
MCB2022
Week 1 – Lecture 1 & 2

1. **Homeostasis** - regulation of the internal environment to maintain a constant state
2. **Organization** - being structurally composed of one or more cells
3. **Metabolism** - to maintain internal organization (homeostasis) and to produce the other phenomena associated with life.
4. **Growth** - a higher rate of anabolism than catabolism.
5. **Adaptation** - the ability to change over time in response to the environment.
6. **Response to stimuli** - a response can take many forms.
7. **Reproduction Dynamic** - characterized by constant change, activity, or progress

Proteins are dynamic

- Although 'folded' they have flexible disordered regions
- allow changes in conformation essential for function – eg enzyme activity
- reversible interactions with other proteins to make large complexes + molecular machines – eg ribosomes
- eg: on average a protein may function through interactions with 5 other proteins = the **interactome**

Motor Proteins produce large movements inside cells

Responsible for:

- vesicle transport
- organelle movement
- chromosome movement in mitosis
- muscle contraction

Using:

- cytoskeleton
- actin filaments
- microtubules
- undergo disassembly + assembly as required to alter the routes throughout the cell

Mitochondria are highly mobile

- move along `microtubules in both directions
- towards regions of high energy demand
- travel long distances
- undergo fission + fusion

****50% of eukaryotic cell is occupied by organelles**

Cellular Traffic

- highly organized
- temporally controlled
- spatially controlled
- bi-directional
- stimulated
- very busy
- destinations

Dynamic aspects of the genome

1. DNA replication

- DNA polymerase – molecular machine
- 4×10^6 genome replicated in 30 min
- 1,000 base pairs replicated / second in bacteria

2. DNA repair

- Self correction by replication machinery
- There are 6×10^9 bp in human genome – suffer 10^4 depurinations/ day / cell → loss of bases A or G
- There are 10^{13} cells per human
- **Total = 10^{17} depurinations /day/ per human body**
- UV in sunlight causes 50 thymine dimers/second/cell
- Not all mutations are repaired
 - good = evolution
 - bad = disease