

Microbial Nutrition and Growth

1. Define:

Enriched media – Enriched media (solid or liquid) are those containing tissue fragments, whole cells, cell parts or other nutrients or growth factors. Blood agar and chocolate agar are examples, and are used to grow fastidious microorganisms.

Fastidious (microbe) – Microorganisms that have complex nutritional requirements and will not grow readily on basal media without nutrient supplements. Fastidious bacteria are most commonly grown on enriched media.

Lag phase (microbial growth) – The lag phase is the first phase in a growth curve obtained when bacteria are grown in a batch culture or closed system. During this phase of growth there is no increase in cell number, but the cells are "gearing up" for the fission process. Bacteria in the lag phase increase in DNA content, cell size, metabolic activity and dry weight.

Stationary phase (microbial growth) – During the stationary phase, the number of cells being formed is equal to the number of cells dying, so there is no increase or decrease in cell number. Some of the cells are dying due to nutrient shortage and the buildup of toxic metabolic waste products.

Carrying capacity – Carrying capacity is a feature of any environment, and is the maximum number of organisms the environment can support in a fully functional state. Carrying capacity is influenced by a variety of limiting factors, e.g., water supply, food supply, temperature, pH, oxygen availability, etc. The reason a bacteria population will reach stationary phase, and then enter into an exponential death phase when left in a batch culture is because the environment can no longer support the organisms present.

2. Chemoheterotrophs/ culture medium (pleural is media)
3. Binary fission/ replicate their genetic information and other essential components (DNA, RNA, and enzymes).
4. Population size or cell number
5. Binary fission/ elongation
6. During the elongation process, portions of the peptidoglycan wall are partially decomposed, and new wall material is deposited. This allows the cell to increase in length. Bacilli deposit new wall material in multiple locations along their long axis, but cocci deposit new wall material only around the equator. As the cell elongates, the chromosomal material is separated.
7. DNA content, metabolic activity, dry weight, and cell size (length)

8. Strepto/ a tetrad
9. The cells increase in DNA content, size (length), metabolic activity and dry weight.
10. The cells begin to die due to increases in metabolic waste buildup and decreases in the amount of nutrients available to them.
11. One or more billion cells (10^9 cells per ml)/ carrying capacity
12. Stationary/ carrying capacity
13. The youngest cells will be found around the outside edge of the colony because the colonies grow from the center outward.
14. Exponential death phase/ A population can be maintained in the exponential growth phase by providing the cells with a constant supply of nutrient and by removing toxic waste materials and dead cells. This method may be used to maintain bacteria for industrial purposes in a bioreactor (see chapter 28).
15. Bacteria populations grown in vitro (in batch cultures) demonstrate that living organisms cannot exceed the carrying capacity of their environments. The human population on the planet earth is following a growth curve similar to that produced by bacterial batch cultures and is rapidly approaching the vertical portion of a J-shaped curve. Although we are not certain what the carrying capacity of the earth is in terms of human population, we can be certain there is a concentration that our population will not be able to exceed. The consequences of population overgrowth are likely to become increasingly uncomfortable for us; for bacteria they are deadly.