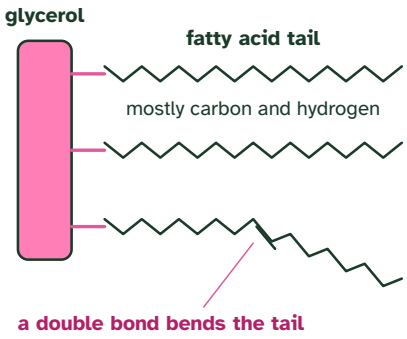
AP BIOLOGY | UNIT 1 | TOPICS 1.5 AND 1.6 | REVISION ON TWO PAGES

Fats, oils and the *code*

What to know, what to draw and what to say. Nothing else.

THE ONE IDEA

Lipids are nonpolar, so water pushes them together. Nucleic acids are chains of nucleotides whose bases pair and carry information.



A triglyceride. Each zigzag is a chain of carbons; hydrogens are left out.

1.5.A START HERE

The molecules water *will not touch*

- Lipids are grouped by how they behave, not by a shared monomer: they are **nonpolar**. Their C–H bonds share electrons almost evenly, so water has nothing to attract and they are **hydrophobic**.
- Fats and oils are mostly **triglycerides**: one glycerol joined to three fatty acids by dehydration synthesis, **releasing three waters**.
- A triglyceride is large but **not a polymer**: four parts joined, not a chain of repeats.

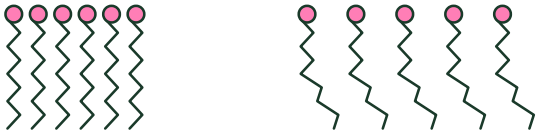
WHAT LIPIDS DO

E	**Energy** the long-term store	**I**	**Insulation** fat under the skin	**W**	**Wax** keeps water off a leaf	**M**	**Membranes** phospholipids

1.5.A STRUCTURE SETS THE MELTING POINT

Saturated and *unsaturated*

- **Saturated:** every bond between carbons is single, so the tail is **straight** and holds as many hydrogens as it can.
- **Unsaturated:** one or more C=C double bonds, each putting a **kink** in the tail.
- Straight tails pack closely and attract each other more, so the fat has a **higher melting point**. The more double bonds, the lower it is.



saturated tails | unsaturated tails

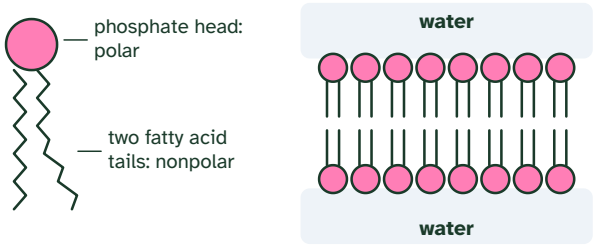
Saturated fat solid at room temperature
Butter, lard. Mammals, at about 37 °C, can store harder fats.

Unsaturated oil liquid at room temperature
Olive oil, sunflower oil. Plants and cold-water fish store oils that stay liquid.

1.5.A HALF LOVES WATER, HALF DOES NOT

Phospholipids make membranes

- A phospholipid is built like a triglyceride, but a **phosphate group** replaces one fatty acid.
- The charged phosphate is a **hydrophilic head**; the two tails stay **hydrophobic**. A molecule with both is **amphipathic**.
- In water, phospholipids form a **bilayer** by themselves: heads out, tails in. Ions and most polar molecules cannot cross its nonpolar core.
- Kinked unsaturated tails keep a bilayer fluid.



1.5.A SAME CLASS, THREE SHAPES

Three lipids to *tell apart*

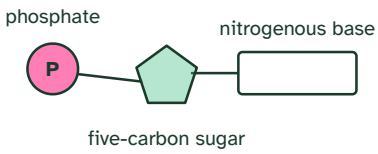
	TRIGLYCERIDE	PHOSPHOLIPID	STEROID
Built from	Glycerol and **three** fatty acids.	Glycerol, **two** fatty acids and a phosphate group.	Four carbon rings joined together.
In water	**Hydrophobic** Gathers into droplets.	**Amphipathic** Forms a bilayer.	**Mostly nonpolar** Can pass through a bilayer.
Job	Stores about **twice the energy** of a carbohydrate, gram for gram, with no water held. Insulates.	Makes **every membrane**: a barrier that holds a cell's dissolved contents in.	**Cholesterol** sits among the tails of animal membranes. Testosterone and estrogen are hormones made from it.

All three are nonpolar, at least in part: that is what makes them lipids.

Nucleic acids: *nucleotides*, pairing, DNA and RNA

1.6.A

A sugar, a phosphate and a *base*



- Nucleic acids carry the instructions for every protein. Their monomers are **nucleotides**.
- Nucleotides join by dehydration synthesis into a **sugar-phosphate backbone** of covalent bonds. The bases stick out: they are the message.
- New nucleotides are added **only to the 3′ end**, so a strand always grows 5′ to 3′.

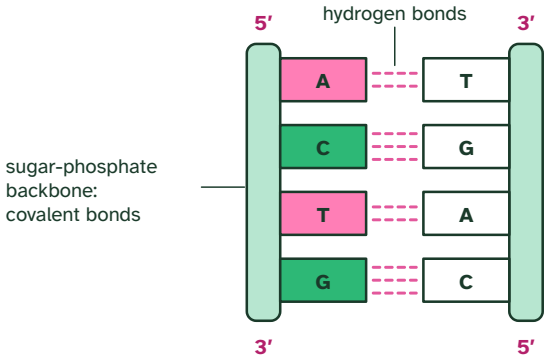
5′ END
A free phosphate
on the 5′ carbon of the sugar.

3′ END
A free OH
on the 3′ carbon. The next nucleotide joins here.

1.6.A

Two strands, running *opposite ways*

- **Complementary base pairing**: A with T, and C with G, held by **hydrogen bonds**. A and T share two; C and G share three.
- The strands are **antiparallel**: one runs 5′ to 3′, its partner 3′ to 5′. Together they twist into a double helix.
- Separated, each strand is a **template**: its bases decide which nucleotide joins opposite.



1.6.A BUILT THE SAME WAY, FOR TWO JOBS

DNA and RNA: *three differences*

	DNA	RNA
Sugar	**Deoxyribose** One oxygen fewer than ribose.	**Ribose**
Bases	**A, T, C and G**	**A, U, C and G** Uracil replaces thymine, and pairs with A.
Strands	**Usually two** Antiparallel, in a double helix, the bases tucked inside.	**Usually one** It can fold back on itself into shapes that do jobs.
Job	**The long-term store** Each strand can repair or copy the other.	**A working copy** Made from one gene when needed, used, then broken down.

Both are strands of nucleotides with a 5′ and a 3′ end.

Each difference fits the job

WATCH OUT

Six mistakes that *cost points*

- ✕ **Melting a fat breaks no covalent bonds.** It only separates whole molecules from each other.
- ✕ **A bilayer is not held by covalent bonds.** Water keeps pushing the tails together, so a membrane can flow.
- ✕ **5′ and 3′ are carbons of the sugar,** not the first and last bases.
- ✕ **The two strands are complementary, not identical.**
- ✕ **Hydrogen bonds join the base pairs;** the bonds along each backbone are covalent.
- ✕ **Uracil replaces thymine, not adenine.** U pairs with A.

COVER THE SHEET

Can you *answer these?*

1. Explain why lipids do not dissolve in water.
2. Describe how a triglyceride is built.
3. Explain why olive oil is liquid when butter is solid.
4. Explain why phospholipids form a bilayer in water.
5. Identify the three parts of a nucleotide.
6. Determine the strand that pairs with 5′-ATGC-3′.
7. Describe what antiparallel means.
8. Describe three ways RNA differs from DNA.

IN THE EXAM

For a lipid, start from polarity: nonpolar tails, polar head. **For DNA, mark 5′ and 3′ on both strands**, and say which bonds are hydrogen bonds and which are covalent.

GO FURTHER

Animated figures, a dry lab and a marked Check are in the full guide online.