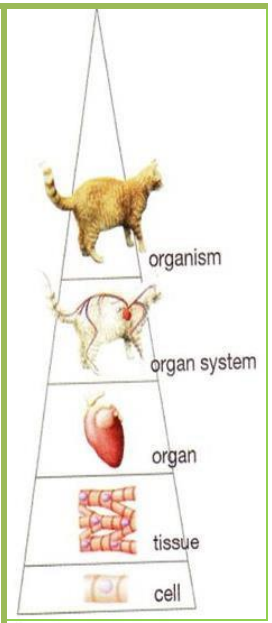
Biology Knowledge Organiser
B2 - Cell division

Unicellular vs. multicellular organisms

Unicellular organisms' bodies are simply one cell. All bacteria and other prokaryotic organisms are unicellular. **Multicellular** organisms are made of many cells and are much more complex. In multicellular organisms, cells **differentiate** to become **specialised cells**, carrying out specific roles in the organism.

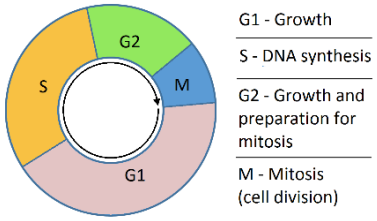
The levels of organisation in multicellular organisms form a **hierarchy**. In biology, hierarchies get simpler as you go down; or more complex as you go up because the upper things are made up of the things below them. The organisational hierarchy in multicellular organisms is shown here.



Stem cells

Once cells are specialised, they can't go back to being an unspecialised cell. This is why we all start life as a mass of unspecialised cells, called **stem cells** – this is what an embryo is. Stem cells can divide to make new cells and can differentiate to become specialised cells.

In an young embryo, all the cells are stem cells, so they can be taken, cloned and used to produce any human cells by differentiation.
In adults, there are not many stem cells left – most have differentiated. But there are some, for repair and replacement of specialised cells. For instance, there are stem cells in the bone marrow. These can be collected, cloned and made to differentiate into any type of blood cell. Using stem cells in this way is an active area of medical research, to treat conditions like diabetes and paralysis.

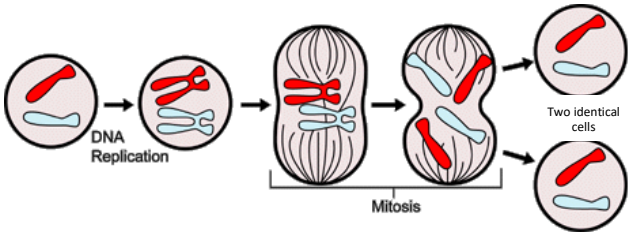


G1 - Growth

S - DNA synthesis

G2 - Growth and preparation for mitosis

M - Mitosis (cell division)



Key Terms	Definitions
Unicellular	Describes organisms formed of only one cell: like all prokaryotic organisms
Multicellular	Describes organisms made of many cells.
Differentiation	The process of becoming a specialised cell. Specialised cells are the result of differentiation of **stem cells**.
Stem cells	Cells that are undifferentiated. Stem cells are capable of forming many more cells of the same type (by cell division), and forming certain types of specialised cell by cell division.
Embryo	A very young multicellular organism, formed by fertilisation. Embryos are made of stem cells.
Cell cycle	The series of stages during which cells divide to make new cells. In the cell cycle, the DNA is replicated (copied exactly) and the cell splits by mitosis into two cells with one set of DNA each.
Mitosis	The specific part of the cell cycle where the cell divides to make two new cells, which are identical.
Chromosome	A structure containing one molecule of DNA. One chromosome contains many genes. In body cells, chromosomes are found in **pairs** (since you inherit one copy of each chromosome from your mother and one copy from your father).

The cell cycle – diagram bottom left

Cells divide to make new cells, for growth and repair, in the **cell cycle**. It isn't as simple as the cell splitting in two: it must prepare before doing that.

1. The cell grows larger and makes more sub-cellular structures, such as ribosomes and mitochondria. (It makes enough for two cells!)
2. The genetic material (**DNA**) is doubled by making an exact replica of the chromosomes. So, there are two copies of every chromosome at this point (labelled S on the cell cycle diagram).
3. Tiny fibres in the cell pull the copies of each chromosome to opposite ends of the cell, breaking the replica chromosomes apart. This means the nucleus can divide into two, each with the full set of chromosomes.
4. The cytoplasm and cell membranes divide to form two genetically identical cells. This is summarised in the diagram left.