

Chapter 5

Mitosis is the basis for the cell cycle

Cell Cycle

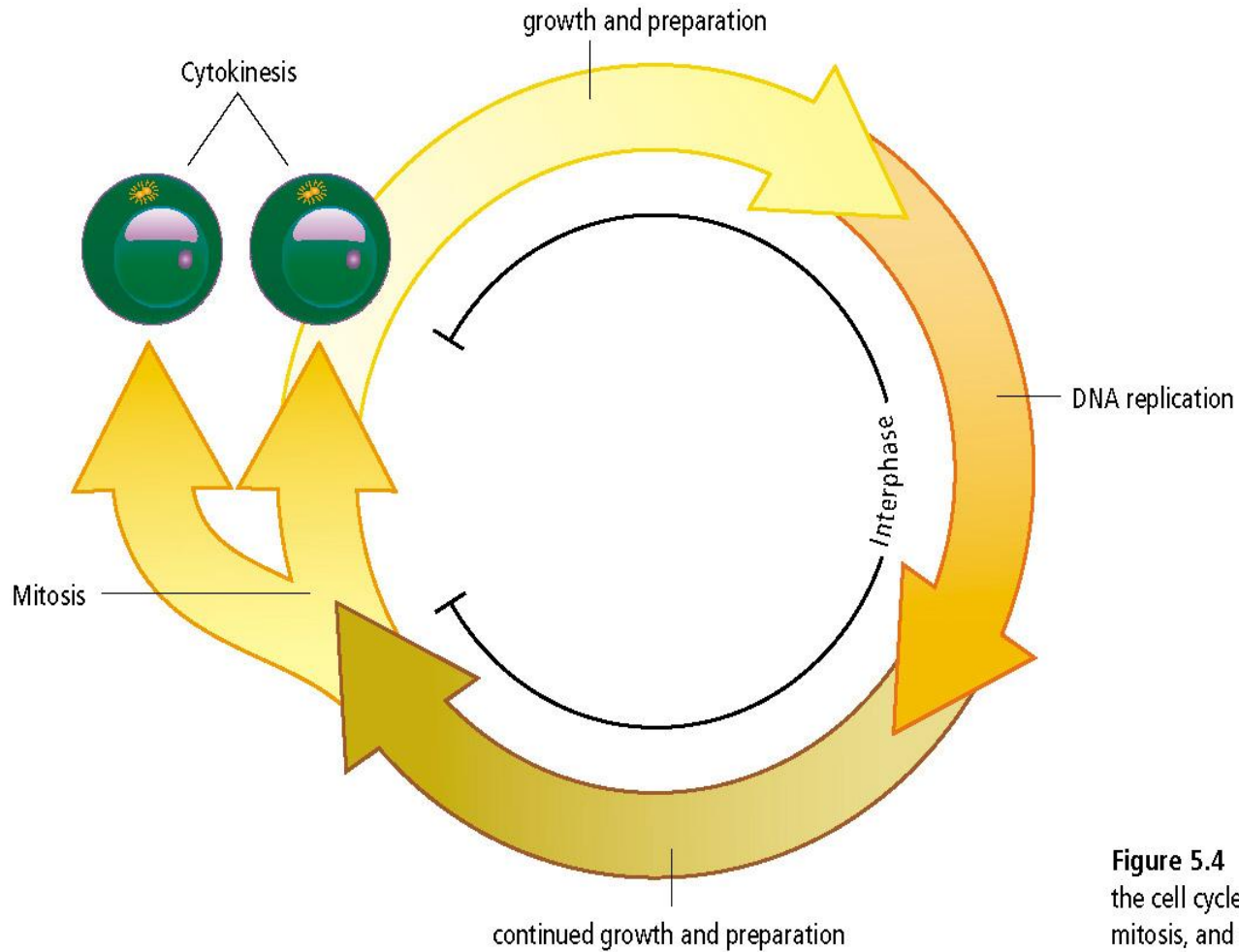


Figure 5.4 The stages of the cell cycle: interphase, mitosis, and cytokinesis

Cell Cycle

- The cell cycle occurs in somatic (body) cells and consists of 3 stages:
- Interphase
- Mitosis (division of nucleus)
- Cytokinesis (cell division)

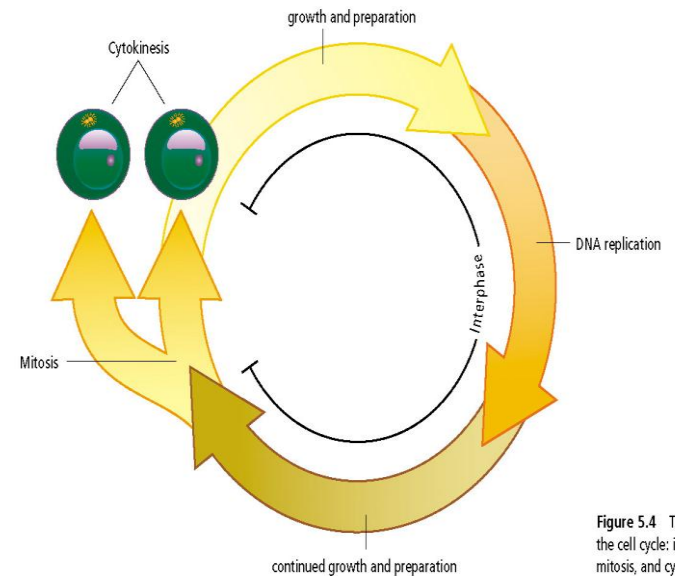
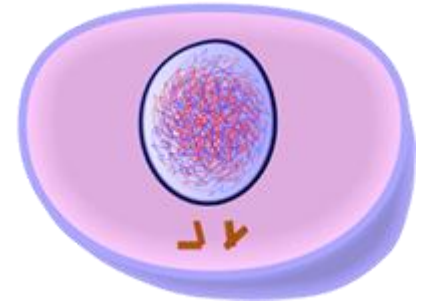


Figure 5.4 The stages of the cell cycle: interphase, mitosis, and cytokinesis

Interphase



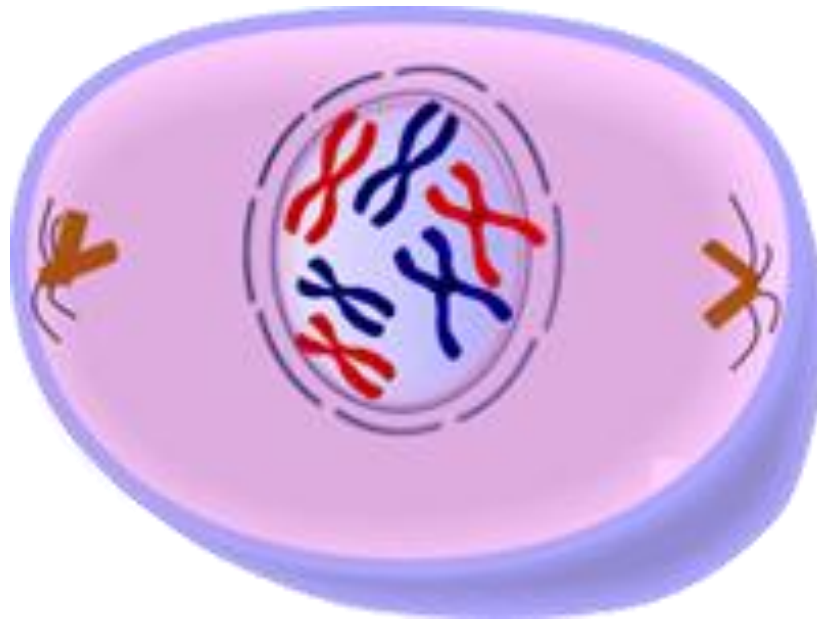
- The longest stage of the cell cycle
- During the 1st part of interphase, the cell doubles in size and makes the necessary proteins and molecules to maintain cell function.
- Some organelles begin to duplicate.
- During the 2nd part of interphase, DNA is being replicated.
- During 3rd part of interphase, the cell continues to grow and makes more proteins for the new cells formed after cytokinesis.

Mitosis

- The shortest stage of the cell cycle
- During this stage, the contents of the cell's nucleus divides, **resulting in daughter nuclei that are identical to the original.**
- As the nucleus prepares to divide, the DNA molecules that replicated during interphase join together to form the sister *chromatids* of a chromosome. The sister chromatids are joined by the centromere.
- Mitosis occurs in 4 stages: prophase, metaphase, anaphase and telophase (PMAT)

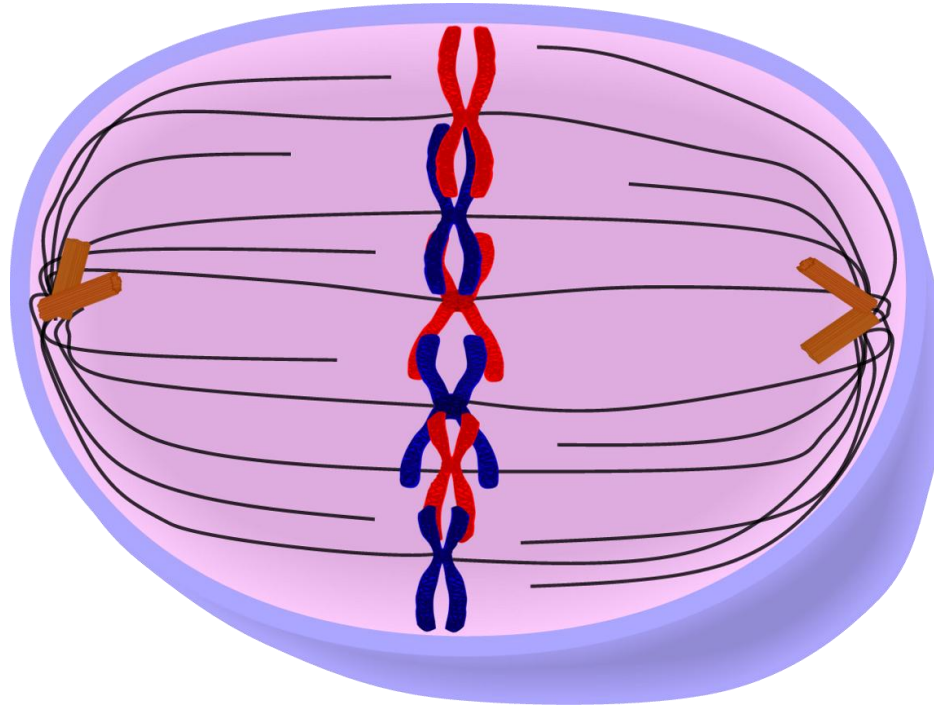
Stages of Mitosis

- Prophase
 - Double stranded chromosomes shorten and thicken and the nuclear membrane begins to fade.



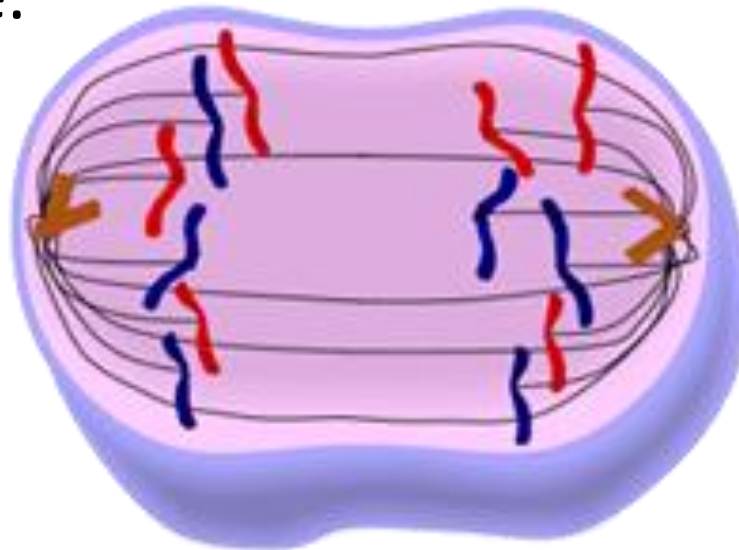
Stages of Mitosis

- Metaphase:
 - X-shaped chromosomes are lined up at the equator of the cell.



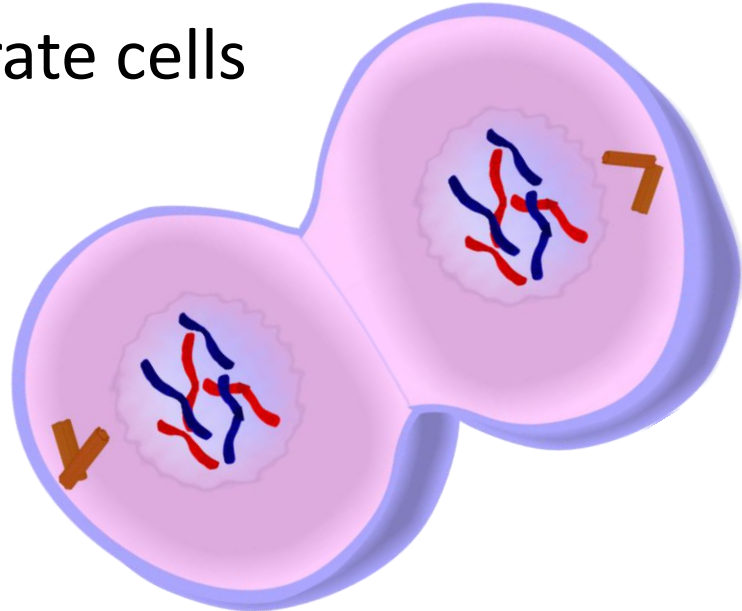
Stages of Mitosis

- Anaphase:
 - The sister chromatids are pulled apart and move to opposite poles of the cell.
 - Each sister chromatid is now considered to be a chromosome.



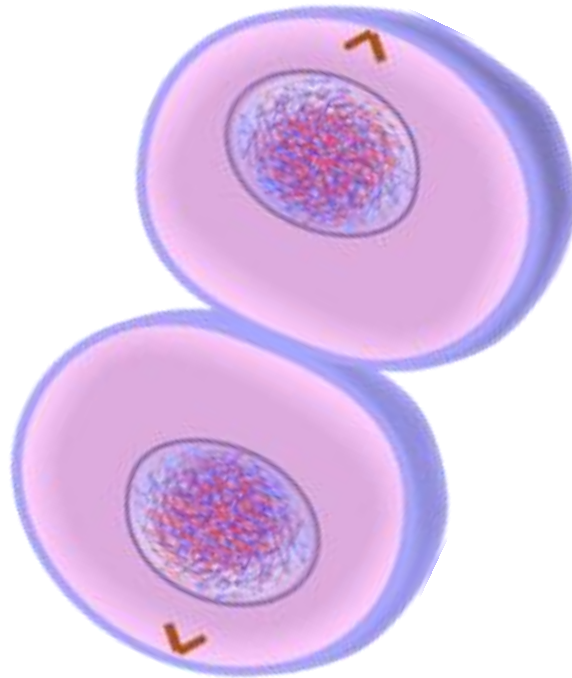
Stages of Mitosis

- Telophase
 - One complete set of chromosomes is now at each pole.
 - Nuclear membrane forms around each set of chromosomes.
 - Now there are two nuclei in one cell and the cell is ready to divide into two separate cells



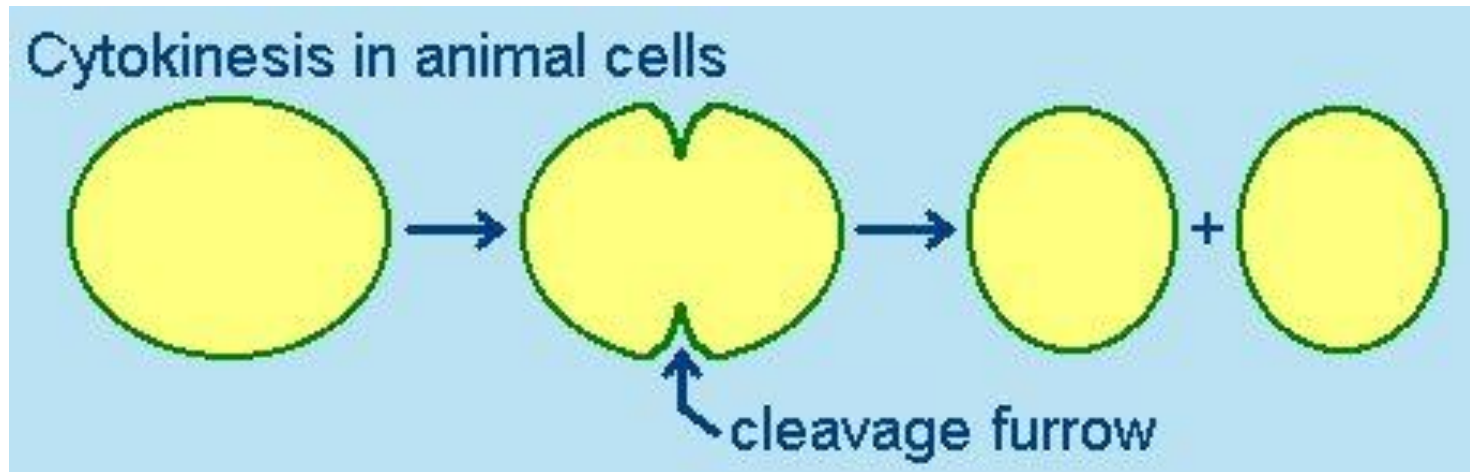
Cytokinesis (cell division)

- The final stage of the cell cycle
- The two nuclei are separated into two daughter cells that are identical to the original parent cell



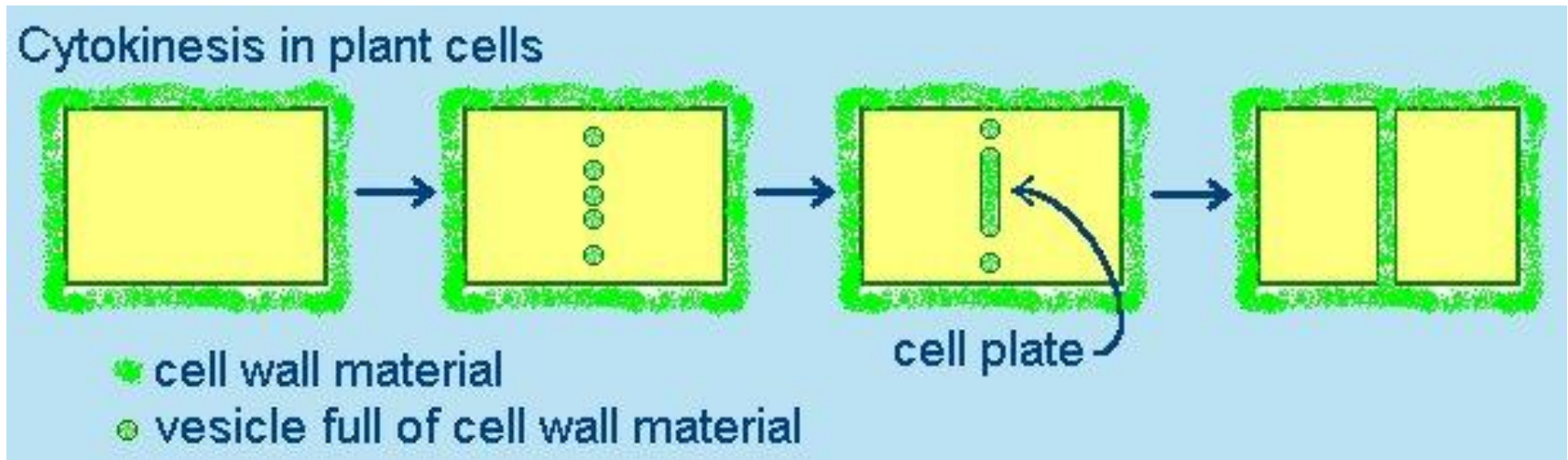
Cytokinesis (cell division)

- In animal cells, the cell membrane pinches together to form two cells.



Cytokinesis (cell division)

- In plant cells, a cell plate forms along the center of the cell to divide the cell into two daughter cells



Asexual Reproduction

- Only one parent is required
- Create 'clones' which are genetically identical to each other and to the parent
- Reproduces unicellular organisms quickly and in large numbers



Types of Asexual Reproduction

Binary Fission (amoeba, bacteria)

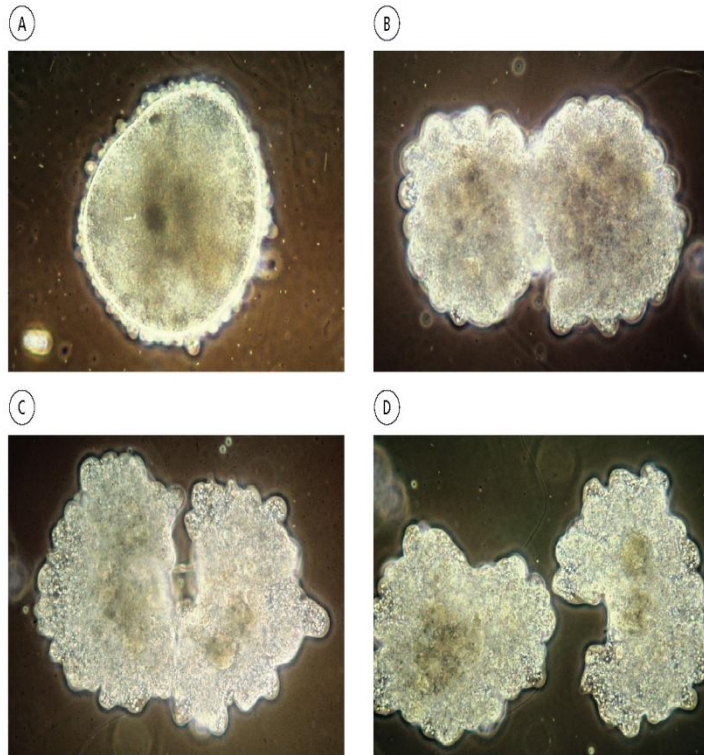


Figure 5.18 Binary fission in an amoeba

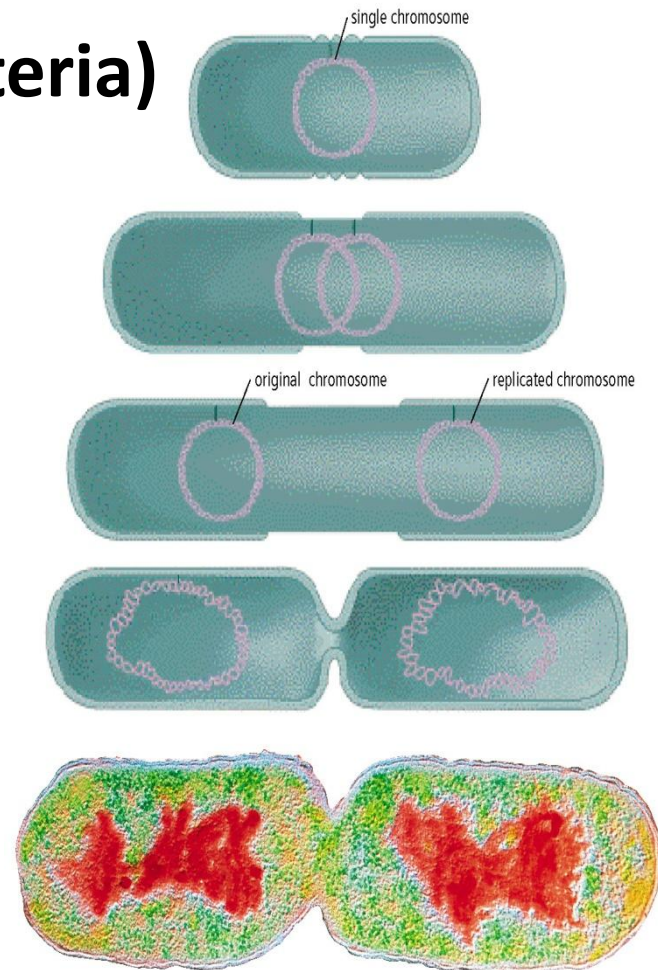
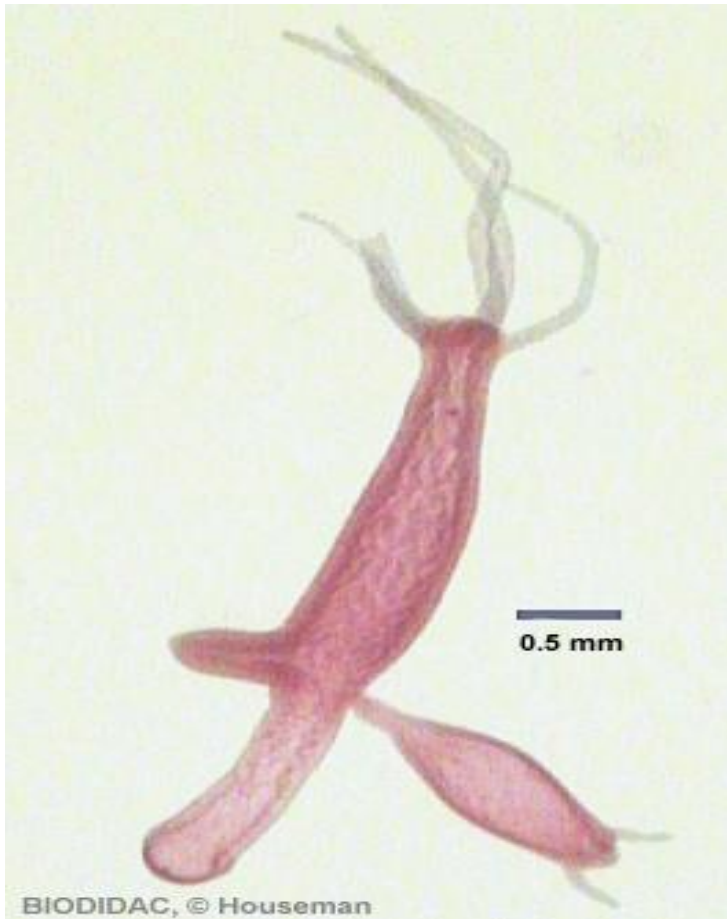


Figure 5.19 Binary fission in a bacterium

Types of Asexual Reproduction

Budding (yeast, hydra, sponge)



Types of Asexual Reproduction

Fragmentation (sea stars)



Figure 5.22 The northern sea star, found off the coast of Newfoundland and Labrador, is able to reproduce asexually by fragmentation.

Types of Asexual Reproduction

Vegetative Reproduction

(plants: tulip, daffodil, strawberry stem runners, potato sprouts)

(A)



(B)



(C)

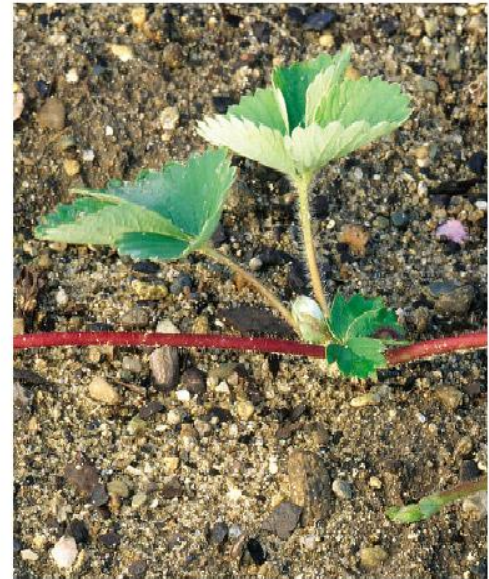


Figure 5.24 A new plant is forming from the bulb of this hyacinth (A). The sprouts or "eyes" growing from these potatoes can develop into separate plants (B). New strawberry plants form where strawberry runners develop roots (C).

Types of Asexual Reproduction

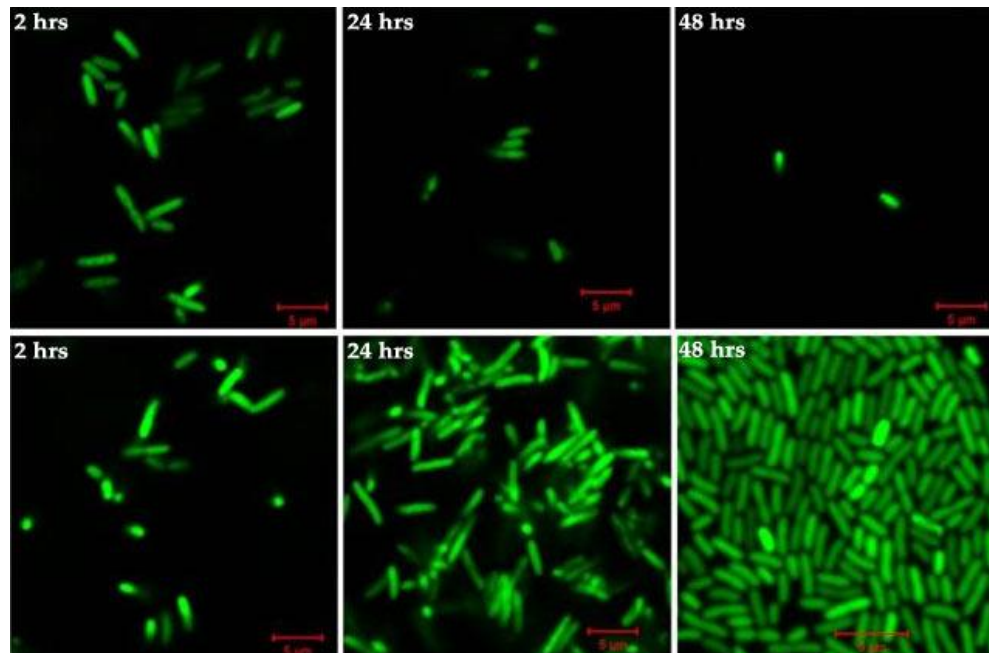
**Spore Formation –
fungi (bread
mould, puffballs),
some bacteria**



Figure 5.30 The cloud of spores rising up into the air will be carried away from the parent fungus by wind.

Advantages of Asexual Reproduction

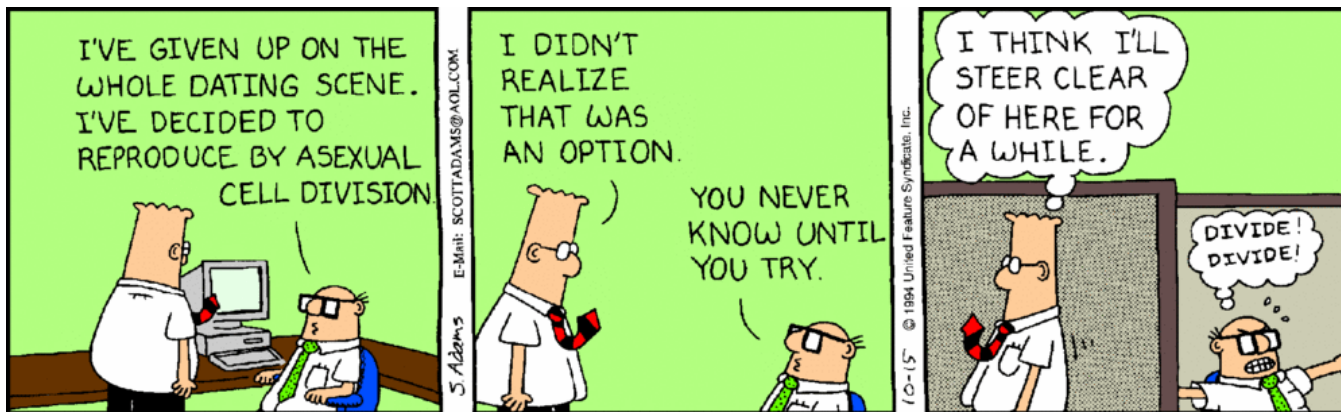
- Large numbers of offspring are reproduced very quickly from only one parent when conditions are favourable



- Large colonies can form that can out-compete other organisms for nutrients and water

Advantages of Asexual Reproduction

- Large numbers of organisms increases the chances that the species will survive when conditions or the number of predators change
- Energy is not required to find a mate



Disadvantages of Asexual Reproduction

- Offspring are genetic clones (a negative mutation can make asexually produced organisms susceptible to disease)



Disadvantages of Asexual Reproduction

- Some methods of asexual reproduction produce offspring that are close together and compete for food and space
- Unfavourable conditions such as extreme temperatures can wipe out entire colonies