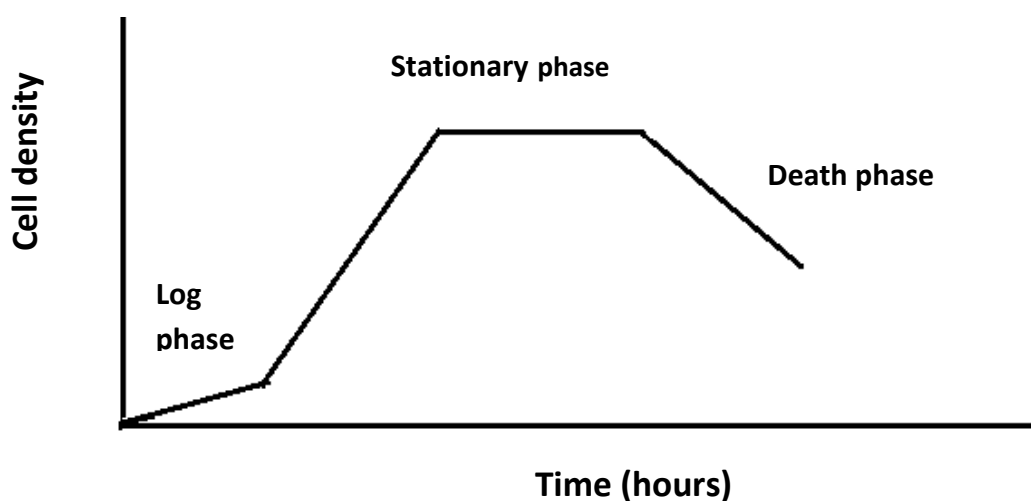


## Bacterial Nutrition and growth

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*Nutrition* is a process by which chemical substances called *nutrients* are acquired from the environment and used in cellular activities such as metabolism and growth . Most **organic** nutrients are molecules that contain a basic framework of carbon and hydrogen such as carbohydrates, lipids, proteins, and nucleic acids .In contrast, **inorganic** nutrient is composed of an element or elements other than carbon and hydrogen and inorganic compounds are metals and their salts; Zinc ,phosphor, magnesium, calcium, potassium sodium ,sulfur, copper, and others gases (oxygen, carbon dioxide), water and vitamins. In laboratory bacteria can be cultured by providing the specific nutrient (media) that promote bacterial growth, the media must contain water, carbon, energy, nitrogen, minerals, and growth factors.

**Bacterial growth** occur when microbes are provided with nutrients and the required environmental factors, they become metabolically active and grow. Growth takes place on two levels the cell increases its size; and the number of cells in the population increases. The division of a bacterial cell occurs mainly through **binary**, or **Transverse fission**. The time required for a complete fission cycle—from parent cell to two new daughter cells—is called the **generation time**.



Microbiologists usually will need to grow bacteria under artificial conditions. Microbiologists have developed several types of procedures for investigating and characterizing microorganisms. These techniques can be summed up briefly as the **six “I’s”**: *Inoculation, Incubation, Isolation, Inspection, Information Gathering, and Identification.*

### **Affecting factor on growth:**

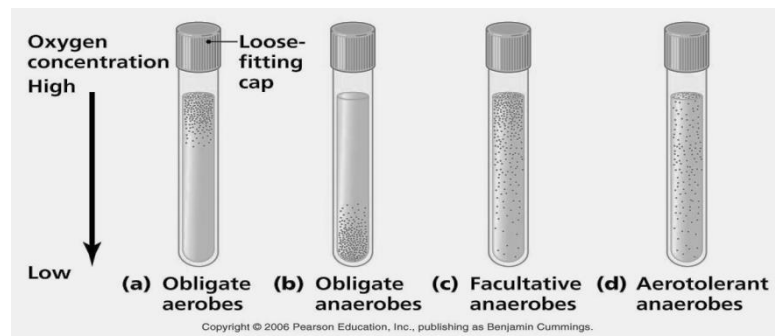
**1. Temperature:** bacteria divided into 3 types depending on temperature adaptation:

- Psychrophilic ( 0-20 °C)
- Mesophile (20-50 °C)
- Thermophile (above 45-80 °C)
- The temperature of incubation in lab. is (20-40°C).

**2. pH:** most microbes are neutrophils, living around pH 7, a few microorganisms live at pH extremes .

**3. Osmotic Pressure:** most microbes exist under hypotonic or isotonic conditions, a few, called **osmophiles**, requires high concentrations of salt; these organisms are called **halophiles**.

**4. Gas Requirements:**



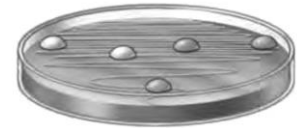
- **Aerobe** (aerobic organism) can use gaseous oxygen in its metabolism.
- **Obligate aerobe:** is organism that cannot grow without oxygen.
- **Facultative anaerobe** is an aerobe that does not require oxygen for its metabolism and is capable of growth in the absence of it.
- **Microaerophile** does not grow at normal atmospheric concentrations of oxygen but requires a small amount of it.

- **Obligate anaerobes** : they cannot tolerate any free oxygen in the immediate environment and will die if exposed to it.
- **Capnophiles** grow best at higher CO<sub>2</sub> tensions.

## **Macroscopic appearance of bacterial growth:**

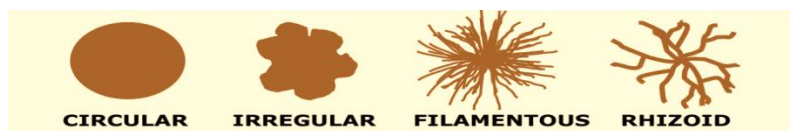
Once a container of medium has been inoculated, it is **incubated** in a temperature controlled chamber (incubator) to encourage microbial growth. Although microbes have adapted to growth at temperatures ranging from freezing to boiling, the usual temperatures used in laboratory propagation fall between 20°C and 40°C. Incubators can also control the content of atmospheric gases such as oxygen and carbon dioxide that may be required for the growth of certain microbes. During the incubation period (ranging from a few hours to several weeks), the microbe multiplies and produces a culture with **macroscopically** observable growth.

### **1. Appearance in petri dish**



A colony is a large number of bacterial cells on solid medium, which is visible to the naked eye as a separate unit. Colony is derived from one bacterial cell. Different species of bacteria can produce very different colonies. So in the identification of bacteria and fungi much Focus is placed on how the organism grows in or on media. colony have many feature as following:

- a) **Form** – The form refers to the shape of the colony.



- b) **Size** - The diameter of a representative colony may be measured. Tiny colonies are referred to as (pin-point) Punctiform.
- c) **surface**- smooth, shiny, rough, dull, wrinkled.
- d) **Texture** – Several terms that may be appropriate for describing the texture or consistency of bacterial growth are: dry, moist, mucoid, hard, viscous, butyrous

(Buttery).

- e) **Color** – It is important to describe the color or pigment of the colony. Such as: opaque, dull, translucent, iridescent (rainbow-like).
- f) **Elevation** – This describes the “side view” of a colony. These are the most common.



- g) **Margin** – The margin or edge of a colony (or any growth) may be an important characteristic in identifying an organism.



## 2. Appearance in test tube

- **Broth**: growth occurs throughout the container and can then present a dispersed, cloudy, or flaky appearance.
- **Semisolid media** the medium is stabbed carefully in the center with an inoculating needle and later observed for the pattern of growth around the stab line.



### **Culturing of anaerobic bacteria:**

Anaerobic bacteria need special handling and incubation and identification, usually requires special media for culturing.

There are commercially available anaerobic transport media in vials and tubes with anaerobic atmosphere and bag systems that act by removing molecular oxygen. Culturing of anaerobic bacteria should be made in anaerobic chamber. Incubation the streaked plates or test tubes inside **gas jar** then incubated in special incubator.