

# Don't know much biology ...

... then you're in the right place, especially when it comes to the finer points of nuclear division

## TOPIC TWO – NUCLEAR DIVISION

The cell cycle is a term that describes the events that occur when a cell has just been formed through cell division until it divides itself to form new cells. The cell cycle is made up of the following stages:

### Interphase

Although the nucleus or cell is not dividing, the cell is actively making new organelles.

Towards the end of this phase, the chromatin becomes arranged into strands of chromosomes.

### Nuclear division (mitosis/meiosis)

This is when the nucleus of the cell divides into:

- ◆ Two identical nuclei in the case of mitosis, or
- ◆ Four different nuclei in the case of meiosis.

It is important to note that only the nuclei have divided at this stage, not the cell.

### Cell division (Cytokinesis)

This is where the cell splits. In the case of mitosis each of the new cells will have one of the identical nuclei. Therefore the cells will be clones of each other.

Now to look at mitosis in more detail. Mitosis is a type of nuclear division after which two identical nuclei have been formed.

If a cell is described as having divided by mitosis, the two daughter cells would have identical nuclei, therefore they can be described as clones. The daughter cells would also be identical to the original parent cell.

There are four stages to mitosis and they are named as follows: prophase; metaphase; anaphase; and telophase.

Students often create their own rhyme to help them remember the order in which these phases appear. Take this opportunity to come up with your own.

For example:

P \_\_\_\_\_ M \_\_\_\_\_  
A \_\_\_\_\_ T \_\_\_\_\_

Example:

Present \_\_\_\_\_ Me \_\_\_\_\_ Another \_\_\_\_\_ Testpaper \_\_\_\_\_  
(As I don't like this one).

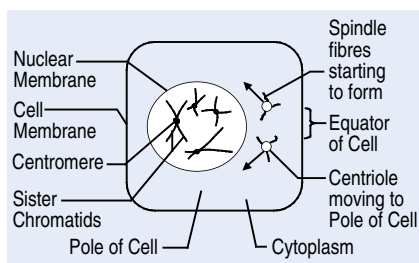
### Mitosis

The following diagrams could be described as  $2n = 4$ , as normally during interphase there would be four chromosomes in this diploid nucleus.

### Prophase

Prophase is the first of the four stages. In this stage:

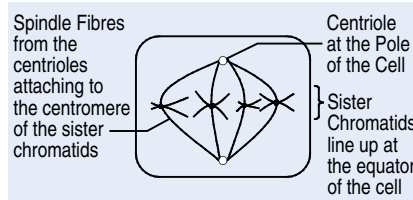
- ◆ The nucleolus is not visible
- ◆ Each chromosome is attached to its identical copy at a point called the centromere. While the chromosomes are joined in this fashion they are called sister chromatids.
- ◆ The centrioles begin to migrate from the equator to the poles of the cell. As they move they begin to make spindle.



### Metaphase

Metaphase is the second stage. In this stage:

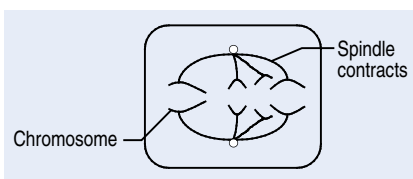
- ◆ The nuclear membrane has broken down and is no longer visible.
- ◆ The pairs of sister chromatids arrange themselves along the equator of the cell.
- ◆ The centrioles have reached their destination of the poles of the cell.
- ◆ Each centromere has spindle attached to it from each pole of the cell.



### Anaphase

Anaphase is the third and the shortest phase of mitosis. In this phase:

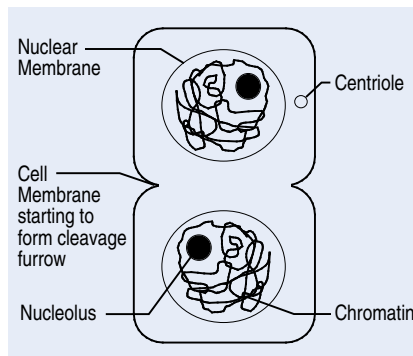
- ◆ The spindle contracts and pulls on the centromeres of the sister chromatids.
- ◆ Eventually the centromere will split and an identical set of chromosomes are dragged to each pole of the cell.
- ◆ Note that now that the sister chromatids have been separated they are now called chromosomes again.



### Telophase

This is the final stage of mitosis. In this stage:

- ◆ The nucleolus and the nuclear membrane have reformed.
- ◆ The spindle has been broken down
- ◆ The chromo-



Dr Bernie Condon prepares inspecting cell cultures at the National Virus Research Laboratory in UCD. Photograph: Matt Kavanagh

somes are not arranged as chromatin.

- ◆ There are two identical nuclei in the cell
- ◆ The cell is preparing for the next part of the cell cycle, cytokinesis, by pinching in the cell membrane and forming a cleavage furrow.

### The significance of the mitosis

In multicellular cellular organisms:

- ◆ It allows the organism to grow, repair, and renew itself by making more and more identical cells.

In unicellular organisms:

- ◆ It allows the organism to reproduce asexually. Where there was one cell there are now two identical clones.

### Meiosis

Meiosis is a type of nuclear division in which four nuclei are produced and each of these nuclei has half of the chromosome number of the original parent cell.

As a result of these daughter cells having a reduced amount of chromosomes, as compared with the parent nucleus, this is often called a reduction division.

## Suggested three-month study plan

1st-7th	8th-14th	MARCH	15th-21st	22nd-28th
Ecology The cell Enzymes Identification of your weakest areas	Food Cell Diversity Photosynthesis All definitions		Characteristics of life Scientific method Respiration All experiments	All DNA and genetics related chapters All important diagrams
		APRIL		
			12th-18th	19th-25th
			Human defence Digestion, enzymes Photosynthesis Weakest areas	Nervous system Endocrine system Respiration Cell and diversity
		MAY		
			10th-16th	17-23rd
			Unit one and two All experiments	Everything
				24th-30th
				Everything