

# Lab 3

# *Microbial Physiology*

## Growth Curve

- The bacterial populations are doubles under favorable conditions by geometric process called the **Exponential growth**.
- When we inculcate a fresh media with a microorganism such bacteria, the bacteria will multiply giving a number of cells and this growth of populations is monitored over a period of time and plotting of date we gain help us to yield the typical growth curve.

## Phases of Bacterial growth

### 1. The Lag phase

In this phase the number of microorganisms doesn't increase, but they are metabolically active, growing in size, synthesizing enzymes and they produce large quantities of ATP.

- The length of this phase is depend on a variety of factors: 1- the size of inoculum 2- time to recover from physical damage or shock in the transfer 3- time required for the synthesis of essential coenzymes or division factors 4- time required for the synthesis of enzymes necessary to metabolize the substrates present in the media.

### 2. The Log or Exponential phase

In this phase the cells begin to divide by binary fission when they adapt to media. The rate of exponential growth of a bacterial culture is known as **the generation time**. The generation time is usually between 20 minutes to 20 hours, but in some cases like *Mycobacterium tuberculosis* the generation time of these bacteria is longer.

- In cultures, if the cells divided together and the generation time of each cell was 20 minutes, the number of cells would increases in a stair-step pattern, a hypothetical situation called **synchronous growth**, but if the cells didn't divide in the same the situation is called **nonsynchronous growth**.

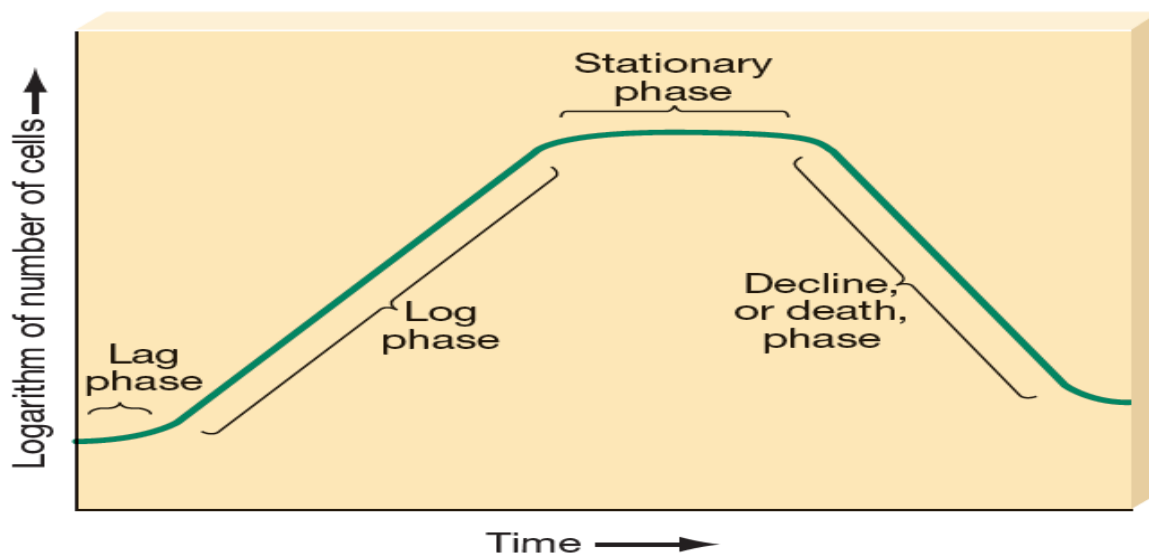
- Leveling off log phase is followed by the stationary phase unless fresh medium is added or organisms are transferred to fresh medium. Logarithmic growth can be maintained by a device called **Chemostat**, which has a growth chamber and a reservoir from which fresh medium is continuously added to the growth chamber or organisms from a culture in the stationary phase can be transferred to a fresh medium.

### 3. The Stationary phase

In this phase cell division decreases to the point that number of cells that are produced is equal to the number of old died cells and the number of living cells stays constant. The medium contains a limited amount of nutrients and may contain toxic quantities of waste materials. Also, the oxygen supply may become not enough for aerobic microorganisms and pH changes may occur.

### 4. The Decline or Death phase

In this phase the medium become less and less supportive of cell division, many cells lose their ability to divide and the cells die. Also the number of live cells decreases. During the decline phase many cells undergo involution resulting in a variety of unusual shapes and make them difficult to identify.



**A Standard bacterial growth curve**