Lab-7 **Practical Bacterial physiology**

Effect of temperature on bacterial growth.

Microbial growth is effected by many factors: some of them are auto factors refer to genetic material and structure of the cell that determine microbial behavior towards the environment and responsible of microbial variation in nature. Some of environment factors directly influence the growth, so they assist in studying M.O. and used efficiently in controlling line particulary in discarding of harmful M.O. especially pathogens species because microbial response differ towards environment factors

e.g: one factor could be lethal and limiting for one species but enhancing the growth of another factors affecting M.O. growth divided into two categories:

1- Physical factors

2- Chemical factors

Sometimes there was interference between Physical and Chemical factors

that can not be separated strictly in so termed physiochemical factors.

**Physical factors include:

1-Temperature

Each microbial has its own cardinal temperature that facilitate growth which are:

1- Optimum temperature

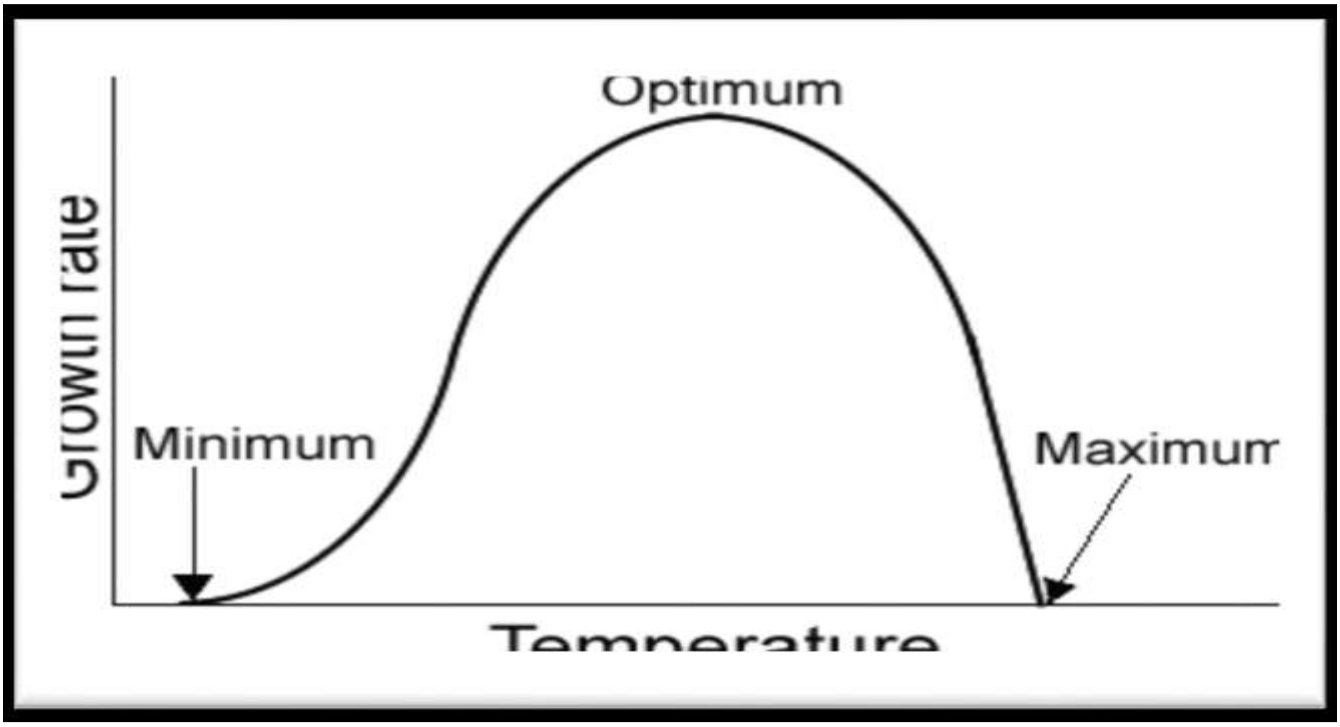
The temperature at which the most rapid rate of multiplication occurs, the microbe shows shortest g.t.

2- Minimum temperature

The lowest temperature at which microbe grows, all microbe will survive but show negligible growth.

3- Maximum temperature

The highest temperature at which growth occurs, temperature only slightly above this point frequently kill microbes by inactivating critical enzymes.



Bacteria could be divided in to 3 major groups according to its optimum growth temperature.

1-Psychrophiles: That microbes capable of growth at (-5 -20)c°

Ex: Sea bacteria, *Flavobacterium* , *Pseudomonas fragi*.

2-Mesophiles: That microbes grow in temperature from (20-50)c° , most known m.o. occur in this group.

Ex: *Clostridium sp* , *Escherichia coli.*

3-Thermophiles: That m.o. grow best above 50 c°.

Ex: *Bacillus stearothermophilus*.

Temperature is one of the most important factors that influences growth of cell, cells grow within a well-defined temperature grow range. This growth range is defined by a minimum temperature below which cells are metabolically inactive and a maximum temperature above which cells do not grow. Within this range of extremes is an optimal growth temperature at which cells exhibit their highest rates of growth and reproduction. Metabolic pathways speed dawn with the increase of temperature to extent point that after whole metabolic cease because of cellular macromolecules irreversibly denatured especially proteins, enzyme that affected the microbial growth which is a yield of metabolic pathways and its affect directly with temperature. Metabolic enzymes since each enzyme has its own optimum, maximum and minimum temperature , so temperature less than optimum decrease

the molecular motion and other physiological functions especially cytoplasmic membrane due to the solidification of lipids and increase of viscosity of proteins resulting in decreasing in enzymatic activity and stop working but does not denaturated (reversible effect) that's why many biological preparation preserved at low temp.(freezing) such as: protein, enzyme , viruses…..etc as lyophilic form.

Temperature over than optimum result in increase in the rate of enzymatic activities and irreversible denaturation occurs due to breakage of hydrogen bonds and scattering the secondary and tertiary arrangement of protein plus DNA melting.

Experiment // Estimating the lethal temperature for bacterial cells

Sometimes it is necessary to determine the high temperature that kills the cells of a particular type of bacteria when exposing it to heat for 10 minutes, this temperature is known as the lethal temperature or it is possible to estimate the time required to kill bacterial cells when exposed to certain degree of high temperature which called Thermal death time.

Procedure :

1. **put 1 ml of *E. coli* broth culture (incubated for 24 hours) in each of four sterile empty tubes.**
2. **Raise the temperature of the water bath to 45°C,50°C, 55°C, 60°C then put the tubes separately in it for 10 minutes, then pour its contents into a sterile petri dish.**
3. **Pour equal amount of sterilized nutrient agar in four petri dishes containing the bacteria that exposed to different temperature**
4. **Incubate the plates at 37°C for 24 hours.**
5. **Record the results in a table and then compare the number of colonies to determine the maximum temperature suitable for killing bacteria used in the experiment**