Biological molecules

IGCSE Biology

The chemical elements in food

Bread is rich in carbohydrates, one of the main food groups.

Living things are built from a few kinds of **molecule** 分子. The most important are carbohydrates, fats and proteins. Each is made from a small number of chemical **elements** 元素.

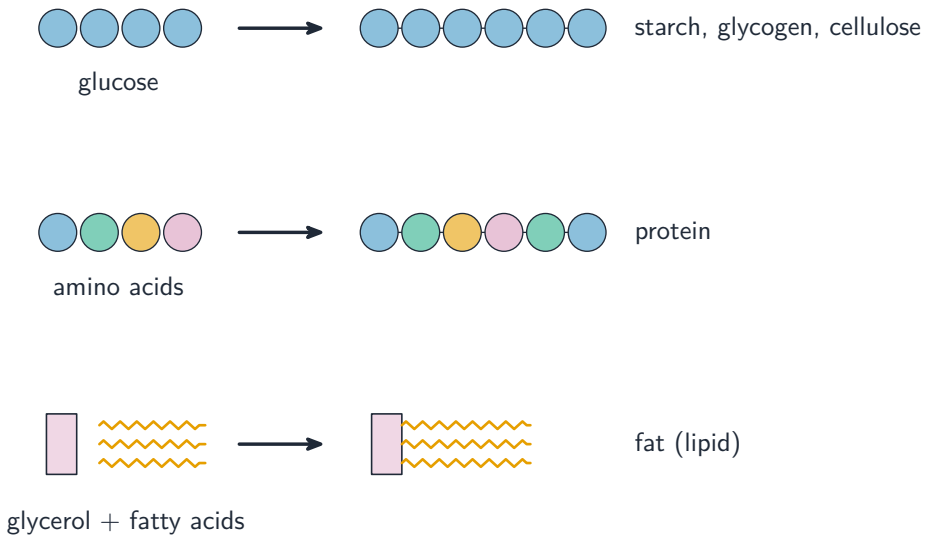
- **Carbohydrates** 碳水化合物 and **fats** 脂肪 contain three elements: **carbon** 碳 (C), **hydrogen** 氢 (H) and oxygen (O).
- **Proteins** 蛋白质 contain carbon, hydrogen and oxygen too, plus **nitrogen** 氮 (N). (Some proteins also contain sulfur, S.)

Building large molecules from small ones

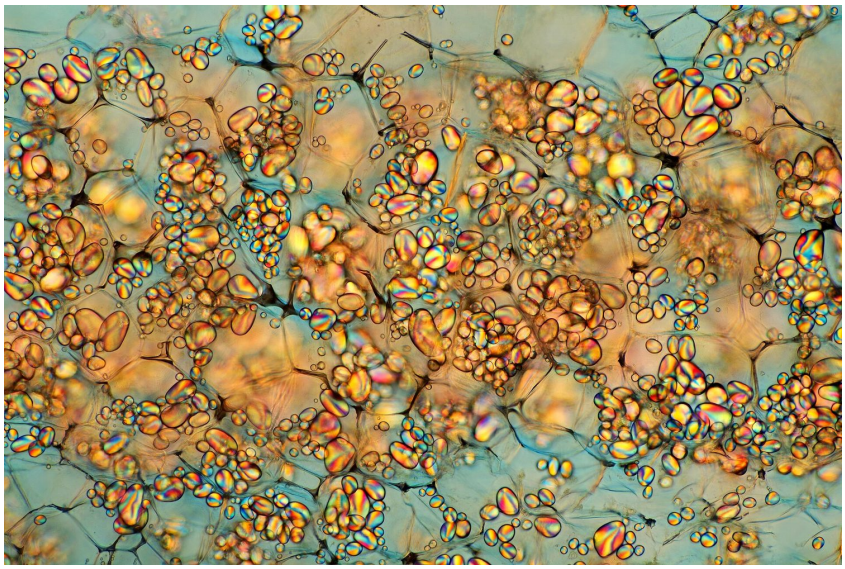
Large molecules are made by joining many small molecules together, like beads on a string.

Large molecule	Built from
starch 淀粉, **glycogen** 糖原 and **cellulose** 纤维素	many **glucose** 葡萄糖 units
proteins	**amino acids** 氨基酸
fats and oils	**fatty acids** 脂肪酸 and **glycerol** 甘油

Starch and glycogen are energy stores; cellulose makes plant cell walls. Proteins are built from about 20 different kinds of amino acid joined in a chain. One fat molecule is made from three fatty acids joined to one glycerol.



Large molecules are built by joining many small units, like beads on a string



Starch grains from a potato, seen under a microscope —each grain is built from many glucose units

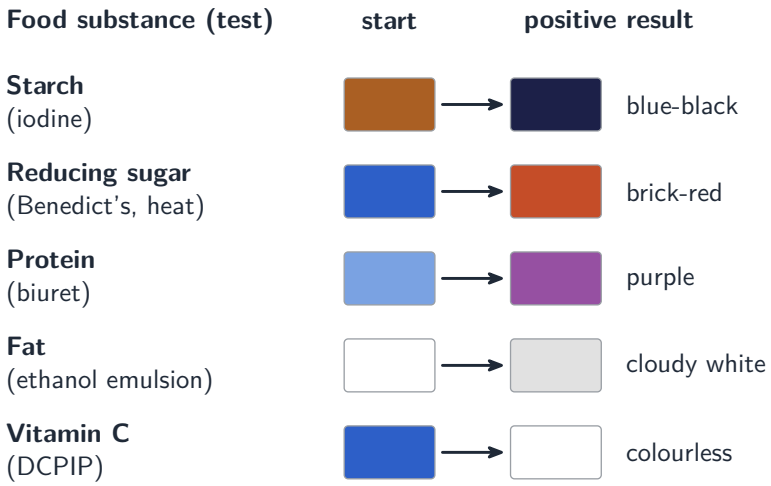
Food tests

You can test a piece of food to find out which substances it contains. Add the test chemical and watch for a colour change.

Food substance	**Test**	**Positive result**
starch	add **iodine solution** 碘液	orange-brown → blue-black
reducing sugars 还原糖 (such as glucose)	add **Benedict's solution** 本尼迪特试剂 and heat	blue → brick-red / orange
protein	add **biuret** 双缩脲 solution	blue → purple
fats and oils	**ethanol** 乙醇 **emulsion** 乳浊液 test	a cloudy white layer forms
vitamin 维生素 C	add to blue DCPIP	blue → colourless

Two things to remember: only the Benedict's test needs **heat**; and DCPIP loses its colour

(goes colourless), while the other tests gain a new colour.

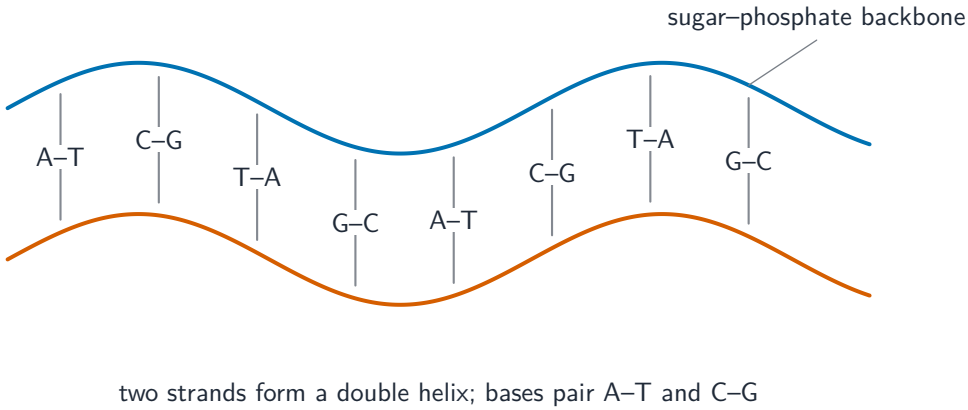


Each food test gives its own colour change for a positive result

The structure of DNA (Supplement)

DNA is the **genetic material** 遗传物质—it carries the instructions for building and running an organism. Its structure has four key points:

- two **strands** 链 are coiled together to form a **double helix** 双螺旋 (like a twisted ladder).
- each strand carries chemicals called **bases** 碱基.
- **bonds** 化学键 between pairs of bases hold the two strands together.
- the bases always pair in the same way: **A with T**, and **C with G**.



DNA is a double helix; the bases always pair A–T and C–G

Exam tips

- Carbohydrates and fats are made of C, H and O. Proteins also contain N (nitrogen).
- Learn each food test and its colour change. For reducing sugars you must **heat** the Benedict's solution.

- DCPIP goes from blue to **colourless**; the other four tests each give a **new** colour.
- In DNA, the bases pair only A–T and C–G. So if you know the bases on one strand, you can work out the other.