are you?**

Pairs estimate the length of DNA in a human body (activity below).

ON THE BOARD, FROM THE GUIDE

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07 Endless sequences, one code

CHAPTER 07 IN THE SLIDES

Slide the figure through Bases in the sequence 0, Bases in the sequence 1, Bases in the sequence 2, Bases in the sequence 3, Bases in the sequence 4, Bases in the sequence 5, Bases in the sequence 6 and Bases in the sequence 7, and have the class say what will change before each.

Switch the figure through Bacterium, Yeast, Wheat, Human cell and Human mitochondrion, and have the class say what will change before each.

Predict box: How many different sequences of three bases can DNA's four bases make? Hands up or mini whiteboards first.

Answer B: 64

THE LESSON

12
min**Endless sequences**

Chapter 7's slider. Predict the number of three-base sequences first, then slide to 10, 100 and 1000 bases.

10
min**One code, five readers**

Chapter 7's second figure. Why would an arbitrary code be shared by everything, unless it was inherited?

15

min

The backbone question

The written question below, then peer-marked against points the class agrees.

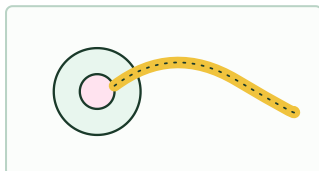
10

min

Exam question, timed

A short written question on A1.2 from the A1.2 exam maker (in Practise and revise, below), timed. For homework, [the Check step](#).

ACTIVITIES



ESTIMATE

How much DNA are you?

Pairs estimate the length of DNA in a human body. A cell with a nucleus holds about 2 m of DNA. A body has about 30 trillion cells, but most of them are red blood cells, which have no nucleus (about 25 trillion of the 30). So take a few trillion cells with a nucleus. A fair answer is around 10 billion km, which is 50 to 70 times the distance from Earth to the Sun (about 150 million km). The size of the answer matters more than the digits.

Needs: calculators.

WRITING

The backbone question

Exam style: "Explain how the strong covalent bonds in each strand and the weak hydrogen bonds between the strands allow (a) the strands to separate, (b) the base sequence to be kept in each copy, and (c) a rare copying mistake to be kept too." Peer-mark against points the class agrees. For (c): once a wrong base is joined into the new strand, the same strong backbone that keeps the right sequence keeps the mistake.

Needs: paper or exercise books.

PLENARY

5

min

Exit

One sentence answering each guiding question.

WHAT STUDENTS GET WRONG

The universal code means the same DNA in everything. Same code, different sequences.

4^n confused with n^4 , or with $4n$. Use the three-base predict box.

STRETCH AND SUPPORT

Support: cut the figures' captions into cards to put in order, use the dotted key terms as a glossary, and give a drawing frame with the pentagon corners marked for the IB drawings.

Stretch: the [Comparative Genome Viewer](#) at NCBI shows long stretches shared by the chromosomes of related species, such as human and mouse. What does that say about common ancestry, and about the diversity of genomes?

Stretch: make a Tarsia puzzle that is better than the site's own, from your own pairs, in the Tarsia builder.

Stretch: [Reading Frame](#), a codon game, looks ahead to D1.2.

IN THE GUIDE

- 7** [Endless sequences, one code](#)
- A1.1** [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 A1.2, built from its key terms and ready to print
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CARD SETS ON SPLYCR

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

- [A1.2 Nucleic Acids](#)

EXAM PRACTICE

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biologybybradford.com/exam-maker/sit?topics=A1.2&level=SL&paper=quiz&marks=15&src=ep



Direction, width and packing HL

60 minutes • A1.2.11 to A1.2.13 • Chapters 8, 9, 10

Directionality, purine with pyrimidine, and the nucleosome, modelled and seen in molecular visualisation software

BY THE END, STUDENTS CAN

- ☐ Explain what the 5' and 3' ends are, and why nucleotides are only ever added at the 3' end A1.2.11
- ☐ Explain why a purine always pairs with a pyrimidine, and what that does for the helix A1.2.12
- ☐ Describe a nucleosome, and use molecular visualisation software to see how histones hold DNA A1.2.13

TIMING

0-5	5 min	Do now	
5-17	12 min	Which end is which	
17-25	8 min	A big base with a small one	
25-40	15 min	Plasticine nucleosome	
40-55	15 min	Nucleosome on screen	
55-60	5 min	Exit	
60 min		One lesson	

STARTER

5 min **Do now**
 Chapter 8's predict box, 5'-ATGC-3', on mini whiteboards.

ON THE BOARD, FROM THE GUIDE

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08 Every strand has a direction

CHAPTER 08 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. Carbons **1' to 5'**.
2. Each phosphate links a **5'** carbon to the **3'** carbon before it.
3. New nucleotides join only at the **3' end**.
4. The strands are **antiparallel**: one runs 5' to 3', the other 3' to 5'.
5. So DNA is copied, transcribed and read in **one direction**.

Predict box: One DNA strand reads 5'-ATGC-3'. Written 5' to 3', what is its partner? Hands up or mini whiteboards first.

Answer C: 5'-GCAT-3'

09 A big base with a small one

CHAPTER 09 IN THE SLIDES

Switch the figure through A with T, G with C, A with G, C with T and A with C, and have the class say what will change before each.

Predict box: 30% of the bases in a sample of double-stranded DNA are adenine. What percentage are purines?
Hands up or mini whiteboards first.

Answer B: 50%

Remember it: Pure As Gold CUT (Purines, Adenine, Guanine, Pyrimidines).

10 Wound on a spool

CHAPTER 10 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. DNA and **histone** proteins.
2. **Eight** histones form a core.
3. The DNA wraps round the core, just under **two turns**.
4. A **ninth** histone, on the linker DNA, holds it in place.
5. **Nucleosomes** along the DNA, like beads on a string.

Predict box: A chemical is added that cancels the negative charges on DNA's phosphate groups. What would you expect to happen to the nucleosomes? Hands up or mini whiteboards first.

Answer C: The DNA would come away from the histones more easily

THE LESSON

12

min

Which end is which

Chapter 8's figure. Students add 5' and 3' to their lesson 1 drawing, and an arrow for each of replication, transcription and translation.

8

min

A big base with a small one

Chapter 9's states, Pure As Gold, and the 30% adenine predict box.

15

min

Plasticine nucleosome

Build the model (activity below), label it, and photograph it for notes.

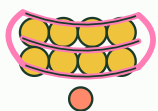
15

min

Nucleosome on screen

Pairs work through [chapter 10's](#) "Try it" list on laptops, then report which part of the DNA the histones touch, and why.

ACTIVITIES

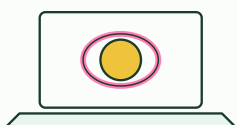


MODEL · HL

Plasticine nucleosome

Press eight equal balls of plasticine (about 1 cm) into a cube. Twist two pipe cleaners into a double helix and wind it just under two turns round the cube. Pin the two ends where they leave with a small ninth piece. Label it, and take a photo for notes.

Needs: plasticine in two colours, pipe cleaners, labels.



SOFTWARE · HL

Nucleosome on screen

Pairs work through [chapter 10's](#) "Try it" list on laptops, then report which part of the DNA the histones touch, and why. The 3D viewer is poor on phones.

Needs: laptops.

5

min

Exit

Describe a nucleosome, three marks' worth.

WHAT STUDENTS GET WRONG

5' and 3' are positions on a gene. They are sugar carbons.

Purine pairs with purine because they are the same size. Big pairs with small.

Eight histones plus DNA is the whole story. The ninth sits on the linker DNA.

STRETCH AND SUPPORT

Support: use the three mnemonics (Apples in the Tree, Some Bananas Split, Pure As Gold) as a starter in each lesson.

IN THE GUIDE

- 8** [Every strand has a direction](#)
- 9** [A big base with a small one](#)
- 10** [Wound on a spool](#)
- A11** [The whole guide, with the figures that play](#)
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How we know HL

60 minutes • A1.2.14, A1.2.15 • Chapters 11, 12

The evidence: Hershey and Chase's film and results, and Chargaff's data against the tetranucleotide hypothesis

BY THE END, STUDENTS CAN

- ☐ Explain how Hershey and Chase's results support the conclusion that DNA, not protein, is the genetic material A1.2.14
- ☐ Use Chargaff's data to falsify the tetranucleotide hypothesis, and explain why one result can falsify what many cannot prove A1.2.15

TIMING

0-5	5 min	Do now	
5-17	12 min	Predict, then watch the film	
17-25	8 min	Error hunt	
25-40	15 min	Chargaff's table	
40-55	15 min	Stop-motion Hershey and Chase	
55-60	5 min	Exit	
	60 min	One lesson	

STARTER

- 5 min** **Do now**
- "It is 1950. Would you bet on protein or DNA as the genetic material?" Vote, with one reason. Then: what did Hershey and Chase need that nobody had before 1946?

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.

11 Hershey and Chase: which one carries the genes?

CHAPTER 11 IN THE SLIDES

Play the animation, Hershey and Chase: the film. It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. Sulfur is in protein, not DNA, so it labels the **protein coat**. Phosphorus is in DNA, so it labels the **DNA**.
2. It **injects** its DNA into the bacterium. The empty protein coat stays outside.
3. A few minutes later, a **blender** shakes the coats off the bacteria.
4. The heavy bacteria sink into a **pellet**. The light coats stay in the liquid above, the **supernatant**.
5. **Where is the radioactivity?** Predict before the results.

Predict box: After blending and spinning, where will most of the radioactivity be in each batch? Hands up or mini whiteboards first.

Answer C: Sulfur-35 in the liquid, phosphorus-32 in the pellet

12 Chargaff's numbers: one result can falsify

CHAPTER 12 IN THE SLIDES

Switch the figure through Bases, Ratios, The hypothesis and Add a virus, and have the class say what will change before each.

Predict box: The tetranucleotide hypothesis says every DNA molecule is 25% of each base. Which result would be enough, on its own, to falsify it? Hands up or mini whiteboards first.

Answer B: One species whose DNA is reliably measured as 30% adenine

THE LESSON

12

min

Predict, then watch the film

Chapter 11's predict box first, by vote, then [chapter 11](#)'s film of the method. It stops on "Where is the radioactivity?" until the prediction is in (in the slides, pause the video on that title card); then play the results and the new phages.

8

min

Error hunt

Find and fix the five mistakes in the short answer (activity below).

15

min

Chargaff's table

The data task below, ending on the discussion of induction against falsification.

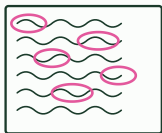
15

min

Stop-motion Hershey and Chase

Storyboard and first frames (activity below). Finish for homework.

ACTIVITIES

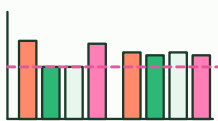


WRITING · HL

Error hunt: Hershey and Chase

Students find and fix the mistakes in this answer: "Hershey and Chase wanted to find out whether RNA or protein was the genetic material. They grew phages with radioactive phosphorus to label the protein and radioactive sulfur to label the DNA. After infection they found the sulfur inside the bacteria, which proved that DNA is the genetic material of all living things." There are five: RNA for DNA; the labels swapped; the wrong result; "proved"; "all living things".

Needs: the answer printed or on the board.

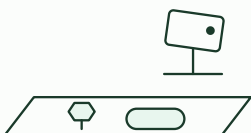


DATA · HL

Chargaff's table

From [chapter 12](#)'s data (printed, or on screen), work out A/T, G/C and $(A + G)/(C + T)$ for each organism. Say what the tetranucleotide hypothesis predicts, then find the one sample that breaks $A = T$ and explain it. End on the discussion: why does one 30% result outweigh a thousand that agree?

Needs: the table, calculators.



FILM · HL

Stop-motion Hershey and Chase

Groups make a 30-second film of the method and conclusion with paper cut-outs on a phone: labelled phages, injection, blender, centrifuge, counters, conclusion. Mark each step on whether it and its reason are right.

Needs: phones, paper, scissors, sticky tack, a stand or a pile of books.

5

min

Exit

"S stays out, P passes in" (the teacher's mnemonic below), then one sentence: why does one 30% result outweigh a thousand that agree?

WHAT STUDENTS GET WRONG

Sulfur labelled the DNA. Sulfur is in protein, phosphorus in DNA.

Hershey and Chase proved it. They gave strong evidence, for T2.

A + T = G + C. No: A = T and G = C.

STRETCH AND SUPPORT

Stretch: a single-stranded DNA virus has 25% A and 33% T. What can you say about its partner strand inside an infected cell, once it is copied?

IN THE GUIDE

- 11** [Hershey and Chase: which one carries the genes?](#)
- 12** [Chargaff's numbers: one result can falsify](#)
- 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 A1.2, built from its key terms and ready to print
- A [pub quiz](#) with rounds on A1.2, to present or run with no projector
- An [escape room built from the question bank](#) on A1.2

ALREADY ON THE SITE FOR A1.2

- Lesson: [Nucleic Acids](#)
- Quiz: [Nucleic Acids \(HL\)](#)
- Quiz: [Nucleic Acids](#)
- Revision map: [A1.2 Nucleic acids](#), to fill in
- Exam questions: [A1.2 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.
- [A1.2 Nucleic Acids](#)

**EXAM PRACTICE****Check yourself**

Set it for homework: a fresh paper of exam-bank questions on A1.2 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=A1.2&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.