Cancer

1) Cancer- abnormally growing and dividing cells of a malignant neoplasm.
   a) Neoplasms- abnormal masses of cells that lost controls over how they grow and divide
      i) Ordinary skin moles and other benign noncancerous neoplasms grow very slowly, and their cells retain the surface recognition proteins that are supposed to keep cells in a home tissue.
   b) All cancer cells display four characteristics
      i) Grow and divide abnormally
         (1) Controls over overcrowding are lost; cells reach high densities
         (2) Number of tiny blood vessels that service the cell mass increases abnormally
      ii) Cells have significantly altered cytoplasm and plasma membranes
         (1) The membrane is leaky with abnormal or lost proteins
         (2) The cytoskeleton shrinks or gets disorganized
      iii) Cells have a weakened capacity for adhesion
         (1) Recognition proteins are lost or altered and can’t hold cells together
      iv) Usually have lethal effects
         (1) Unless treated with chemotherapy or removed with surgery, they lead to death.
   c) In developed countries, 15 to 20% of all deaths result from cancer
      (1) Cancer rates rose in most industrial nations in the 20th century
         (a) 2nd leading cause of death in U.S.
         (b) A.C.S. estimates ½ of males and 1/3 of females will have some form of cancer in their lifetime.
         (c) EPA estimates that in the U.S. more than 200 million people live in areas where the combined upper limit lifetime cancer risk is 10 times the risk normally considered acceptable.
   d) Where does cancer come from?
      i) Cancer cells are not foreign cells
         (1) Unlike bacterial diseases, cancer is not caused by an invading cell.
      ii) Cancer cells have profound genetic defects
         (1) Many chromosomes are broken or have parts missing, or other parts might be attached and there may be extra chromosomes
         (2) Normal cells undergo apoptosis, programmed cell death, in order to get rid of damaged cells.
            (a) The cell dies and is engulfed by healthy cells around it.
         (3) In cancer cells, genes that fix damaged DNA or control apoptosis are mutated and are not able to stop cells for dividing.
      iii) How does this damage occur?
         (1) Inherited
            (a) Some forms of cancer can be hereditary, which doesn’t mean that everyone in a lineage will get it, but that there is a propensity
         (2) Viruses
            (a) HIV patients may get the cancer Kaposi sarcoma
(i) Develops in lymph vessels, which are the 'transport network' for the body's immune system.

(ii) It is common in people who are HIV positive or have had organ transplants, and therefore have weaker immune systems.

(3) **Carcinogens** - substances that cause cancer, invasive out-of-control cell growth

(a) Ex: Asbestos, Benzene, DDT, Radon, PCB (all found in your neighborhood!)

(b) Cigarette smoke contains benzopropene, a known carcinogen.

iv) Treating Cancer

(1) **Surgery**

(a) By completely removing the cancerous cells, a person can rid themselves of the cancer.

(b) Sometimes the cancer will **metastasize** or move to other locations and penetrate other tissues

(2) **Chemotherapy**

(a) Chemotherapy is the use of anti-cancer (**cytotoxic**) drugs to destroy cancer cells (including leukaemia and lymphoma).

(b) There are over 50 different chemotherapy drugs. Some are given on their own but often several drugs may be combined (known as combination chemotherapy).

(c) Different drugs damage cancer cells in different ways Unfortunately, as the chemotherapy drugs can also affect some of the healthy cells in your body, they can cause unpleasant side effects. However, damage to the healthy cells is usually temporary and most side effects will disappear once the treatment is over.

(i) Healthy cells in certain parts of the body are especially sensitive to chemotherapy drugs:

1. the lining of the mouth
2. the bone marrow (which makes blood cells)
3. the hair follicles
4. the digestive system.

(d) **Colchicine**, a water-soluble **alkaloid** found in the autumn crocus, blocks or suppresses cell division by inhibiting **mitosis**, the division of a cell's **nucleus**. Specifically, it inhibits the development of **spindles** as the nuclei are dividing. The cell may end up copying some or all of the chromosomes anyway, but can't parcel them out into new cells, and so it never divides.

(3) **Radiation**

(a) Many people with cancer will have radiotherapy as part of their treatment. This can be given either as external radiotherapy from outside the body, using x-rays or cobalt irradiation, or from within the body as internal radiotherapy.

(b) Radiotherapy works by destroying the cancer cells in the treated area. Although normal cells are also sometimes damaged by the radiotherapy, they can repair themselves more effectively.