

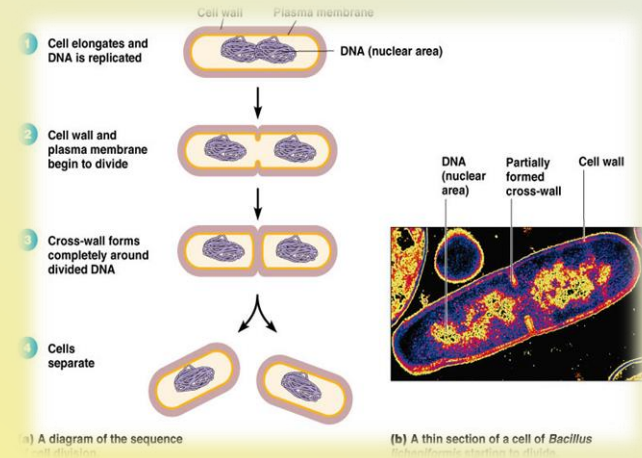
# Microbial Growth requirements

# Microbial growth

- *Biomass*
- The importance

# Microbial multiplication

- Binary Fission
- Budding



- Generation (doubling) time



# Bacterial growth

- Forms of growth:
  1. Development of colonies
  2. Transformation of a clear broth to a turbid one
  3. Biofilm formation

# Nutritional requirements

## 1. The energy source

- *Phototrophic*
- *Chemotrophic*

## 2. The hydrogen donors

- *Organotroph*
- *Lithotroph*

## 3. Carbon source

- *Autotrophs*
- *Heterotrophs*

# Physical requirements

## 1. Growth atmosphere

- **Oxygen**

Types of bacteria according to energy production

- *Strict or Obligate aerobe*
- *Strict or Obligate anaerobe*
- *Facultative anaerobes*
- *Microaerophilic*
- *Aerotolerant anaerobes*
- *Capnophiles*

# Physical requirements

## 1. Growth atmosphere

- Moisture
- Osmotic pressure
  - Hypertonic
  - hypotonic
- *Extremophiles*

# Physical requirements

## 2. Growth temperature

- *Psychrophiles*
- *Mesophiles*
- *Thermophiles*
- *Hyperthermophiles* (or extreme thermophiles)

## 3. Growth pH

- *Neutrophiles*
- *Acidophiles*
- *Alkaphiles*



# Chemical requirements

- Carbon
- Nitrogen, Sulfur, Phosphorus
- Trace Elements

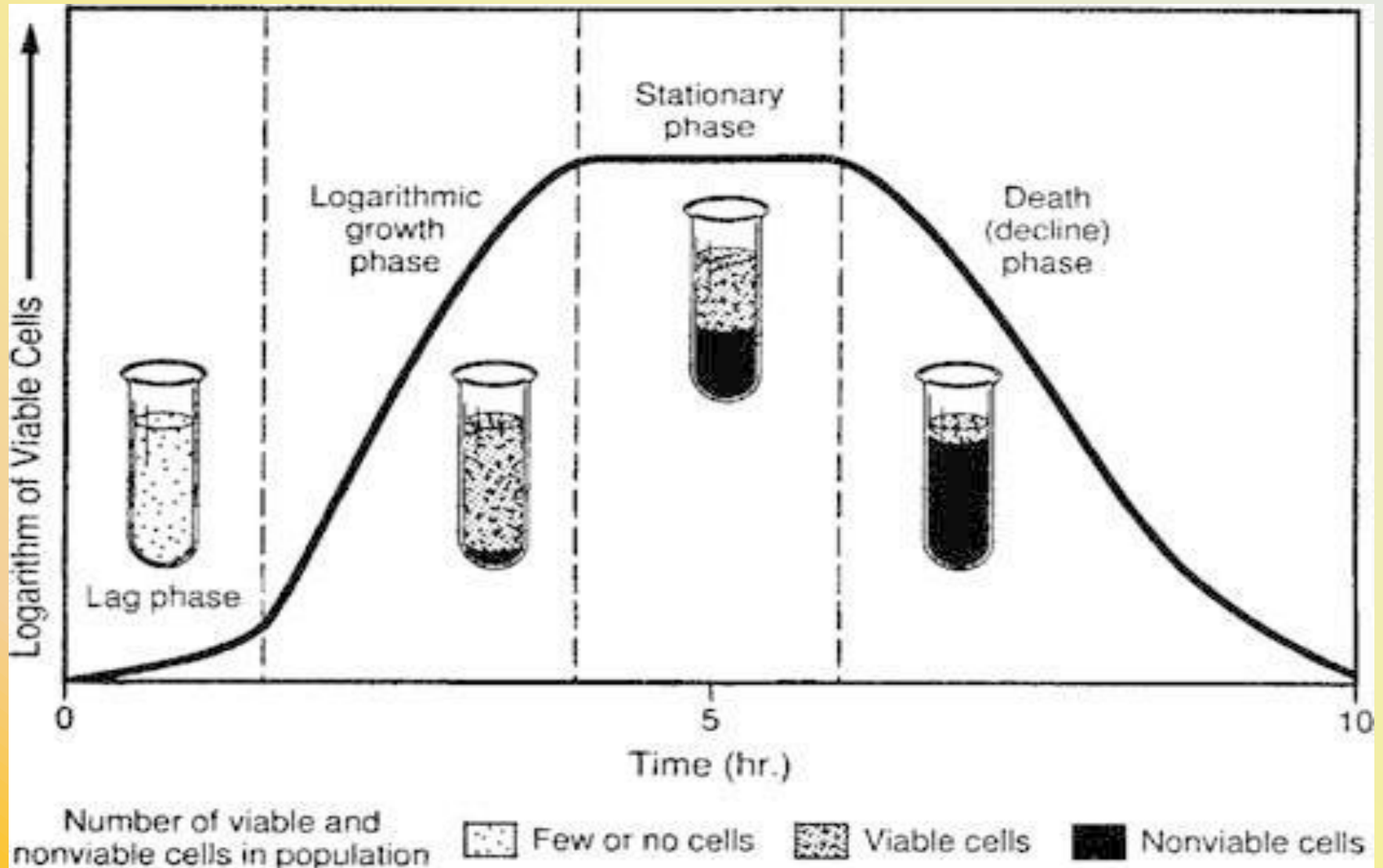
# Culturing Bacteria in the Laboratory

- ***Bacterial Growth***
  - fastidious
- ***Culture Media***
  - enriched medium, selective medium, differential medium
- ***Inoculation of Culture Media***
- ***Aseptic Technique***
- ***Incubation***
- ***Bacterial Population Growth Curve***
- ***Bacterial Population Counts***

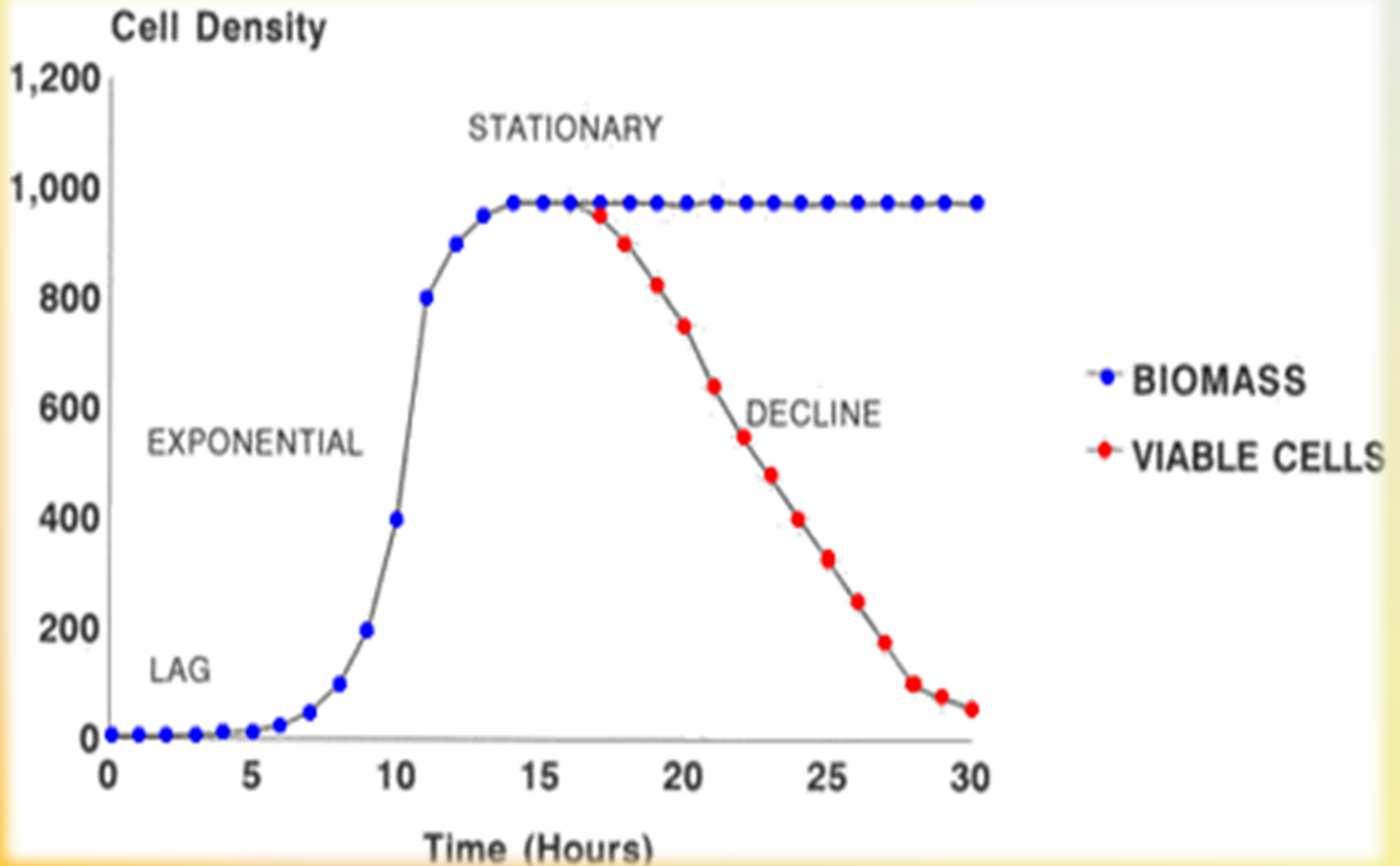
# Growth phases in broth culture

1. Lag phase
2. Logarithmic phase
3. Stationary phase
4. Decline phase(Death phase)

# Growth phases in broth culture

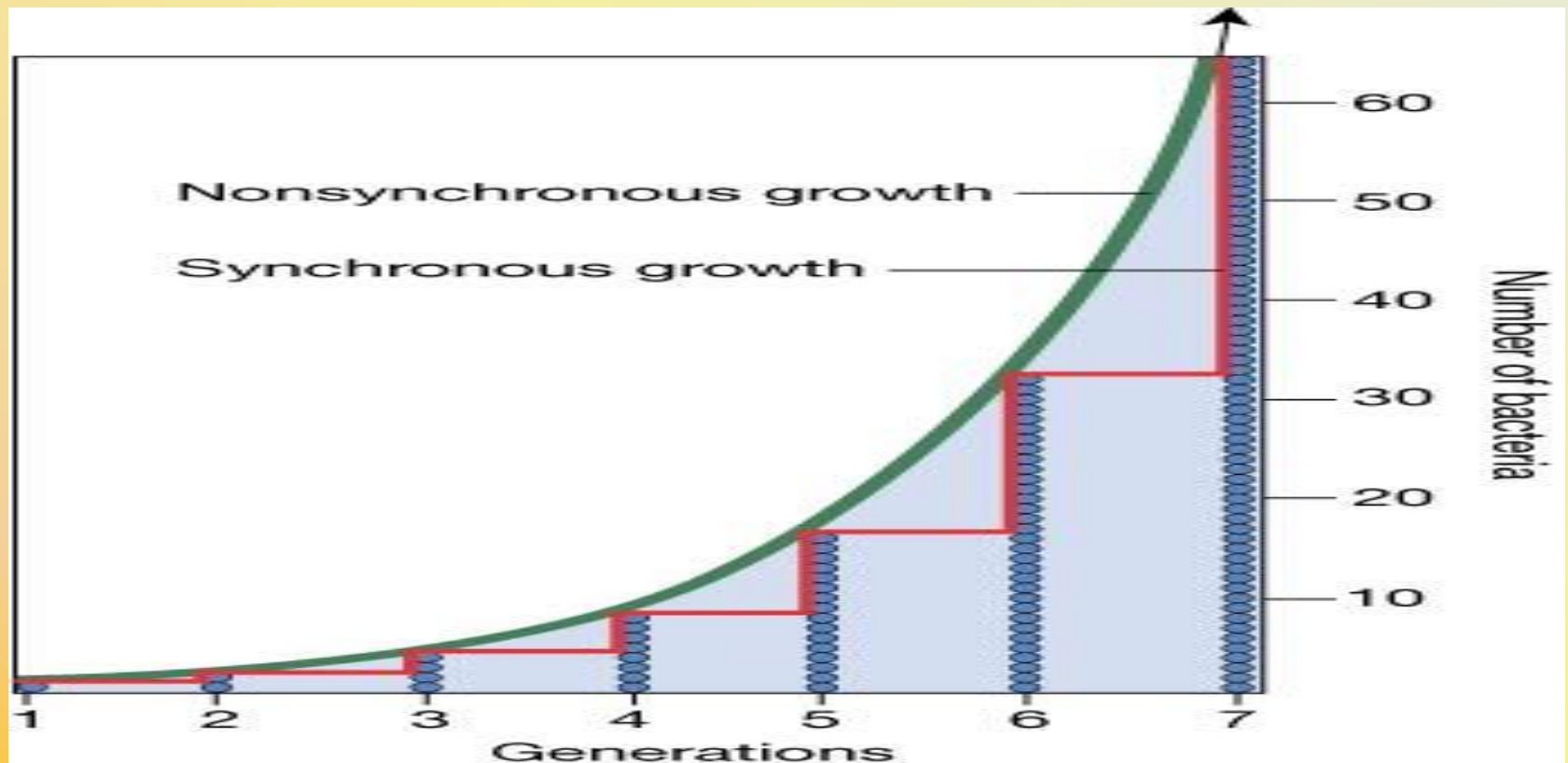


# Growth phases in broth culture



# Bacterial growth

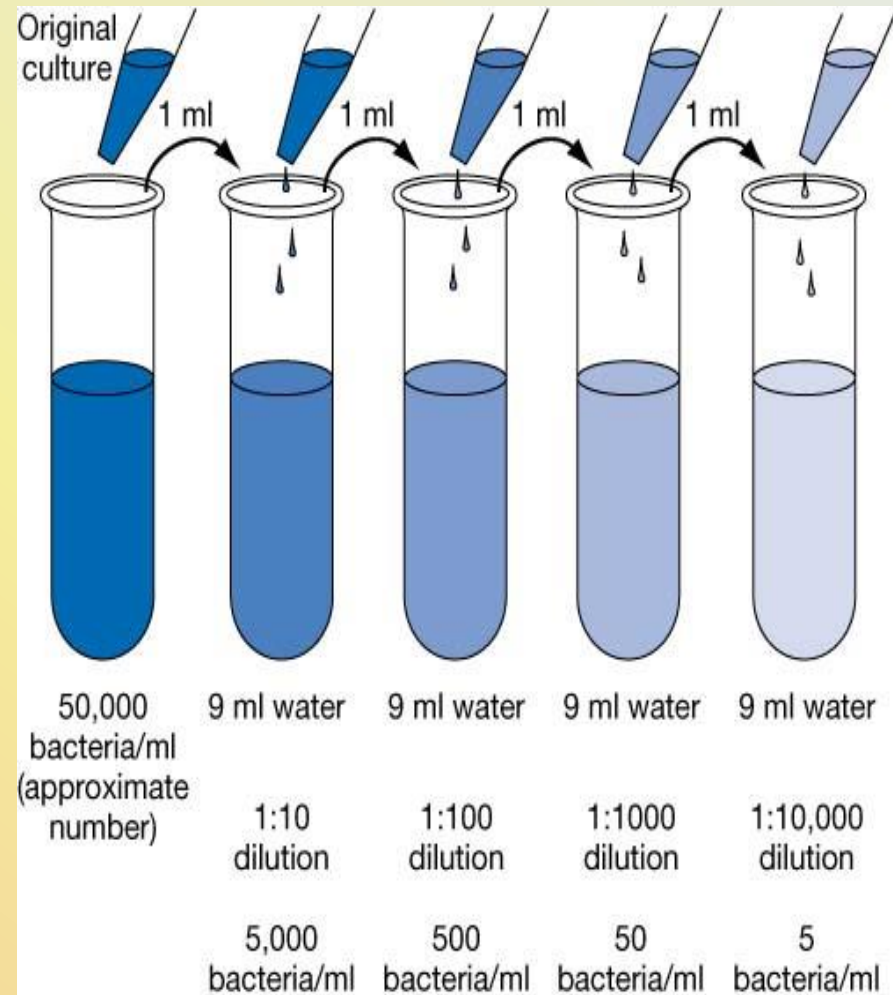
## Synchronous growth



# Measuring Bacterial Growth

Serial dilution

standard plate counts



# Culturing Viruses and Other Obligate Intracellular Pathogens in the Laboratory

- embryonated chicken eggs
- Laboratory animals
- Cell cultures



# Culturing Fungi in the Laboratory

- Solid culture media
- liquid culture media

# Culturing Protozoa in the Laboratory