Chapter 1

Introduction and Perspective

Cancer is the general term for a series of neoplastic (Gr. neos new, plasma formation) diseases that are characterized by changes in a cell leading to abnormal (unordered and uncontrolled) cellular proliferation. Cancer is commonly encountered in all animals except the lower forms (see Chapter 9), and even plants develop growths that resemble cancer. Cancer is well known in all human populations and has probably been with us from the beginning of time. Indeed some fossilized dinosaur bones have been located that seem to reflect damage attributable to cancer.

In the broadest sense, neoplastic disease can be divided into benign and malignant categories. A benign tumor is generally contained within a membrane of connective tissue, and histologically all cells appear alike and derived from one tissue source. Unlike malignant tumors, they do not metastasize. At the start, malignant tumor cells may maintain some degree of their original specialized function, structure, and relationship to the tissue cells of origin. By maintaining this degree of differentiation, some cancer cells can at an early stage still perform some limited useful activity. However, as the disease progresses, the histological changes become more apparent until the cell is no longer recognizable. At this point dramatic structural and functional changes are obvious.

G. R. Pettit, Biosynthetic Products for Cancer Chemotherapy
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The uncontrolled cellular advance characteristic of malignant neoplastic disease does not necessarily mean a more rapid rate of cell growth, since cancer cells have the same variations in growth rates as do normal cells. However, if this process is not arrested, it will progress to cause death. The usual relentless progression of human cancer is due to the tendency toward metastases as malignant cells leave the original site and circulate in the blood and lymph systems to initiate abnormal growth at other sites in the body. Metastases may not occur until the primary site has reached an easily detectable size. The time interval for metastases may range from a very short period to many years. In this period, metastases may form by the hundreds in widely separated parts of the body. Usually these metastases proceed by way of the lymph system, and regional lymph nodes are frequently the first points of attack. In many cases, the actual route of metastases can be predicted and, in the more common types of cancer, is well known. For example, in breast cancer, metastases to the thoracic cavity, lungs, liver, and bones are frequently seen, and in lung cancer metastases to the liver, brain, adrenals, and bone are the common routes. Interestingly some types of tissue are less attractive for metastases; these include the spleen, the heart, the kidney, the prostate, the thyroid, the breast, and skeletal muscle.

Biological classification of cancer is based on both the type of cell and tissue involved. The majority of human cancer is of the carcinoma type, that is, solid tumors derived from epithelial tissues. These comprise the internal and external surfaces of the body as well as the colon and derived organs, which include the mucus membranes, the skin, the pancreas, the thyroid, the prostate, the liver, and the breast. The human carcinomas comprise about 95% of all malignancies. The next 3–4% of human cancer is made up of tumors affecting mixed tissues, such as the testes and the ovaries. The remaining percentage (about 2%) of human cancer is of the sarcoma type. The sarcomas are solid tumors derived from embryonal mesoderm and thus arise in connective tissues, such as cartilage, muscle, fibrous connective tissue, and bone. Sarcomas are very prominent among the