



Asexual Reproduction

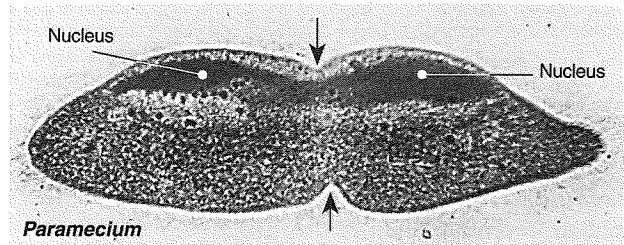
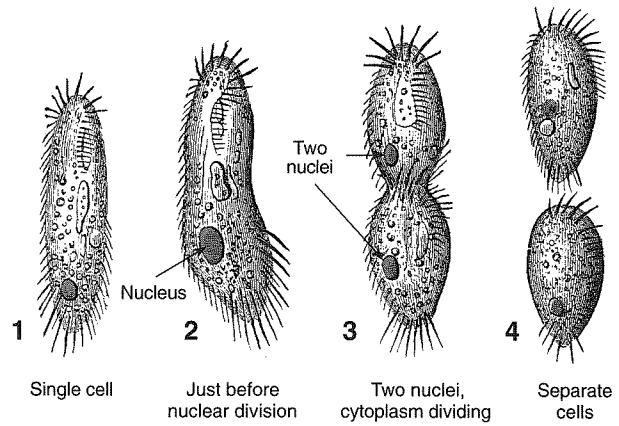
In most forms of asexual reproduction, the parent splits, fragments, or buds to produce offspring identical to itself. Parthenogenesis is a special type of asexual reproduction where unfertilised eggs give rise to clones. Asexually reproducing

organisms do not need to find a mate, so the energy that might otherwise be used for sexual activity can be used for other things. Asexual reproduction is rapid, but all the offspring are genetically identical. If conditions change there is little ability to adapt.

Binary Fission

Binary fission is a method of asexual reproduction that occurs in prokaryotes (bacteria and cyanobacteria) and protists (e.g. *Amoeba* and *Paramecium*). Binary fission occurs by division of a parent body into two, more or less equal, parts. The cell's DNA is replicated, followed by division of the nucleoplasm (in prokaryotes) or the cytoplasm (protists). Binary fission is illustrated in *Paramecium* (right). The first series shows stages in the fission process: 1: the single cell. 2: nucleus large and in preparation for division. 3: nucleus divided with division of the cytoplasm. 4: two separate and independent cells. The photograph (right) shows *Paramecium* in the process of fission. The nucleus has divided and the cytoplasm is dividing. The arrows indicate where a constriction is developing in the cell.

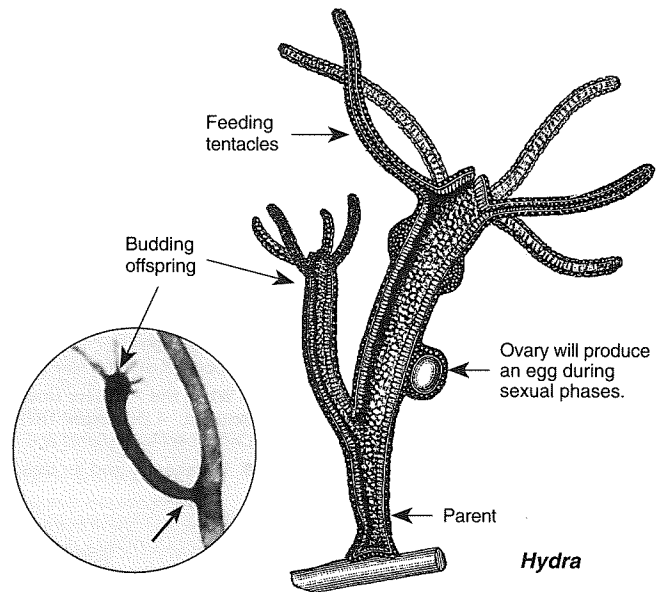
Note that some life cycle stages of parasitic protozoans, such as the malarial parasite *Plasmodium*, undergo **multiple fission**. The nucleus divides repeatedly before the final division of the cytoplasm to produce many new cells. Repeated cycles of multiple fission produce large numbers of offspring very rapidly.



Budding and Fragmentation

Sponges and most cnidarians (e.g. *Hydra*) can reproduce by **budding**. A small part of the parent body separates from the rest and develops into a new individual. This new individual may remain attached as part of the colony, or the budding offspring may constrict at its point of attachment (arrowed on the inset photograph) and eventually be released as an independent organism.

The illustration (right) shows *Hydra* budding. The new individual is forming on the left of the animal. On the right, is the ovary (labelled), which will produce a single egg cell during phases of sexual reproduction. Cnidarians also undergo **fragmentation**. In this natural process, the organism spontaneously divides into fragments which then regenerate. Fragmentation also occurs in sponges and flatworms (platyhelminthes).



1. Name the reproductive process occurring in the photograph of *Paramecium* above: _____
2. Name the reproductive process occurring in *Hydra*: _____
3. (a) Suggest why multiple fission produces offspring more rapidly than does simple binary fission: _____

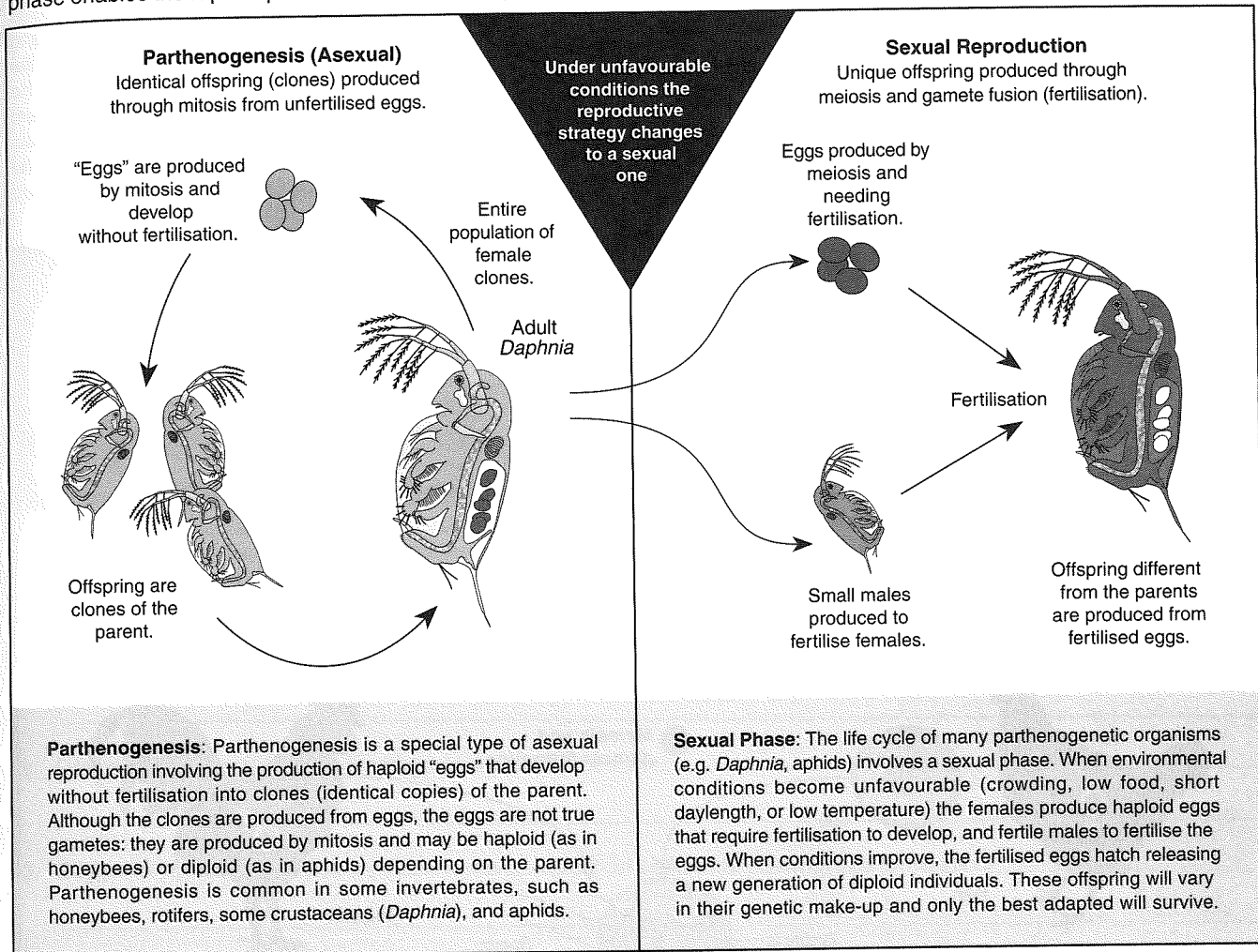
- (b) Explain the advantage of multiple fission to an intracellular parasite such as *Plasmodium*: _____

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Alternating Asexual and Sexual Cycles of Reproduction

Some organisms combine several cycles of asexual reproduction by **parthenogenesis** (below, left) with periods when they reproduce sexually (producing gametes by meiosis which combine in fertilisation). The parthenogenetic phase enables the rapid reproduction of a well adapted clone.

The sexual phase is induced when the environment becomes unfavourable for the clone. The new generation, produced by sexual reproduction, may include some individuals that are better adapted to a new set of environmental conditions.



4. Name ONE potential disadvantage of reproducing asexually: _____

5. Explain what is meant by parthenogenesis: _____

6. Describe TWO advantages of having a reproductive strategy where parthenogenesis (the asexual phase) is interrupted occasionally by a period of sexual reproduction:

(a) Advantage 1: _____

(b) Advantage 2: _____

7. Suggest why some organisms (e.g. *Daphnia*, rotifers, aphids) are stimulated by certain environmental conditions (e.g. crowding, low food, temperature or daylength changes), to enter a sexual phase of reproduction:
