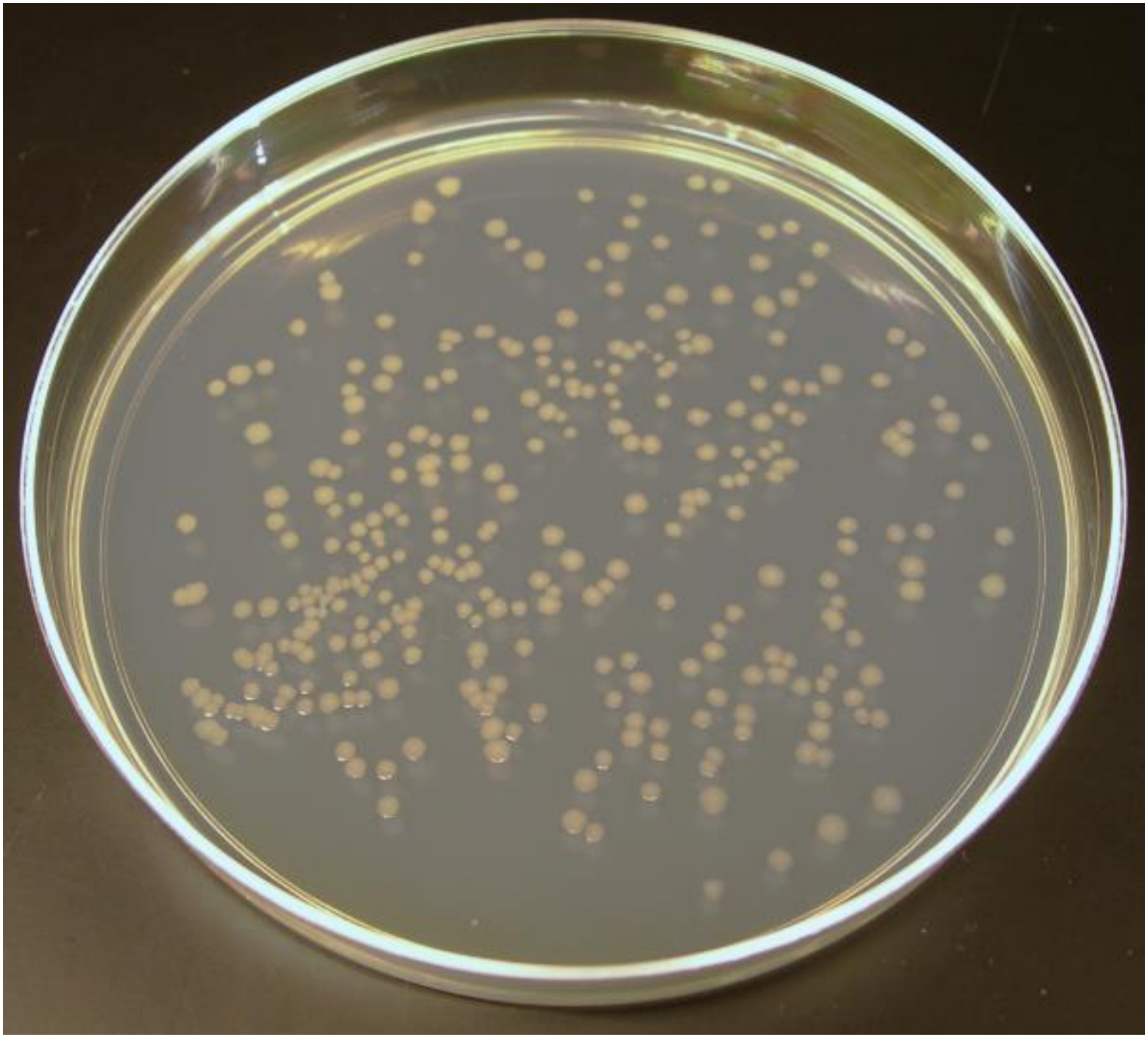
Bacterial growth

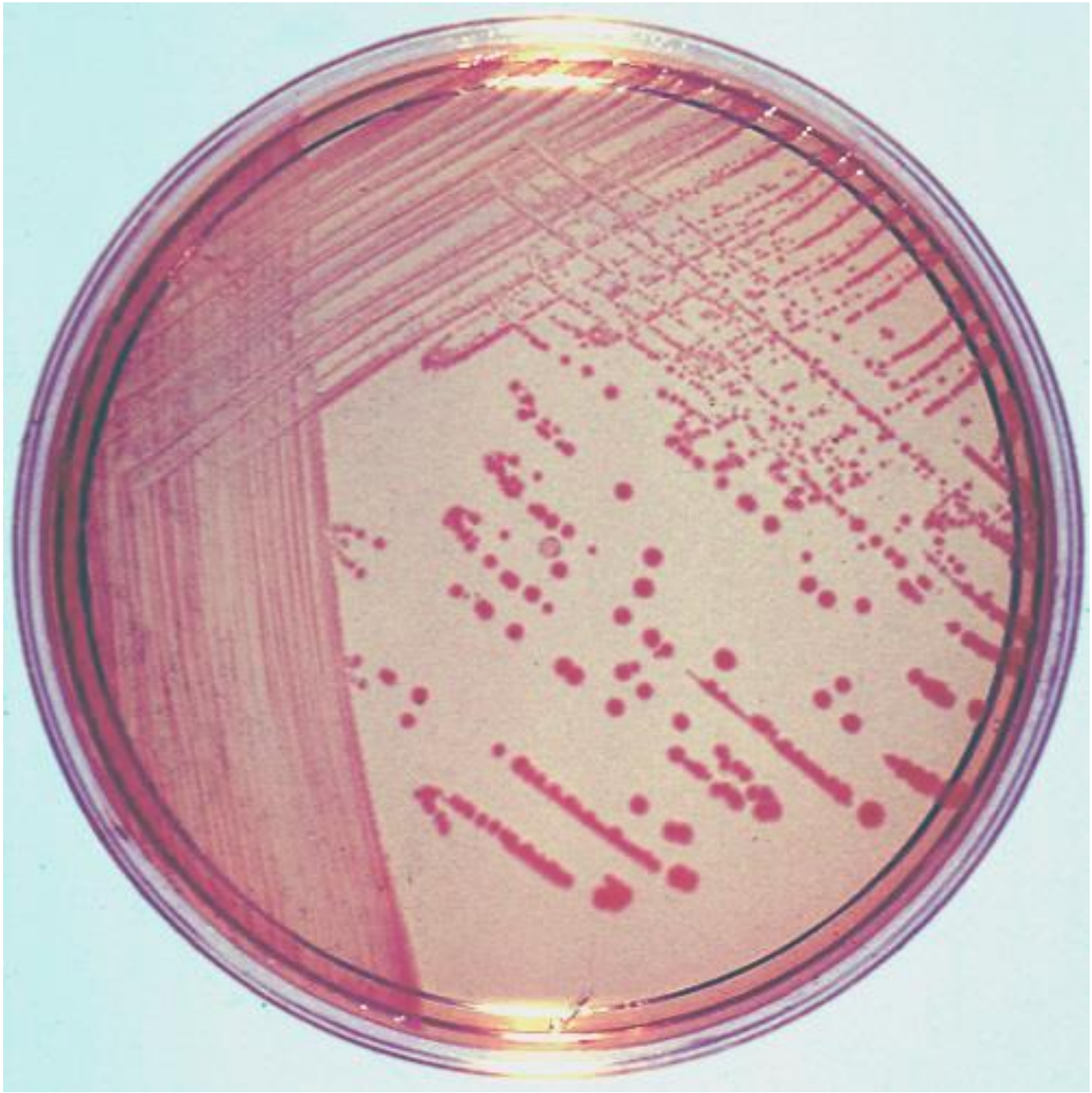
Bacterial growth

- Bacteria multiply by binary fission
- Solutions of nutrients that support the growth of bacteria are called **media.** which can be solidified by the incorporation of agar

- The introduction of live cells into liquid sterile media or onto the surface of solidified media is called **inoculation**

- A population of bacterial cells is referred to as a **culture.**
- The population is genetically homogeneous (i.e., if all cells belong to the same strain of the same species), it is called a **pure culture.**
- Visible mounds of bacterial mass called **colonies.**
- A colony are usually descended from a single original cell and, in this case, constitute a **clone.**





Factors affecting bacterial growth:

1. Nutrition
2. Temperature
3. pH

Nutrition

I- **Carbon**:

bacteria are divided into 2 groups according to the source of carbon:

A. **Autotrophs**: utilize carbon dioxide as a source of carbon, these are non-pathogenic
B. **Heterotrophs**: utilize carbohydrates & amino acids as sources of carbon & they are pathogenic.

Nutrition

2- **Inorganic ions:**

Phosphate, Na, K, Mg, ……..

3- **Oxygen:**

When bacteria utilize oxygen, they produce 2 toxic free radicals: **superoxide** & **hydrogen peroxide**

- The ability of the bacteria to survive in oxygen depends on its ability to eliminate these free radicals by production of the enzymes
- **Catalase & superoxide dismutase**

Temperature

- **Psychrophiles**

grow best at refrigerator temperatures 0 - 10°C .

- **Thermophiles**

grow in 50 - 60°C .

- **Mesophiles**

between, include virtually all pathogens 20 - 40°C

Bacteriologic Media

1. **BASAL MEDIA:** are those that may be used for growth of bacteria that do not need enrichment.

Examples: Nutrient broth, nutrient agar and peptone water.

2. **ENRICHED MEDIA.** The media are enriched usually by adding blood, serum or egg. Examples: blood agar and Lowenstein-Jensen media.

3. **Selective media:** These media favour the growth of a particular bacterium by inhibiting the growth of undesired bacteria and allowing growth of desirable bacteria. Examples: MacConkey agar.

- Antibiotic may be added to a medium for inhibition.

4. **TRANSPORT MEDIA:** These media are used when speciemen cannot be cultured soon after collection. Examples: Cary-Blair medium, Amies medium, Stuart medium

5. **STORAGE MEDIA:** Media used for storing the bacteria for a long period of time. Examples: Egg saline medium, chalk cooked meat broth.
6. 6. **Differential culture media:** are used to differentiate between different types of bacteria on the basis of their growth characteristics when grown in/or these media, e.g.: MacConkey agar.

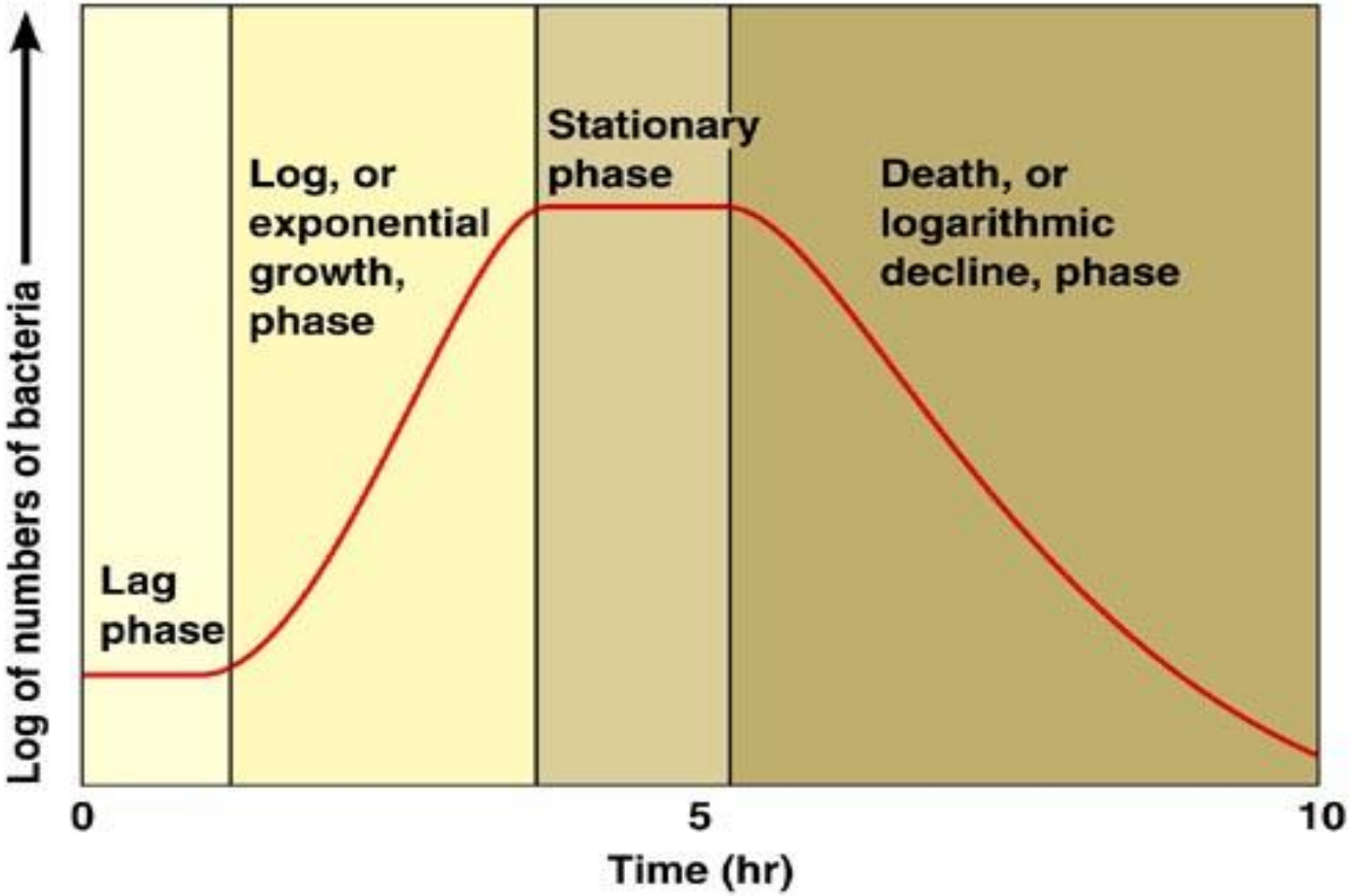
Bacterial growth curve

- If bacteria is grown in nutrient fluid media, the rate of bacterial growth can be demonstrated in a curve called:

  "standard bacterial growth curve"

- Four phases are found:

Bacterial growth curve



1- Lag Phase

- No increase in number of bacteria, but there is active metabolism
- Because bacteria start to adapt to the new environment.

2- Log Phase

- Bacteria increase in number exponentially (double its number in generation time)
- Generation time is the time required for bacteria to double its number.

3- Stationary phase

- No increase in total number of bacteria.
- Number of dead bacteria= number of generated bacteria
- Bacteria dye because of:

1. Depletion of nutrition
2. Accumulation of toxic metabolites
3. Reduction of oxygen

4- Death (decline) phase

- Number of dead bacteria > number of viable bacteria

- **If a bacterial cell in a broth tube has a generation time of 40 minutes, how many cells will be there be after 4 hours of optimal growth?**


Thank
You