Binary Fission

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- **Binary fission** is the process by which prokaryotic cells, such as bacteria, **divide** and **reproduce**.
- The speed of this division depends on conditions such as temperature and nutrient concentrations.
- Some bacteria can divide as often as once every 20 minutes but if conditions are unfavorable binary fission will stop and cells will start to die.

Process of Binary Fission

1. Under optimal conditions (the availability of nutrients and suitable temperature), the bacterial cell prepares for division.

2. The bacterial cell replicates the genetic material inside it and increases in size.

3. Each circular piece of DNA moves to opposite ends.

4. The cytoplasm divides

5. The bacterium cell becomes two daughter cells.

- Some species of bacteria, such as E. coli, can replicate in as little as 20 minutes. So, the number of bacteria can increase very rapidly. Two ways bacteria can be cultured are:

    1. In a nutrient broth (or culture medium)
    2. On an agar plate

- They both contain all the essential nutrients that bacteria need to live and grow successfully.

BINARY FISSION
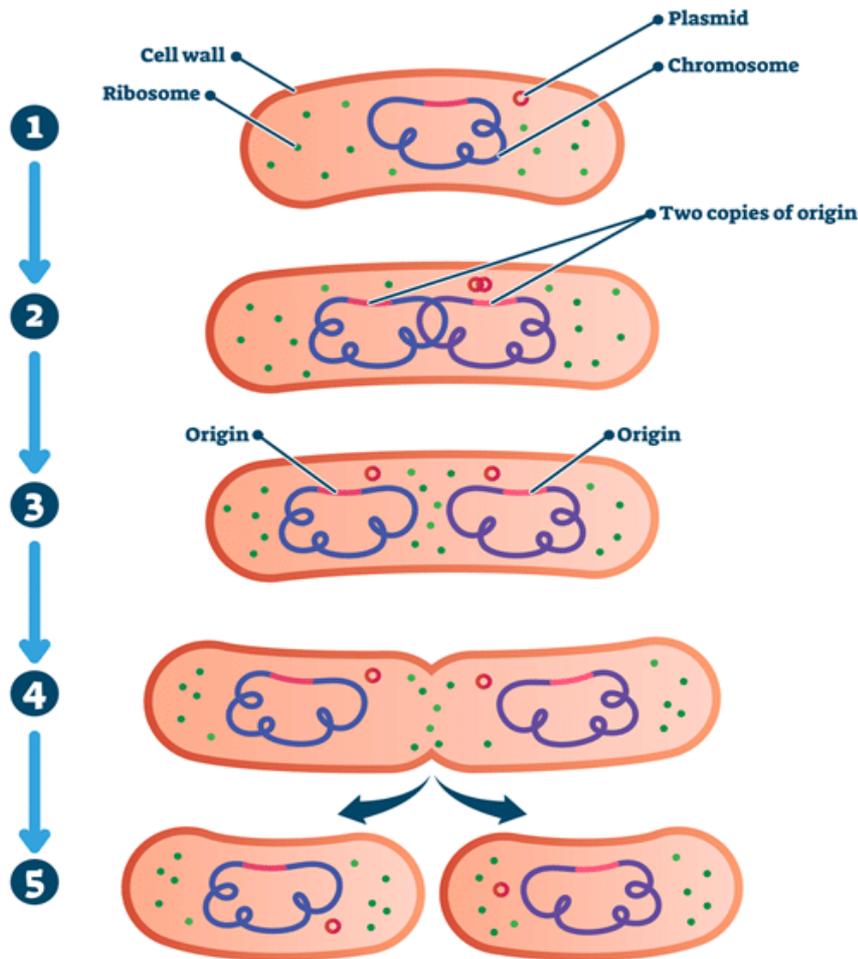
Mean Division Time

➤ The **mean division time** is the average time it takes for one bacterial cell to **divide once**.
➤ Mean division time can be used to work out **how many times a cell has divided** and therefore the **number of cells produced**.
➤ Formula:

$$\text{Number of divisions} = \frac{\text{Time spent dividing}}{\text{Mean division time}}$$

$$\text{Number of cells produced} = 2^{\text{Number of Divisions}}$$

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Example: **A cell has a mean division time of 20 minutes. How many cells will it have produced after 4 hours.**

4(hours)×60 =   240 minutes
Number of divisions =   240/20   = 12 divisions

Number of cells produced= 2 to the power of 12 = **4096 cells**