

Introduction to Cancer

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The existence of cancer has been known to man since ancient times; however, recovery from this disease was rare through the nineteenth century. Since 1900, numerous cancer research programs, particularly those at the National Cancer Research Institute in the United States, have contributed to an explosion of knowledge in oncology which includes such areas as etiology, pathophysiology, detection, and treatment of cancer.

Examination of cancer-related statistics reveals that, in the United States, the odds of contracting this disease are 1 in 2 for men and 1 and 3 for women. 1,268,000 cases were expected to be diagnosed in 2001 and 533,400 deaths due to cancer were projected to occur. The most common cancers in men are prostate, lung and bronchus, colon and rectum. In women, the most common cancers are breast, lung and bronchus, colon and rectum. Approximately 8,600 new cases of cancer were projected to occur in children age 0-14 in 2001. Common sites in children include the blood, bone marrow, lymph nodes, brain, sympathetic nervous system, kidneys and soft tissues.

The 5-year relative survival rate for all cancers combined is 60% after adjusting for normal life expectancy (factors such as dying of heart disease, accidents and diseases of old age). The relative 5-year survival rate represents persons who are living five years after diagnosis, whether disease free, in remission or under treatment with evidence of cancer. Relative survival does not reflect the proportion of people who are cured permanently and live longer than five years after diagnosis.

Cancer is a complex series of diseases characterized by an uncontrolled proliferation of cells into masses, referred to as malignant neoplasm or malignant tumors. Metastasis occurs when some tumor cells leave the site of tumor origin and travel to other parts of the body.

Although many attempts have been made to classify these diseases in a logical system, unfortunately, most of these systems have become obsolete as knowledge of cancers has increased. The classification system described here is based on the histogenesis, or the presumed tissue of origin of the cancer.

Some aspects of this classification are related to the three layers of cells formed in the young embryo:

1. Ectoderm: Cells which form the outer layer of embryonic tissue. The following parts of the body arise from this

layer: skin, epidermal tissue, fingernails, hair, skin glands, mucous membranes of mouth and anus, sensory organs, (i.e., eyes ears), nervous tissue (i.e., brain and spinal cord)

2. Mesoderm: The middle cell of embryonic tissue which forms bone, connective tissue, muscle, blood, vascular and lymphatic tissue.

3. Endoderm: The innermost embryonic cell layer which gives rise to the epithelial cells which line digestive and respiratory tracts. See Figure 1.

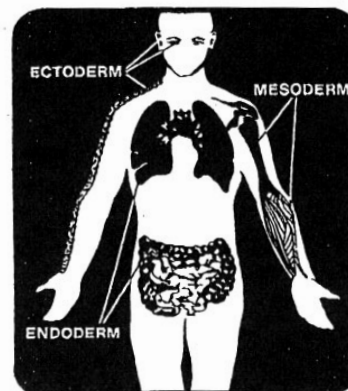


Figure 1. Embryonic cell layers and examples of related organ systems.

- a. Ectoderm - skin, sensory organs
- b. Mesoderm - bone, muscle, cartilage
- c. Endoderm - epithelial cells of intestinal respiratory tract

The classification based on the tissue or origin is as follows;

1. Carcinoma – cancer of the epithelial cells which includes skin, mucous membrane, glands, etc. Since cells on the surface areas of such organs as skin, mucous membranes, lung, stomach, large intestine and cervix are constantly being sloughed off and replaced by younger cells, cell division below this surface layer is a continuous activity. Frequent division makes these cells more susceptible to uncontrolled proliferation. These epithelial cells are also in immediate contact with carcinogens present in the external environment; 56 percent

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of all carcinomas involve these external epithelial cells. Cancer involving organs whose surface cells are not directly in contact with the outside environment but are frequent sites of cancer include breast, prostate, ovary, bladder and pancreas. Frequency of carcinomas of this type is 36 percent. Over 90 percent of all cancers can be included under the main classification of carcinoma. A carcinoma can arise from tissue that was formed in either the ectoderm or endoderm. There are two types of carcinoma – squamous cell and adenocarcinoma.

2. Sarcoma – cancer of supporting tissue, such as the bone, muscle or connective tissue. The mesoderm is the embryonic cell layer involved in the development of these cancers.
3. Hematopoietic or Leukemic – these cancers arise from the hematopoietic system, primarily the bone marrow where new blood cells originate. The young cells are still capable of cell division are the ones most frequently involved. Although leukemia originates in the bone marrow, the affected cells frequently migrate into the circulating blood.
4. Lymphoid – lymphocytes originate in the bone marrow and some migrate to the thymus to become T-cells. Mature lymphocytes populate the secondary lymphoid organs, such as lymph nodes, spleen and circulating lymph. A malignancy can originate in any lymphoid tissue such as the bone marrow, thymus, lymph nodes or spleen. Lymphoid cancer which originates in the bone marrow is referred to as lymphocytic leukemia. Tumors which originate in the lymphoid tissue are called lymphomas.
5. Neural Tumor – a tumor in the supporting structure of nervous tissue. This tissue originates from the ectodermal layer of cells in the embryo. The term is sometimes expanded to include nervous system organs such as the brain and spinal cord.
6. Glioma – a primary tumor of the brain composed of glial cells.
7. Melanoma – a malignant tumor composed of melanin-producing cells which are part of the epidermal skin layer.
8. Embryonic tumor – a malignant tumor formed in the embryo.

The histologic classification is made after microscopic examination of the cancer has been completed. This method is particularly useful when the tissue surrounding the malignant tumor retains some normal characteristics. If metastasis has occurred or the appearance of the cells and surrounding tissue is severely distorted or bizarre, it may be difficult or impossible to determine the tissue of origin. See Figure 2.

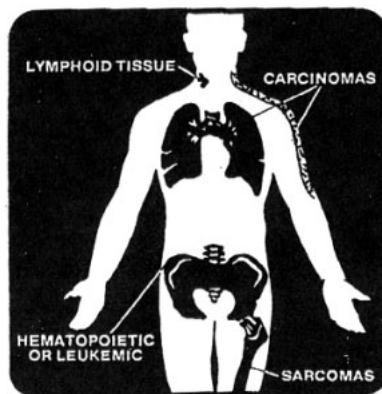


Figure 2. Examples of cancer classification based on microscopic examination of tissues.

To summarize, although our knowledge of cancer has increased during this century, there are still many questions to answer before the mystery of cancer is solved and our understanding becomes complete.

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Article **323**
0.1 CEC

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In addition to marking your answers, be sure to include all the required information on the answer sheet and a processing fee of \$3.00 per article.

In the following, choose the one best answer for each question.

- 1** Cancer is a disease which has appeared in this century due to the increased number of carcinogens in our environment.
 - A.** True
 - B.** False

- 2** The incidence of cancer is approximately:
 - A.** one in six
 - B.** two in five
 - C.** one in three
 - D.** two in seven

- 3** Which of the following statements can be included in a definition of cancer?
 1. uncontrolled cellular growth
 2. cells may leave site of tumor origin
 3. is a general term for a number of specific diseases
 4. tumors show increased numbers of normal cells
 - A.** 1, 2 & 3
 - B.** 1 & 3
 - C.** 2 & 4
 - D.** 4 only

- 4** Define Hematopoietic.
 - A.** Cancers which originate in the bone marrow
 - B.** Tumor composed of melanin-producing cells
 - C.** Cancers related to the nervous system
 - D.** A form of carcinoma

- 5** Define Neural tumor.
 - A.** Cancers related to the nervous system
 - B.** Malignant growth of lymphocytes in lymph nodes or spleen
 - C.** A cancer of connective tissue or muscle
 - D.** embryonic cell layer from which skin and nerve tissue are formed

- 6** Define Sarcoma.
 - A.** Embryonic cell layer from which skin and nerve tissue are formed
 - B.** A cancer of connective tissue or muscle
 - C.** Cancers related to the nervous system
 - D.** Tumor composed of melanin-producing cells

- 7** Define squamous cell.
 - A.** Cancer of connective tissue or muscle
 - B.** A form of carcinoma
 - C.** Cancers related to the nervous system
 - D.** Cancers which originate in the bone marrow

- 8** Define Lymphoid.
 - A.** A form of carcinoma
 - B.** Malignant growth of lymphocytes in lymph nodes or spleen
 - C.** Cancer related to the nervous system
 - D.** Cancers which originate in the bone marrow

- 9** Define Melanoma.
 - A.** A form of carcinoma
 - B.** Tumor composed of melanin-producing cells
 - C.** Embryonic cell layer from which skin and nerve tissue are formed
 - D.** Cancers related to the nervous system

- 10** Define Ectoderm.
 - A.** A form of carcinoma
 - B.** Embryonic cell layer from which skin and nerve tissue are formed
 - C.** Cancer which originates in the bone marrow
 - D.** Cancers related to the nervous system

Introduction to Cancer Biology 2nd edition © 2010 Momna Hejmadi & bookboon.com ISBN 978-87-7681-478-6. Download free eBooks at bookboon.com. 3. Introduction to Cancer Biology. Contents. Introduction to Cancer Biology. 3 Sustained growth signals (oncogenes*) 3.1 Bibliography 3.2 Further Reading. 4 Bypass anti-growth signals (Tumour Suppressor Genes*) 4.1 Bibliography 4.2 Further reading. 1. Introduction to cancer. Cancers are caused by combined genetic and non-genetic changes induced by environmental factors that trigger inappropriate activation or inactivation of specific genes leading to neoplastic transformations, or abnormal cell growth. There is a lack of information about key cellular events that occur in early stages of cancer development as well as environmental factors and internal cues that trigger these changes. Cancer -Cancer cells metastasize via moving through basal lamina into circulation -Malignant if: >Malignant cells invade surrounding tissue and establishment of secondary areas of growth ->Secondary tumors= metastases -Melanomas are usually metastatic Ex.) Cancer in colorectal can get into bloodstream and get to liver >Cancer is not necessarily hepatic cancer but a secondary tumor. Abnormal Cell functions in cancerous cells.