CANCER

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CANCER

- Cancer is an independent, autonomous, uncontrolled growth of tissue containing a mass of aberrent or abnormal cells.

- Its a tumour, abnormal growth has no co ordination with a normal tissues

Cancer

- **Cancer** is not a single disease but rather a name applied to a great variety of malignant tumor that are formed by the same basic process of uncontrolled growth.

- **Cancer** is one of the most common and severe problem of clinical medicine.

- **Cancer** has emerged as a major public health problem in developing countries for the first time, matching its effect in industrialized nations. This is a global problem.

CHARACTERISTICS OF TUMOUR

- Tumour arises from an existing tissue or cells of body
- Growth abnormal
- It is not regulated by those governing tissues
- Undifferentiated and anaplastic in nature.(reversion of differenced cells into undifferentiated)
- Greater potentiality and multiplication
- Carryout none of the functions of normal adult cells.
- Irregular and larger nuclei.
- Loose contact inhibition

PROPERTIES OF CANCER CELLS

- Disobeying the loss of cell division
- Avoid programmed cell death(apostasis).
- Proliferate indifinitely
- Invasive and spread to other organs.
- Originate from normal cells through mutation caused by mutagens like chemicals and x rays.
- Genetically unstable.
- Lose their ability to repair the damaged DNA.
- Shows chromosomal abnormality due to abnormal mitosis.

- Misbehaviour of centrioles.
- Plasma membrane is leaky.
- Ribosomes and rough endoplasmic reticulum is abundant.
- Glycolysis faster rate.
- Release excess amount of growth promoting factors.

TUMOR

Tumor

Benign Tumor

Malignant Tumor (Cancer)
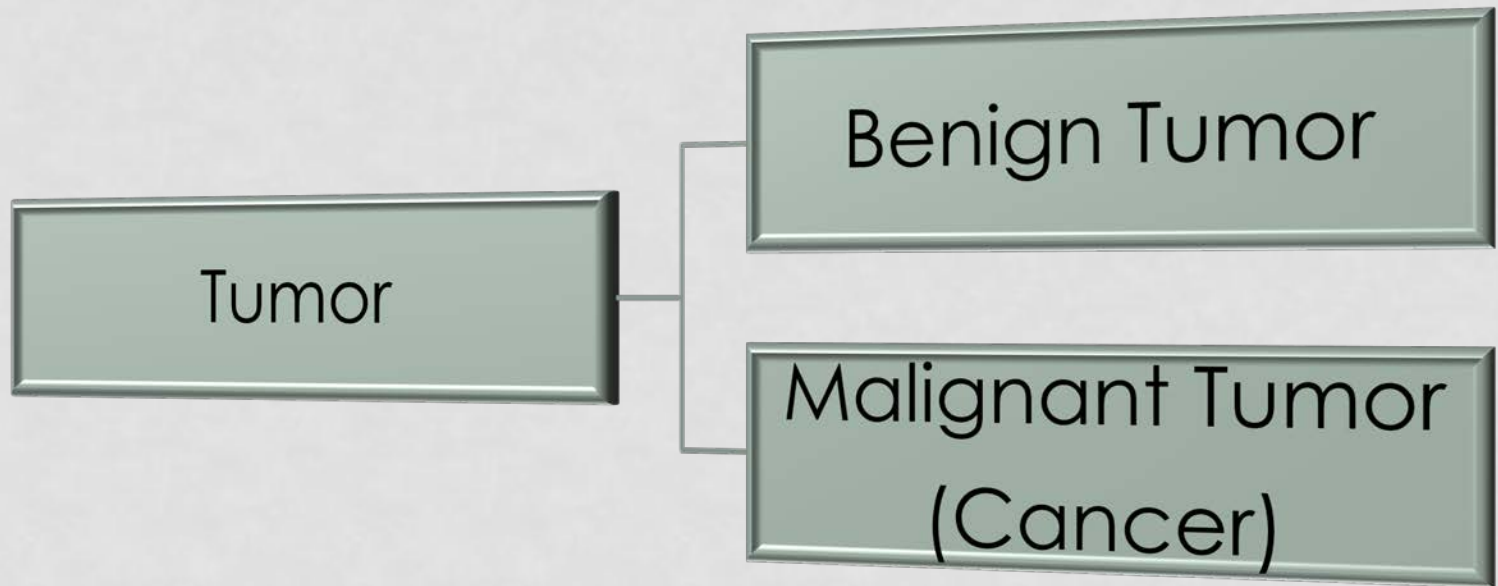
Benign Tumors

- Self-limited in their growth.

- Do not invade or metastasize (although some benign tumor types are capable of becoming malignant).

Malignant Neoplasm or Tumors (Cancer)

Group of cells display

- Excessive growth and division without respect to normal limit,

- Invasive, invade and destroy adjacent tissues, and sometime,

- Distant metastasis spread to other locations in the body.

- Types of Cancer
- • **Classifications of Cancer**
- – Carcinomas-epithelial tissue
- – Sarcomas-connective tissues
- – Lymphomas-lymph nodes
- – Leukemias-blood cells
- Osteoma-bones
- Fibroma-fibrous tissues
- Glioma-supporting connective tissue of central nervous system

- Cancer cells have abnormal cell cycles
  - divide excessively and form tumors
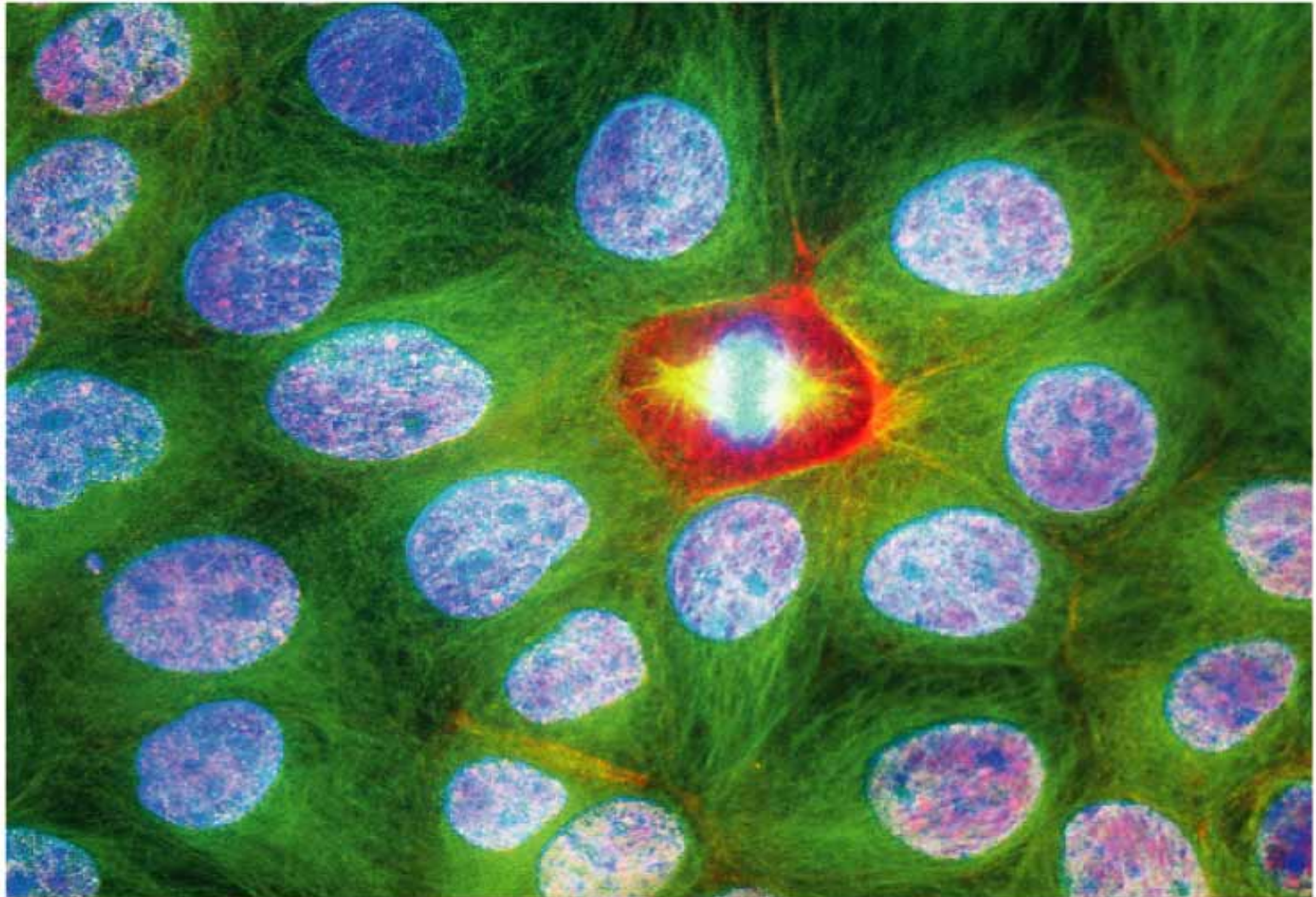
Malignant versus Benign Tumors

Benign (not cancer) tumor cells grow only locally and cannot spread by invasion or metastasis

Malignant (cancer) cells invade neighboring tissues, enter blood vessels, and metastasize to different sites

Time

Source: National Cancer Institute
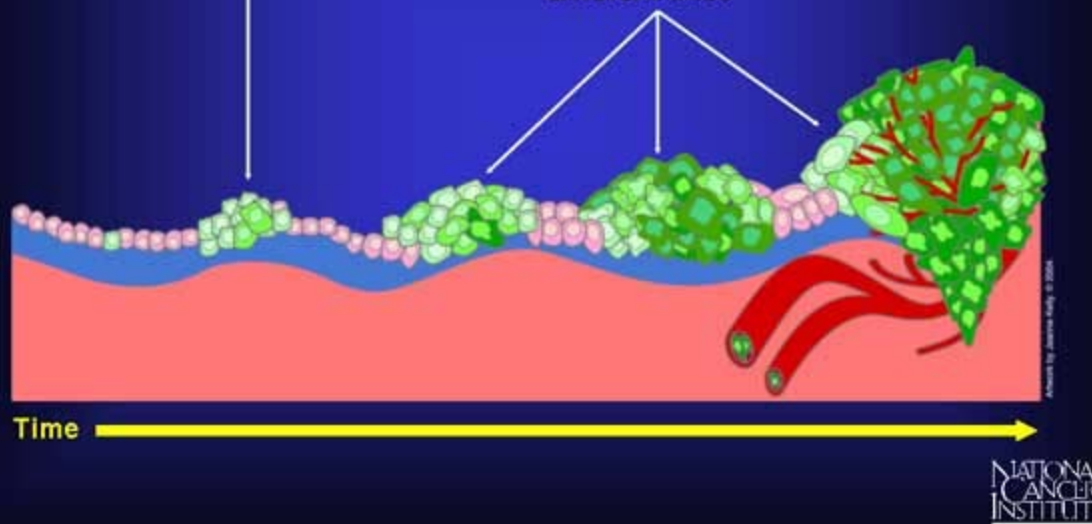
Cancer

- <u>Cancer</u> may affect people at all ages, even fetuses but risk for the more common varieties tends to increase with age.

- Early diagnosis and early treatment are vital, and identification of persons at increased risk of cancer before its development is an important objective of cancer research.

Microscopic Appearance of Cancer Cells
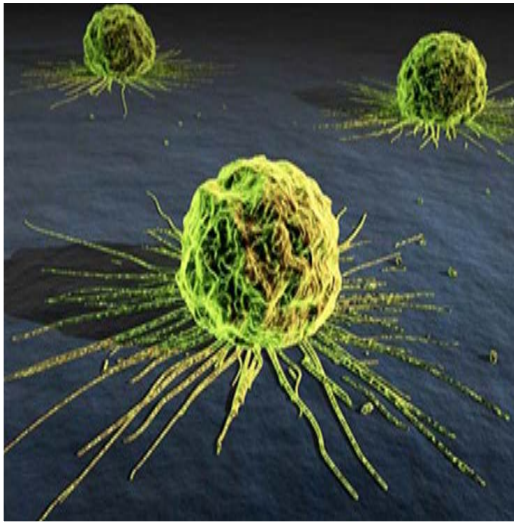
Microscopic Appearance of Cancer Cells

Normal	Cancer	
		Large number of irregularly shaped dividing cells
		Large, variably shaped nuclei
		Small cytoplasmic volume relative to nuclei
		Variation in cell size and shape
		Loss of normal specialized cell features
		Disorganized arrangement of cells
		Poorly defined tumor boundary

CANCER METASTASIS

Common sites and symptoms of
Cancer metastasis

Brain
- Headaches
- Seizures
- Vertigo

Respiratory
- Cough
- Hemoptysis
- Dyspnea

Lymph nodes
- Lymphadenopathy

Liver
- Hepatomegaly
- Jaundice

Skeletal
- Pain
- Fractures
- Spinal cord compression
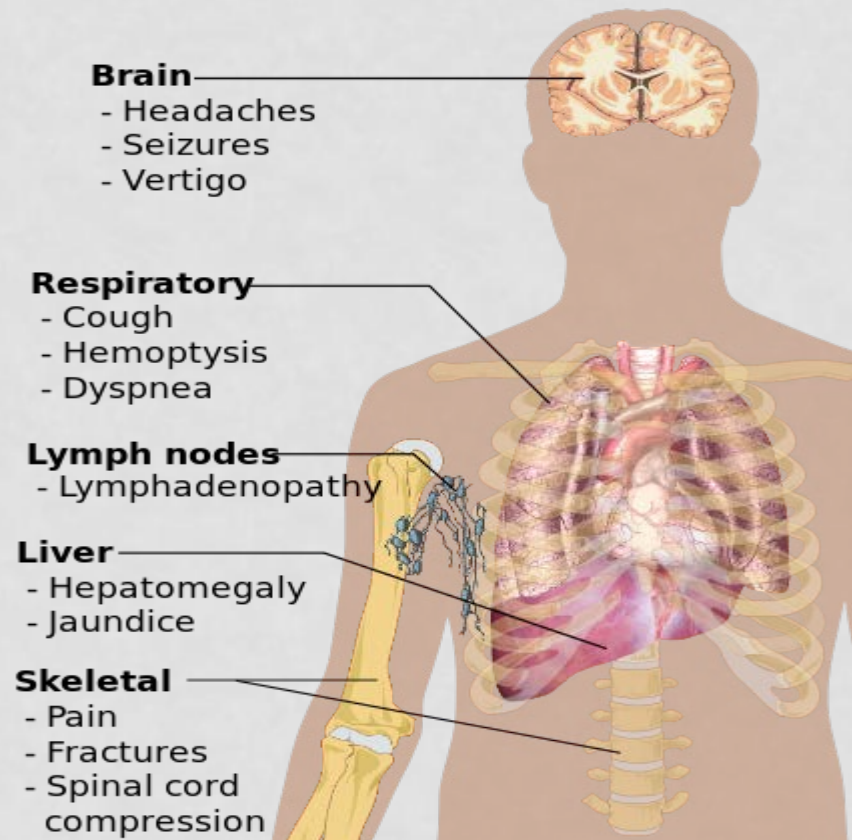
Etiology

- The etiology of cancer is <u>multifactorial</u>, with genetic, environmental, medical, and lifestyle factors interacting to produce a given malignancy.

- Most cancer is caused by genetic mutations often, by a series of mutations.

Abnormalities in the genetic material due to:

- Error in DNA replication (randomly acquired).

- Effects of carcinogens, such as tobacco smoke, radiation, chemicals, or infectious agents.

- Inheritance, and thus present in all cells from birth.

Cancer as a Genetic Disease
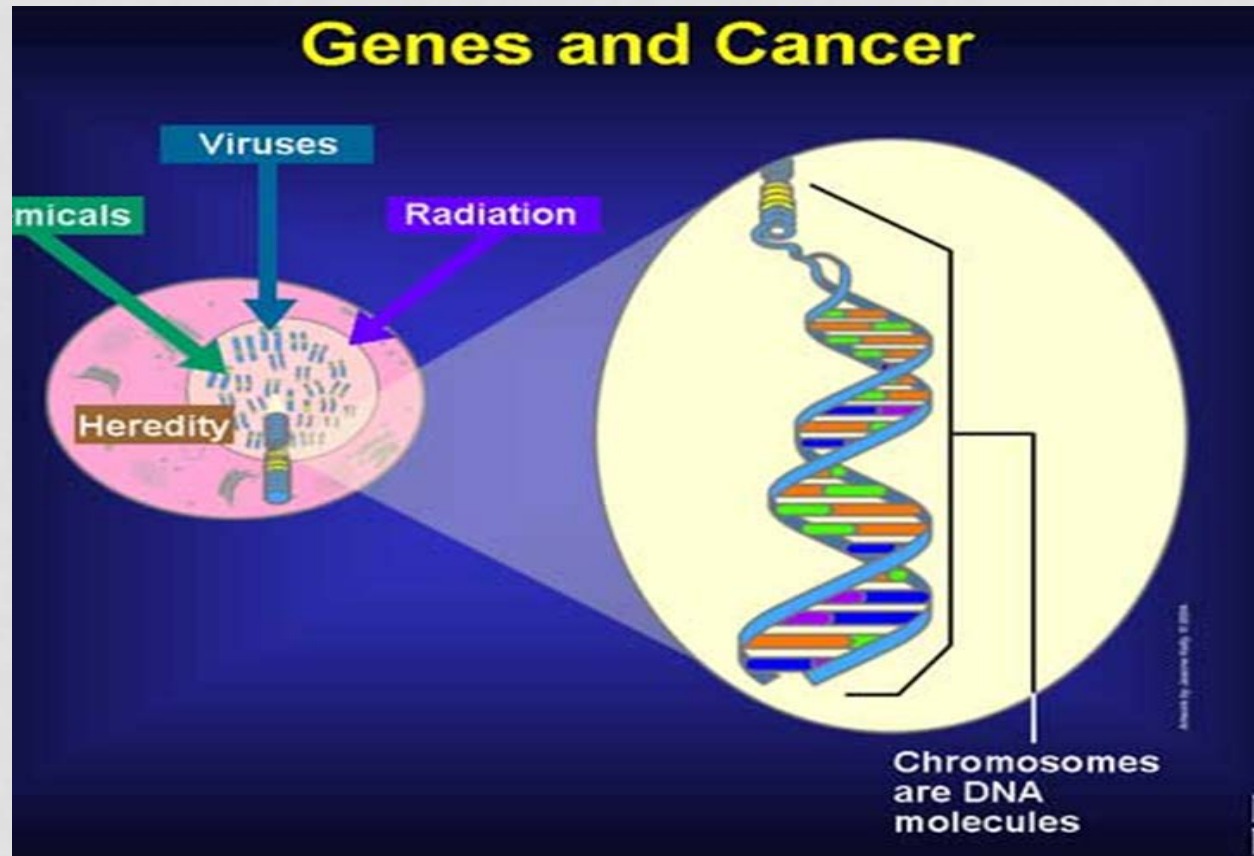
Series Mutation can Lead to Cancer
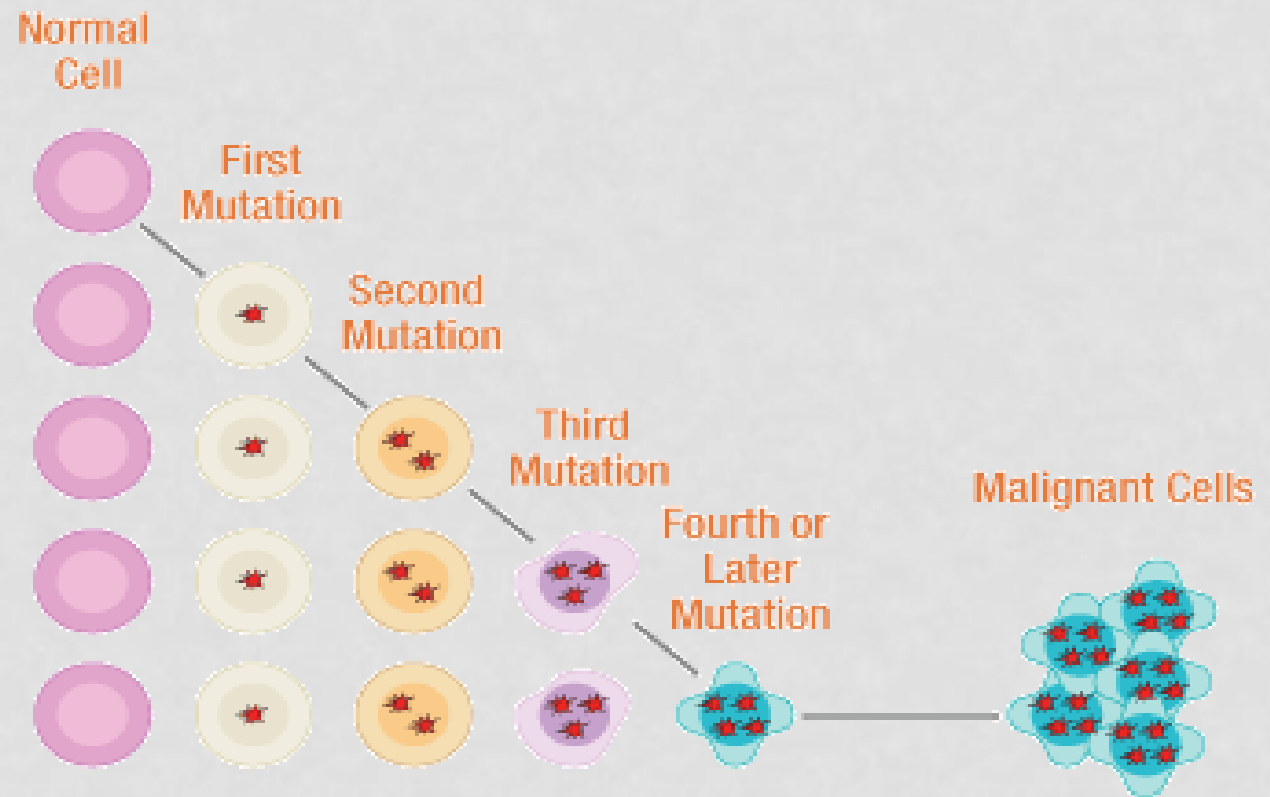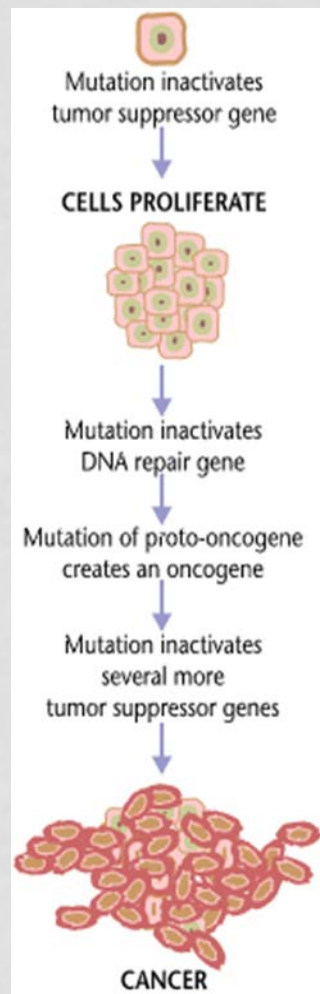
Source: National Cancer Institute

WORLDWIDE DISTRIBUTION OF CANCERS AND p53 MUTATIONS
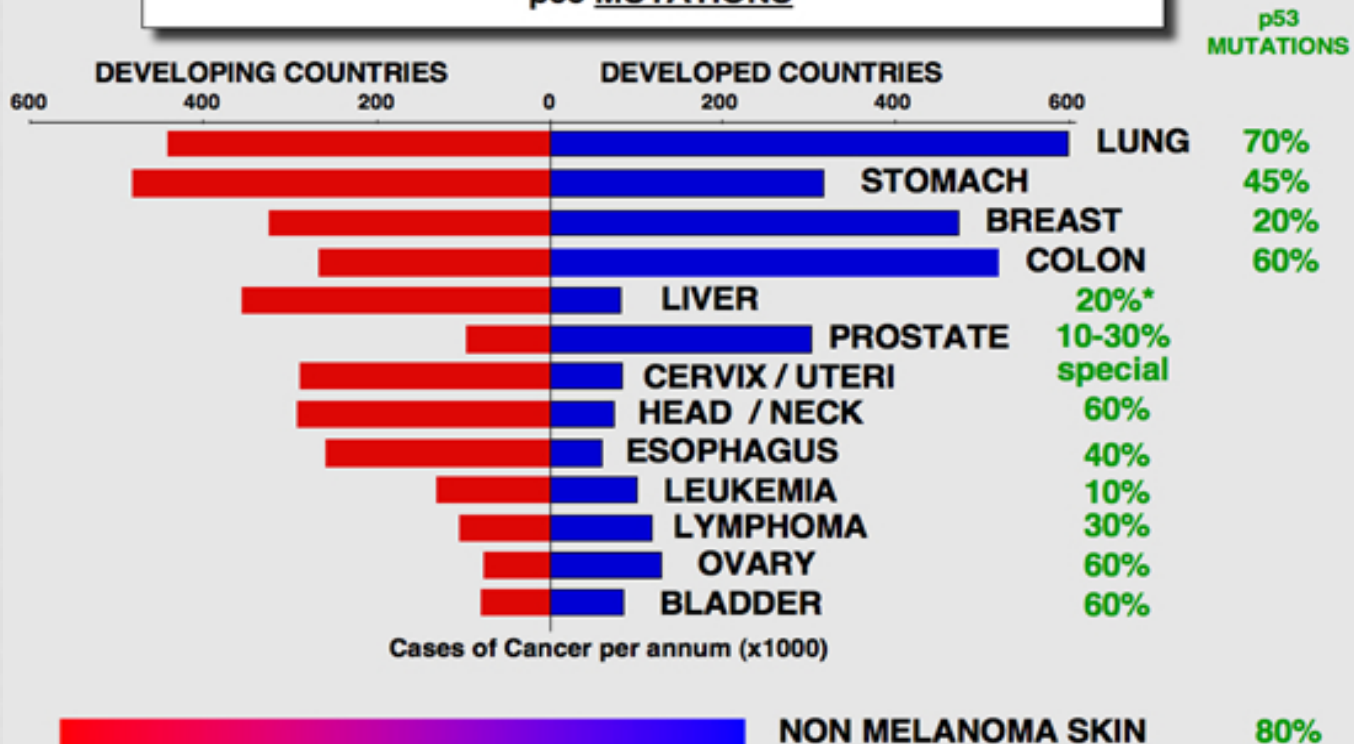
Risk Factor

- A <u>risk factor</u> is anything that increases a person's chance of getting a disease.

- Some risk factors can be changed, and others cannot.

- Different cancers have different risk factors

Risk Factors

- **Old** age
- **Unhealthy** lifestyle (Western lifestyle), Poor diet, lack of physical activity, or being overweight.
- **Environmental** factors, defined broadly to include tobacco use, diet, sunlight and infectious diseases.
- **Occupational** carcinogens
- **Radiation**
- **Family history** of cancer (Genetic susceptibility)
- **Alcohol**
- **Chemicals** and other substance

Risk Factors of Cancer

Nature Reviews | Cancer
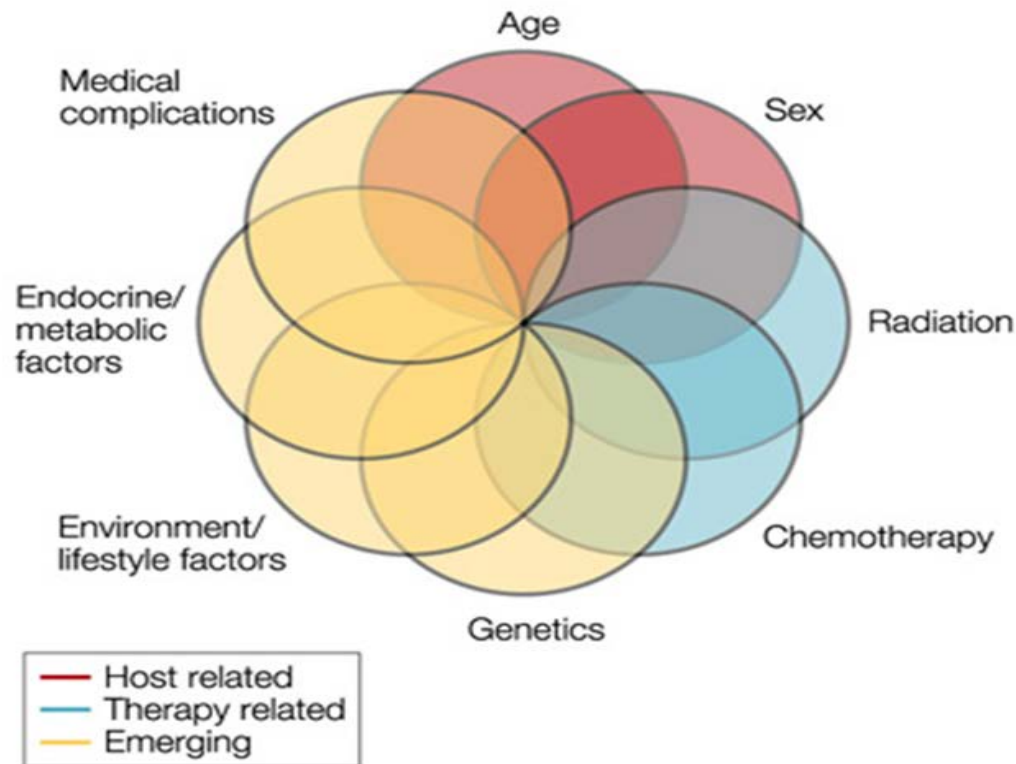
Risk Factor/ Cancer Type

Cancer Type	Risk Factor
Lung Cancer	Tobacco smoke Radon Asbestos and other substances Air pollution
Breast	Radiation Genetic changes (Inherited mutation)
Colorectal	Cancer polyp Genetic alteration Diet Cigarette smoking Ulcerative colitis or chon's disease
Prostate	Diet Certain prostate changes Race Africans Americans

Risk Factor/ Cancer Type

Cancer Type	Risk Factor
Liver	Hepatitis viruses (HCV.HBV)
Pancreas	Smoking Diabetes Being male Chronic pancreatitis
Kidney	Tobacco smoking High blood pressure Von-Hippel-Lindau syndrome (VHL)
Leukemia	Radiation Chemotherapy Certain disease (Down syndrome) Human T cell leukemia virus Myelodysplatic syndrome

Risk Factor/ Cancer Type

Cancer Type	Risk Factor
Bladder	Occupation Certain infection Tobacco smoking Race Twice as often as Africans Americans Treatment with cyclophosphamide or arsenic
Uterine	Endometrial hyperplasia Race Africans Americans Hormonal replacement therapy Obesity
Melanoma	Dysplastic nevi Fai skin Weakened immune system Sever blistering/Sunburn UV irradiation
	Source:http://ishwaryatechnosolutions.com/cancer.aspx

Certain viruses or bacteria may increase the risk of developing cancer

Microorganism	Cancer
Human papilloma virus	Cervical cancer
Helicobacter pylori	Stomach cancer
Hepatitis B and hepatitis C viruses	Liver cancer
Human T-cell leukemia/lymphoma virus	Lymphoma and leukemia
Human immunodeficiency virus	Lymphoma and a rare cancer called Kaposi's sarcoma
Epstein-Barr virus	Lymphoma
Human herpes virus 8	Kaposi's sarcoma

Risk Factors for Breast Cancer

Risk factors for breast cancer

Direct factors
- Radiation, especially during puberty
- Inherited mutations

Contributing factors
- Lack of exercise
- Excess of alcohol
- Deficiencies of vitamin D, fiber, melatonin??
- Harmful xenohormones (some plastics, fuels, pesticides)
- Increased insulin-like growth factor

Vulnerability factors
- Early menses
- Late menopause
- No pregnancy or lactation

Breast Cancer

Risk Factors for Prostate Cancer

Prostate Cancer Risk Factors

Wrong Diet

(+) Prostate Biopsy for PIN or PIA (Abnormal Cells but not Cancer)

(+) Family History

Race

Increased Blood Levels of IgF1

Exposure to Anabolic Steroids

Obesity

(+) History of Coronary Artery Disease

Increased Height (>6' 2")

Genetic Mutations: Vit. D Receptor & Others. EpiGenetic Issues: GSTP1 Gene Hypermthylation (Blood & Urine Tests)

Specific Job Risk: Wood Cutter - (? Sawdust Exposure) Farmer - (? Chemical Exposure) Teacher - (Unknown)

Specific Toxin Exposure

Insulin Resistance (Increased Fasting Insulin Level)

Increased PSA; Decreased % Free PSA

Decreased Blood Level of 1, 25 OH Vit. D

Age

Too High Calcium Intake (>2000 mg Daily)

Significant Weight Gain as Young Adult

Unhealthy Colon

Decreased Blood Selenium

Decreased Zinc

Abnormal Estrogen Metabolism Ratio: (2OH / 16 Alpha OH)

Abnormal Omega 3 Profile (Omega 3 Deficiency)

Bladder

Urethra

Prostate Gland

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- TREATMENT
- •Surgery
- •Chemotherapy
- •Radiation
- •Targeted Cancer Treatments
- •Small Molecule Inhibitors
- •Antibodies
- •Cell Based Immunotherapy
- •Gene Therapy

- Chemotherapy
- Drugs used to kill cancer cells; disrupt some
- aspect of cell division.
- Toxic to healthy cells; hair, bone
- marrow, lymphocytes, and epithelial cells of
- intestinal lining .
- Side effects include hair
- loss, nausea, vomiting, and reduced immune
- responses.

- Radiation therapy
- High-energy rays are used to kill cancer cells
- Stop them from growing and dividing.
- radiotherapy is a local treatment; it can affect
- cancer cells only in the treated area.
- side effects-
- Tiredness, skin reactions such as rash or
- redness, and loss of appetite.
- Temporary lowering of the WBC count.

- **Surgery therapy**
- In localized cancer surgery typically attempts
- to remove the entire mass.
- **Biological therapy/immunotherapy**
- Monoclonal antibodies, interferon, interleukin-
- 2, and colony-stimulating factors.
- **Side effects - Temporary flu-like symptoms**
- **such as fever and chills, muscle aches and**
- **weakness, loss of appetite and diarrhea**

- Recently launched drugs-
- ☐Axitinib (Inlyta) for advanced kidney cancer.
- ☐Vismodegib (Erivedge) for advanced basal cell
- carcinoma.
- ☐Carfilzomib (Kyprolis) for multiple myeloma.
- ☐Ziv-aflibercept (Zaltrap) in combination with
- chemotherapy for metastatic colon cancer.
- ☐Regorafenib (Stivarga) for metastatic colorectal
- cancer .

Cancer as a Global Health Problem

- In the year 2000, malignant tumors were responsible for 12 percent of the nearly 56 million deaths worldwide from all causes. In many countries, more than a quarter of deaths are attributable to cancer. In 2000, 5.3 million men and 4.7 million women developed a malignant tumor and altogether 6.2 million died from the disease.

- The predicted sharp increase in new cases from 10 million new cases globally in 2000, to 15 million in 2020 will mainly be due to steadily ageing populations in both developed and developing countries and also to current trends in smoking prevalence and the growing adoption of unhealthy lifestyles.

- **Update:** http://www.who.int/topics/cancer/en/

Avoidable Cancer Risk

- Having a healthy diet, being physically active, and maintaining a healthy weight may help reduce cancer risk.

- <u>Eat well:</u> A healthy diet includes plenty of foods that are high in fiber, vitamins, and minerals. This includes whole-grain breads and cereals and 5 to 9 servings of fruits and vegetables every day. Also, a healthy diet means limiting foods high in fat (such as butter, whole milk, fried foods, and red meat.

Avoidable Cancer Risk

- Be active and maintain a healthy weight: Physical activity can help control your weight and reduce body fat. Moderate physical activity (such as brisk walking) for at least 30 minutes on 5 or more days each week is recommended.

Daily physical activity

Fruits

Oils

Milk

Meat & beans

Grains

Vegetables

ADAM
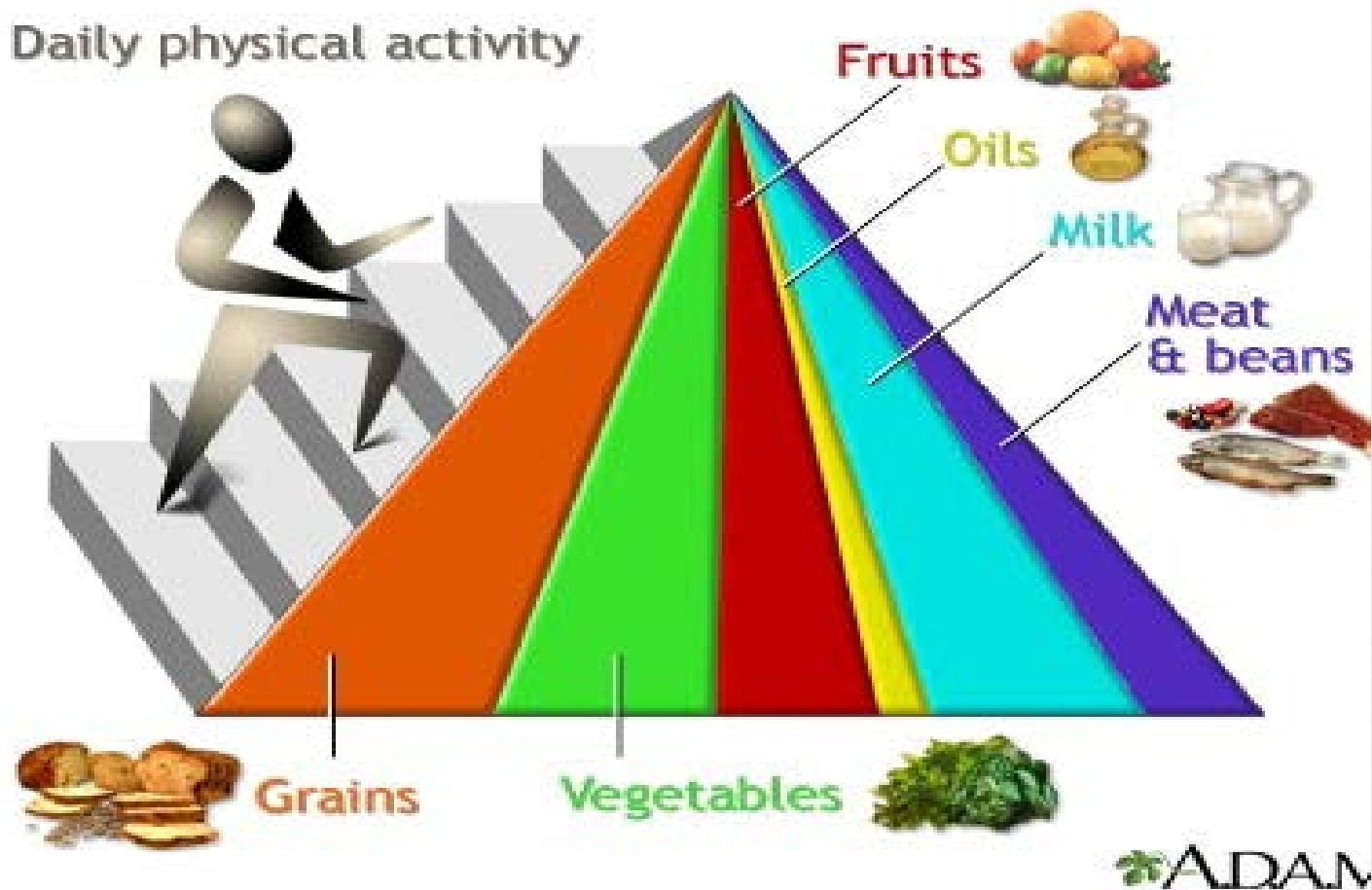
Prevention

▪Primary prevention: avoidance of exposure to cancer-causing agents (e.g. tobacco, industrial carcinogens, etc ….).

▪Early detection of cancer: education to promote early diagnosis and screening (Imaging diagnosis and laboratory tests,…)

▪Genetic testing: these tests can check for certain inherited gene changes that increase the chance of developing cancer.

Avoid Carcinogens at Work

Some Carcinogens in the Workplace

Carcinogen	Occupation	Type of Cancer
Arsenic	Mining, pesticide workers	Lung, skin, liver
Asbestos	Construction workers	Lung, mesothelioma
Benzene	Petroleum, rubber, chemical workers	Leukemia
Chromium	Metal workers, electroplaters	Lung
Leather dust	Shoe manufacturing	Nasal, bladder
Naphthylamine	Chemical, dye, rubber workers	Bladder
Radon	Underground mining	Lung
Soots, tars, oils	Coal, gas, petroleum workers	Lung, skin, liver
Vinyl chloride	Rubber workers, polyvinyl chloride manufacturing	Liver
Wood dust	Furniture manufacturing	Nasal

Artwork by Jeanne Kelly. © 2004.

NATIONAL CANCER INSTITUTE

Cancer Screening

- NHS Cancer Screening Programs: http://www.cancerscreening.nhs.uk/
- Cancer screenng overview: http://www.cancer.gov/cancertopics/pdq/screening/overview/patient/page1
- **American Cancer Society Guidelines for the Early Detection of Cancer:** http://www.cancer.org/Healthy/FindCancerEarly/CancerScreeningGuidelines/american-cancer-society-guidelines-for-the-early-detection-of-cancer
- Cancer screening: http://www.cancerscreening.gov.au/

Table 13.1
Preventing Cancer through Diet and Lifestyle

Type	Decreases Risk	Increases Risk	Preventable by Diet
Lung	Vegetables, fruits	Smoking; some occupations	33–50%
Stomach	Vegetables, fruits; food refrigeration	Salt; salted foods	66–75%
Breast	Vegetables, fruits	Obesity; alcohol	33–50%
Colon/rectum	Vegetables; physical activity	Meat; alcohol; smoking	66–75%
Mouth/throat	Vegetables, fruits; physical activity	Salted fish; alcohol; smoking	33–50%
Liver	Vegetables	Alcohol; contaminated food	33–66%
Cervix	Vegetables, fruits	Smoking	10–20%
Esophagus	Vegetables, fruits	Deficient diet; smoking; alcohol	50–75%
Prostate	Vegetables	Meat or meat fat; dairy fat	10–20%
Bladder	Vegetables, fruits	Smoking; coffee	10–20%

Here are some tips issued by a panel of cancer researchers:

- Avoid being underweight or overweight, and limit weight gain during adulthood to less than 11 pounds.
- If you don't get much exercise at work, take a 1-hour brisk walk or similar exercise daily, and exercise vigorously for at least 1 hour a week.
- Eat 8 or more servings a day of cereals and grains (such as rice, corn, breads, and pasta), legumes (such as peas), roots (such as beets, radishes, and carrots), tubers (such as potatoes), and plantains (including bananas).
- Eat 5 or more servings a day of a variety of other vegetables and fruits.
- Limit consumption of refined sugar.
- Limit alcoholic drinks to less than 2 a day for men and 1 for women.
- Limit intake of red meat to less than 3 ounces a day, if eaten at all.
- Limit consumption of salted foods and use of cooking and table salt. Use herbs and spices to season foods.

Sources: World Cancer Research Fund, American Institute for Cancer Research.

Table 13.1

References and Further Reading

- http://www.who.int/topics/cancer/en/
- http://www.cancer.org/docroot/CRI/content
- http://www.cancer.gov/cancertopics/wyntk/overview/page4
- http://www.nci.nih.gov/cancertopics/pdq/genetics/overview/healthprofessional
- http://www.cancer.gov/dictionary/db_alpha.aspx
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Image Citation

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