

## Under the microscope — Cell division by mitosis



### Prophase (a-b)

During prophase, the first stage of mitosis, the chromosomes become shorter and thicker until they are clearly visible in the cell. Owing to the duplication process during interphase the chromosomes, which were originally single threads, are seen to be *double* structures. As they become thick enough to be visible during prophase they are seen to consist of two **chromatids** joined at a point called the **centromere**. Each chromatid contains a complete replica of the genetic code. In other words, a prophase nucleus contains twice as many "chromosomes" (chromatids) as usual.

### Metaphase (c)

During metaphase, the second phase of mitosis, the nuclear membrane disappears and a structure called the **spindle apparatus** is established. The spindle is an arrangement of very fine fibres to which each chromatid pair becomes attached at the centromere. Metaphase is completed when all the chromatid pairs are positioned at the "equator", or middle, of the cell.

### Anaphase (d-e)

During anaphase, the third phase of mitosis, the two chromatids of each "double chromosome" separate. Initially the centromere splits and separation of the chromatids begins, processing outwards. The chromatids of each pair then move apart in opposite directions. Remember that throughout this process each chromatid pair is attached to a separate fibre of the spindle apparatus. It is thought that the spindle fibres contract, and draw the chromatids apart.

### Telophase (f)

During telophase, the final phase of mitosis, a group of chromatids - now true chromosomes - assemble at opposite ends of each cell. Each of these two groups becomes an interphase nucleus with long, fine invisible chromosomes and a nuclear membrane. A cell surface membrane is formed (in plant cells an additional wall of cellulose grows between them). This process continues until the two cells are nipped apart.



**B** Metaphase (cp. c) of mitosis. Arrows point to fibres of the spindle apparatus. The two chromatids of each chromosome are clearly visible.

#### Note:

The chromosomes of an **interphase** cell (before a and following f) are thought to exist as long, fine threads (chromatin), which contain the genetic code. In an interphase cell which is about to undergo mitosis, a **perfect replica of the genetic code** within each chromosome is created. The replica is usually exactly the same as the original down to atomic level. In other words a perfect copy is made of the genetic code. When the copy is complete mitosis begins.