

## Biology

### 03.3B Living State of Cells

”There is none righteous no not one” - Romans 3:10

#### THE LIVING STATE OF CELLS

##### Introduction

1. Life depends on the ability to maintain its internal environment. A matter of survival.
2. Homeostasis: “steady state”. To stay the same. e.g. living cells must maintain homeostasis to survive. But this requires work.
3. Dynamic equilibrium: Actively involved in maintaining homeostasis. e.g. pumping out unwanted molecules. (Na-Cl)

##### Optimal point and range of tolerance

1. Optimal temperature point for cells to functions e.g. human muscles: 37°C
2. Optimal temperature range for cells to functions e.g. human muscles: +/- 1°C
3. Range of Temperature Tolerance is the T<sub>i</sub> cells (muscles) still alive but not function well.
4. Limit of tolerance: No longer functions. Death.
5. Different cells have different tolerance levels: e.g. cells in geysers, hot showers, skin cells vs muscle cells
6. Homeostatic responses
  - a. Sweating, shivering, directional blood flow
  - b. Dormancy: by reducing metabolism and activity to survive extreme cold

##### Cell environment

Environmental solutions can threaten life of cell. e.g. poison, alcohol, ether, solute concentration, water concentration

1. Hypertonic solution: When the solute concentration of the environment is greater than the inside of the cell. Water concentration inside cell is greater.
  - a. Water diffuses out of the cell by osmosis and the cell shrinks. Plasmolysis
  - b. Plants or fish in sea water, fertilizer
2. Hypotonic solution: When the solute concentration of the environment is less than the inside of the cell. Water concentration inside cell is less.
  - a. Water diffuses into cell by osmosis until it bursts. Cytolysis
  - b. Cell walls prevent and contractile vacuoles help
3. Isotonic solution: Equilibrium. Equal concentration of solutes inside and outside of cell.
  - a. I.V. injection of fluids must be isotonic.

##### Passive Transport

1. Simple diffusion across the membrane. Molecular kinetic energy
2. Factors affecting diffusion
  1. concentration gradient

2. size and weight of molecules
3. shape of molecules
4. charge of molecules
5. permeability of membrane

#### Passive Mediated Transport

1. Simple diffusion aided by membrane proteins

#### Active Transport

1. Molecular movement against the concentration gradient. e.g. roots absorbing minerals from the soil.
2. Requires cellular energy
3. Na pump
4. As much as 50% of body energy use is to maintain ion concentrations on either side of the membrane.

#### Interesting facts about cells

1. Human bodies contain from 37 trillion cells. (Ann Hum Biol. 2013 Nov-Dec;40(6):463-71. Epub 2013 Jul 5.)
2. You began as one cell, which divided into trillions of copies.
3. Every cell in your body has the same genetic information copied from your first cell.
4. There are over two hundred different types of cells in your body.
5. There are about 20 different organelles and structures in cells.
6. Most cells are colorless and transparent.
7. To see cells, you need a microscope.
8. Bacterial cells in and on your body outnumber your body cells. Some estimate 95% of all cells in your body are bacterial.
9. Some cells in your digestive tract live only a few days. Others live up to a year.
10. Red blood cells live 120 days.
11. Liver cells live 18 months.
12. Skin cells live about 20 days.
13. Brain cells can live from birth to death.
14. Bone cells can live 25 to 30 years.
15. About 96 million cells die every minute in an adult male's body.
16. Skin cells continue growing for several days after body dies.
17. After your body dies, hair and fingernails appear to grow.
18. Oxygen is needed by human cells to obtain energy from molecules.
19. The carbon dioxide you breathe out your nose is from the sugar molecule catabolized by your cells.
20. Your body organization is preserved but your body molecules are continually replaced.
21. 72% of your body mass is water.
22. Red blood cells have no nucleus.
23. The yolk of bird eggs is the egg cell. The biggest cell in the world is the ostrich egg yolk.
24. Because of semi-conservative replication of DNA, it is theoretically possible that someone living today has the original DNA strand from Adam.