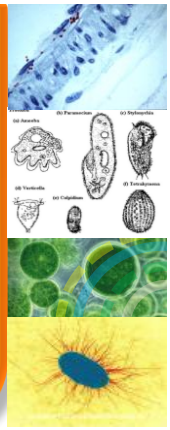
CELL DIFFERENTIATION & GROWTH OF ORGANISMS



BIOLOGY TEAM

Agricultural Technology Faculty
Brawijaya University
2013

OVERVIEW

- Growth Definition & Terminology
- Differentiation & Growth of Unicellular Organisms
- Differentiation & Growth of Multicellular Organisms

GROWTH DEFINITION & TERMINOLOGY

GROWTH DEFINITION

- The process or act of growing, especially in organisms following assimilation of food.
- An increase in size, number, significance.
- Growth is biology process of an individual. organism growing organically.
- A purely biological unfolding of events involved in an organism changing gradually from a simple to a more complex level

GROWTH CHARACTERISTICS

- An increase in the size of an organism or part of an organism, usually as a result of an increase in the number of cells.
- Growth of an organisms may stop at maturity, as in the case of humans and other mammals
- It may continue throughout life (in many plants and certain body parts of human such as hair, nail)

GROWTH TERMINOLOGY

- Morphogenesis : differentiation and growth of the structure of organims
- Cytogenesis : the development & variation of cells
- Gametogenesis : development & maturation of sex cells through meiosis
- Life Cycle : development changes in an organisms
- Proliferation : growth by the rapid multiplication

Growth Terminology in Animals :

- Amelogenesis : forming tooth enamel
- Angiogenesis : forming blood vessels
- Auxesis : increase in cell size without cell division
- Kenogenesis : embryonic development
- Gastrulation : gastrula developing from blastula
- Myelinisation : development of myelin sheath
- Gametogenesis : development & maturation of sex cells through meiosis

Growth Terminology in Plants :

- Cultivation : fostering the growth of something
- Vegetation : the process of growth in plants
- Rooting : process of putting forth roots
- Foliation : process of forming leaves
- Fructification : the bearing of fruits
- Germination, sprouting : seeds or spores sprout
- Apposition : growth in thickness of cell wall

Growth Terminology in Microorganisms :

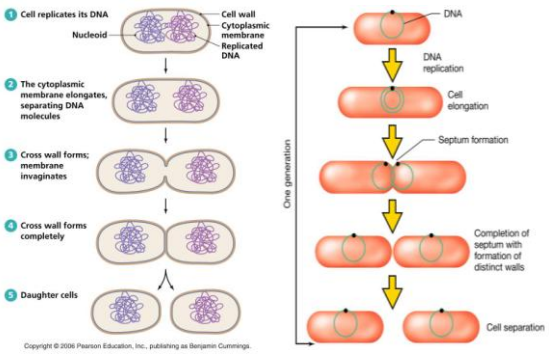
- Culture : growing of microorganisms in a nutrient medium
- Apposition : growth in the thickness of a cell wall
- Cytogenesis : the development & variation of cells
- Gametogenesis : development & maturation of sex cells through meiosis
- Germination, sprouting : spores sprout

CELL GROWTH & DIFFERENTIATION OF UNICELLULAR ORGANISMS

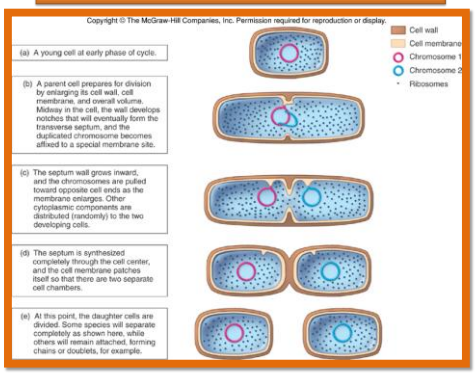
The Study of Microbial Growth

- Microbial growth occurs at two levels: growth at a cellular level with increase in size, and increase in population
- Division of bacterial cells occurs mainly through **binary fission** (transverse)
  - parent cell enlarges, duplicates its chromosome, and forms a central transverse septum dividing the cell into two daughter cells

BINARY FISSION OF BACTERIA



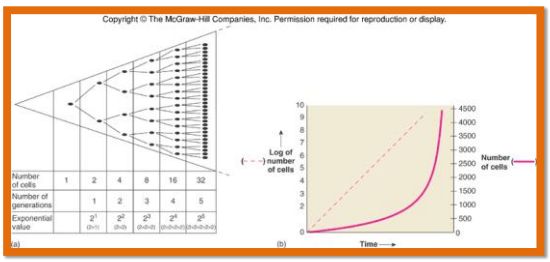
BINARY FISSION OF BACTERIA



Rate of Population Growth

- Time required for a complete fission cycle is called the **generation**, or **doubling** time
- Each new fission cycle increases the population by a factor of 2 – **exponential** or **logarithmic** growth.
- Generation times vary from minutes to days.

Rate of Population Growth



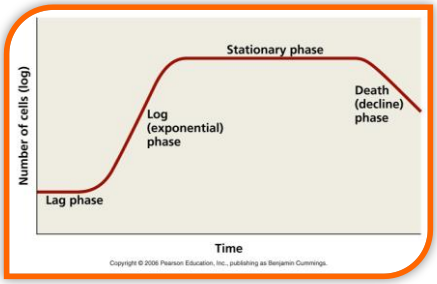
Rate of Population Growth

- Equation for calculating population size over time:

$$N_f = (N_i)2^n$$

N_f is total number of cells in the population.
N_i is starting number of cells.
Exponent n denotes generation time.
2^n number of cells in that generation

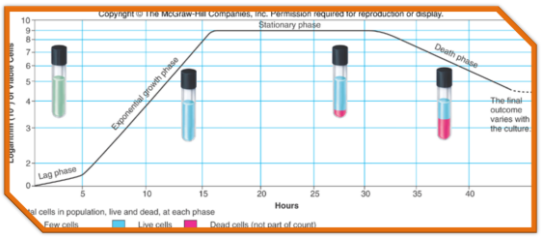
The Population Growth Curve



The Population Growth Curve

1. **Lag phase** – "flat" period of adjustment, enlargement; little growth
2. **Exponential growth phase** – a period of maximum growth will continue as long as cells have adequate nutrients and a favorable environment
3. **Stationary phase** – rate of cell growth equals rate of cell death caused by depleted nutrients and O_2, excretion of organic acids and pollutants
4. **Death phase** – as limiting factors intensify, cells die exponentially in their own wastes

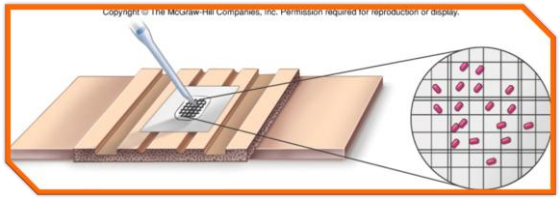
The Population Growth Curve



Methods of Analyzing Population Growth

- **Turbidometry** – most simple
  Degree of cloudiness, turbidity, reflects the relative population size
- **Enumeration** of bacteria:
  - viable colony count
  - direct cell count – count all cells present; automated or manual

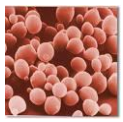
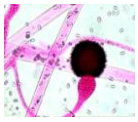
Methods of Analyzing Population Growth



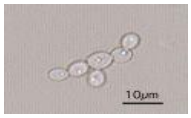
CELL GROWTH & DIFFERENTIATION IN MULTICELLULAR ORGANISMS

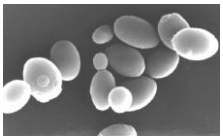
MULTICELLULAR ORGANISMS :

- Yeast
- Mold
- Plant
- Animal

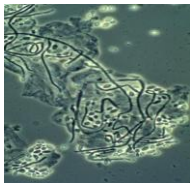



Yeast / Khamir



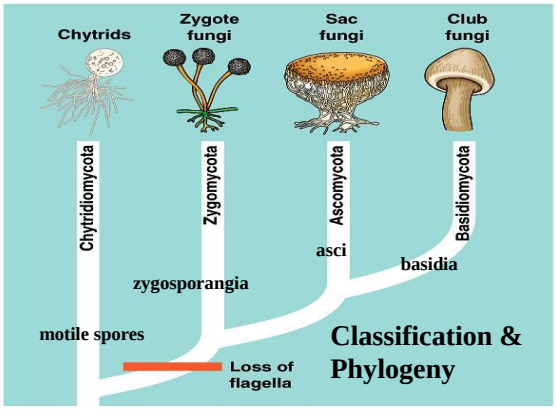


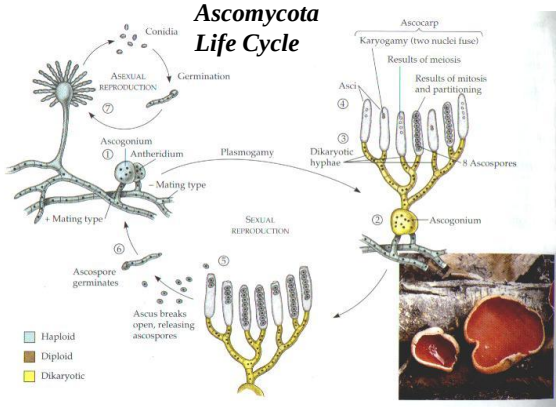
Saccharomyces

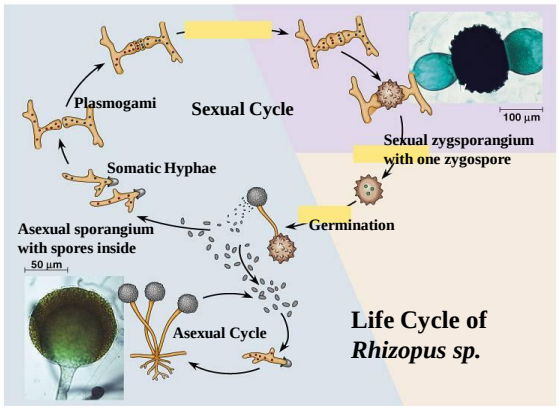


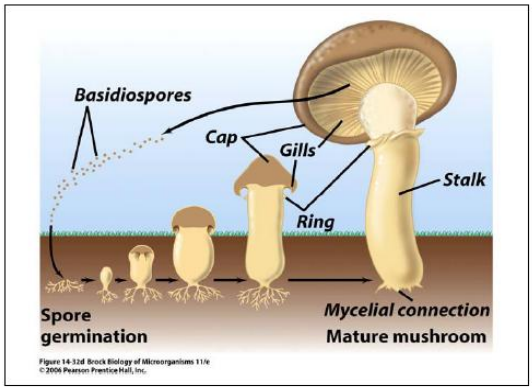
Candida

- **Unicellular fungi**
- **P 1-50 µm x L 1-10 µm**
- **Budding , Binary fission, Budding Fission & sporulasi**
- **Slime Capsule**

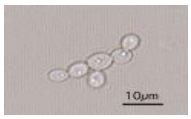


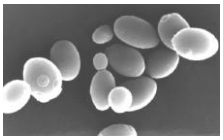






Yeast / Khamir





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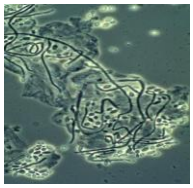

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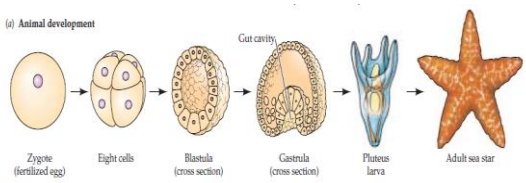
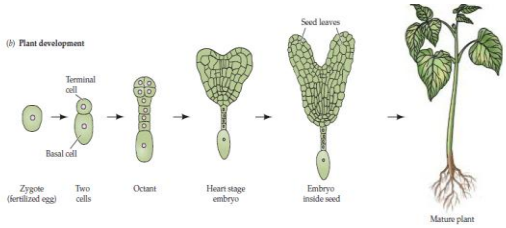
Development Process

- Embryo : earliest stages of development in plant & animal
- Embryo is contained within a protective structure, such as a seed coat, an eggshell, or a uterus

DEVELOPMENT PROCESS OF ANIMAL



DEVELOPMENT PROCESS OF PLANT



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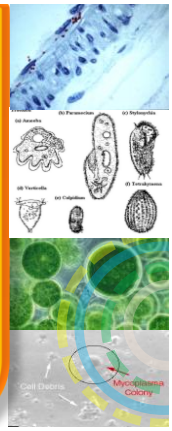
THANK YOU



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