



The four main stages of the cell cycle are:

M phase: mitosis when the cell divides (about 1 hour)

G1 phase: gap 1, the preparation for S phase

S phase: DNA synthesis

G2 phase: gap 2 during which assembly of the apparatus for the distribution of chromosomes occurs.

Go phase : This phase is non-proliferative and is known as growth arrest. Cells in Go may re-enter the cell cycle at G1, thereby regaining the proliferative state. Locally active small-molecular-weight proteins called growth factors are important in stimulating this re-entry.

Cells can undergo terminal differentiation, in which case they cannot re-enter the cell cycle ( non dividing cells). In a permanent cell population, all the cells are terminally differentiated.

### *Control of the cell cycle*

a) Growth factors

These are low-molecular-weight proteins which have a similar mechanism of action to hormones. In general, the growth factor is produced by a cell, for example a macrophage, and acts either on the cell itself (autocrine action) or on a neighbouring cell (paracrine action) by linking to cell surface receptors. This interaction activates the receptor and triggers a series of cytoplasmic events usually involving phosphorylation-dephosphorylation of proteins. Ultimately, a signal reaches the nucleus where genes are switched on, new proteins produced and cell growth and division is initiated. Growth factors are thought to be particularly important in stimulating stable, non-proliferating (G0) cells to enter the cell cycle at G1 and undergo mitosis.

#### b) Cyclins

The cyclins are a family of proteins which seem to coordinate the journey of cells through the different phases of the cell cycle. They form complexes with a protein kinase (phosphorylating) enzyme. The cellular concentration and activity of different cyclins varies through the cycle.