

REGULATION OF THE CELL CYCLE

Normal growth, development and maintenance depend on the timing and rate of mitosis

Cell-Cycle Control System = a molecular signaling system which cyclically switches on the appropriate parts of the cell-cycle machinery and then switches them off

- Composed of a family of internal signaling proteins called cyclins

Factors that Influence Cell Division:

- If there are not enough nutrients in the environment, the cell will not divide
- Density-dependent inhibition = crowding that prevents cell division
 - Cells STOP dividing when they form a single layer of tissue
 - If some cells are lost, those bordering the space divide again until the space is refilled
- Anchorage Dependence = to divide, cells must stick to something

CANCER

- Cancer cells divide excessively, invade other tissues and can kill the whole organism
- Cancer cells:
 - Are originally normal cells that have mutated
 - Result from accumulating changes in DNA
 - Have lost control of their cell cycle
 - Are immortal in that they continue to divide indefinitely, as long as nutrients are available
 - Are normally recognized by the immune system and destroyed
 - Do NOT exhibit density-dependent inhibition or anchorage dependence
- If an abnormal cell evades destruction, it may form a tumor
 - If it remains at the original site, the mass is called a benign tumor

- If it begins to invade neighboring tissues enough to impair their normal function, it is called a malignant tumor
 - May need to develop its own blood supply to support its rapid growth = angiogenesis
 - At this point an individual is said to have cancer
- Metastasize = cancer cells break free from the original tumor and spread to other tissues
 - Requires radiation and chemotherapy

Origin of Cancer

Proto-oncogenes = genes that code for proteins which encourage the cell cycle to continue (growth and division)

- Are normal genes for the cell cycle
- If mutated, they may become oncogenes = cancer-causing genes
 - May mistakenly:
 - Stay on, keeping the cell dividing despite external signals
 - Ex. BRCA1 gene → breast and ovarian cancer predisposition

Guardian Angel Genes = code for proteins that slow or stop the cell cycle

- Produce proteins that recognize when DNA is faulty and initiate apoptosis
- If mutated, they ~~no~~ fail to give a “stop” signal, and the cell continues to divide

Causes of Cancer:

- Not just genetic, but environment plays a role too!
- Some viruses can transform normal cells into cancerous state.
 - Ex. Retroviruses, papovaviruses (ex. HPV), adenoviruses and herpesviruses
- Carcinogens = cancer-causing agents
 - Ex. Chemicals, UV rays, X-rays, radon, asbestos,...