Synchronous Growth

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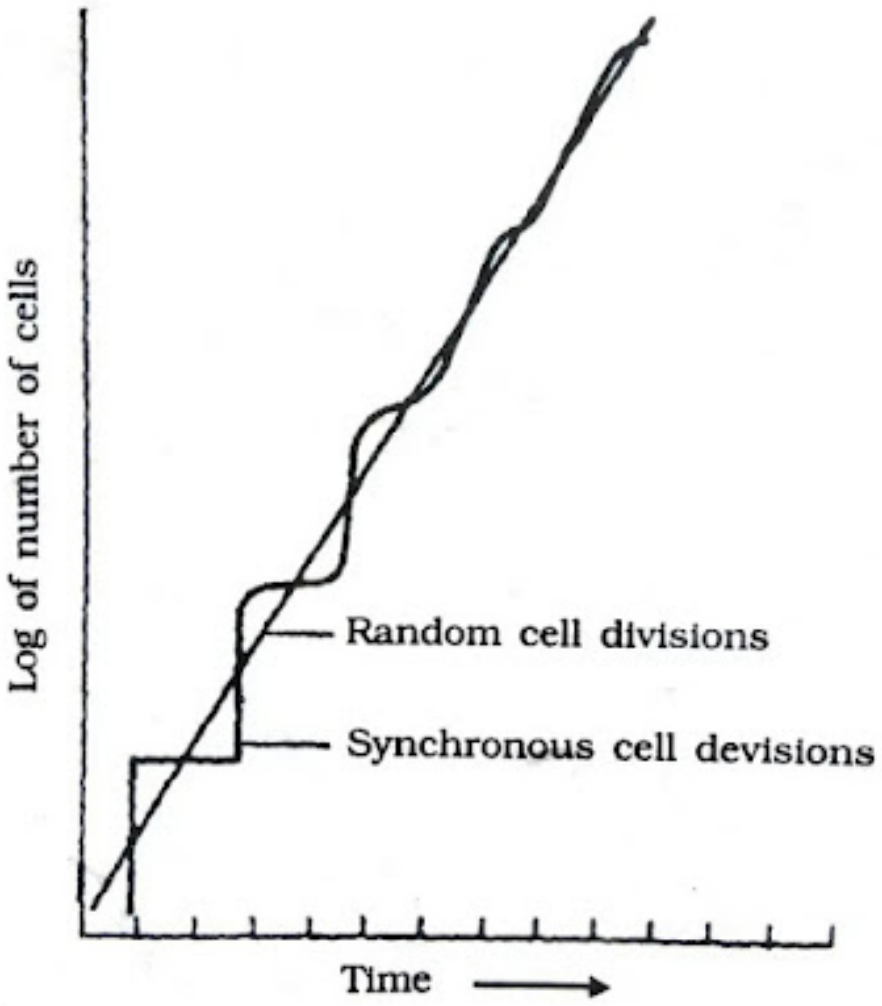
Synchronous growth

- Synchronous growth is the growth of **bacteria** such that all the bacteria are at the same stage in their growth cycle (e.g., exponential phase, stationary phase).
- Because the same cellular reactions occur simultaneously throughout the bacterial population, synchronous growth permits the detection of events not normally detectable in a single cell or in a population consisting of bacteria in various stages of growth.
- In a normal batch **culture** of fluid, or on an **agar** plate, bacteria in the population exhibit a range of sizes, ages, and growth rates. In contrast, the bacteria in a synchronized culture are virtually identical in terms of these parameters.


Log of number of cells
Random cell divisions
Synchronous cell devisions
Time

Synchronized growth can be imposed in the laboratory

- **Method 1**
- A population of bacteria can be filtered to obtain bacteria of a certain size range.
- Usually, the filter that is used has very small holes.
- All but the smallest bacteria in a population are excluded from passing through the filter.
- Because the smallest bacteria are frequently the youngest bacteria, the filtering method selects for a population comprised of bacteria that usually have just completed a division event.
- When the bacteria are suspended in fresh growth medium the population will subsequently grow and then divide at the same rate.

Method 2

- Bacteria of the same size can also be recovered using special techniques of centrifugation, where the bacteria in the fluid that is spinning around in a centrifuge are separated on the basis of their different densities.
- The smallest bacteria will have the lowest density and so will move furthest down the centrifuge tube.

Method 3

- Another method of obtaining a synchronous bacterial population involves the manipulation of some environmental factor that the bacteria depend on for growth.
- Typically, the factor is a nutrient that the bacteria cannot manufacture, and so is required to be present in the medium.
- In the alternative, an agent (e.g., an antibiotic) can be added that does not kill the bacteria but rather halts their growth at a certain point.
- Again, once the bacteria are added to fresh medium, the growth of all the bacteria will recommence from the point of blockage in the **cell cycle** .

- Synchronous growth can only be maintained for a few rounds of growth and division. Ultimately, the inherent randomness of bacterial population growth again dominates.
- In other words, not all the bacteria will continue to divide at exactly and differences in size and other attributes will once again appear in the population.
- For those few generations, however, much useful information can be extracted from a synchronously growing population.