Go with the flow

Membranes are fatty, fluid barriers

In 1972, Seymour Singer and Garth Nicolson proposed the 'fluid mosaic model' of the cell membrane: a matrix made up of a fluid lipid bilayer containing membrane proteins and glycoproteins. The cell membrane is a partially permeable barrier that lets some molecules in while stopping others, and it's the lipid composition of the cell membrane that determines how it behaves.

In animal cells, the phospholipid molecules create a watertight bilayer. Cholesterol molecules change the fluidity of the membrane, stopping it from crystallising but also allowing certain small molecules to pass through it.

Each phospholipid in the lipid bilayer is composed of two hydrophobic, non-polar fatty-acid tails attached to a hydrophilic, polar head made of a glycerol molecule and phosphate group. On each side of the membrane, the heads face outwards, while the tails pack tightly together on the inside to escape their watery surroundings. The polar heads may have carbohydrate chains attached, forming glycolipids, which are involved in cell signalling and direct cell-to-cell interactions – the sugar components are exposed on the surface of the cell where they can be recognised by other molecules.

Pathogens can also use these glycolipids. The bacterial toxin that causes diarrhoea in cholera, for example, binds to a particular glycolipid receptor displayed on gut cells, and uses it to get inside the host cells.

REFERENCES

- 'The Molecular Biology of the Cell' by B Alberts et al.
- Membrane glycolipids in stem cells (2010)
- Phospholipid diagram [GIF]

[continued]

ABOUT THIS RESOURCE

This resource first appeared in 'Fat' in December 2015. Published by the Wellcome Trust, a charity registered in England and Wales, no. 210183.
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FURTHER READING

- Big Picture: The Cell issue
- The biology behind cholera

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