Finally, we turn to cancer diagnosis, focusing on new technologies that are helping to direct the use of cancer drugs that are targeted at particular molecular lesions. Throughout, we give examples of new analytic methods and therapies that are not only changing our approach to cancer treatment but also providing new insights into cancer pathophysiology.

Nomenclature

Neoplasia means "new growth," and a new growth is called a *neoplasm. Tumor* originally applied to the swelling caused by inflammation, but the nonneoplastic usage of tumor has almost vanished; thus, the term is now equated with neoplasm. *Oncology* (Greek *oncos* = tumor) is the study of tumors or neoplasms.

Although all physicians know what they mean when they use the term *neoplasm*, it has been surprisingly difficult to develop an accurate definition. In the premolecular era, the eminent British oncologist Willis came closest: "A neoplasm is an abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of the normal tissues and persists in the same excessive manner after cessation of the stimuli which evoked the change." In the modern era, a neoplasm can be defined as a disorder of cell growth that is triggered by a series of acquired mutations affecting a single cell and its clonal progeny. As discussed later, the causative mutations give the neoplastic cells a survival and growth advantage, resulting in excessive proliferation that is independent of physiologic growth signals (autonomous).

All tumors have two basic components: (1) neoplastic cells that constitute the tumor *parenchyma* and (2) *reactive stroma* made up of connective tissue, blood vessels, and variable numbers of cells of the adaptive and innate immune system. The classification of tumors and their biologic behavior are based primarily on the parenchymal component, but their growth and spread are critically dependent on their stroma. In some tumors, connective tissue is scant and so the neoplasm is soft and fleshy. In other cases, the parenchymal cells stimulate the formation of an abundant collagenous stroma, referred to as *desmoplasia.* Some demoplastic tumors—for example, some cancers of the female breast—are stony hard or *scirrhous.*

Benign Tumors. **A tumor is said to be *benign* when its gross and microscopic appearances are considered relatively innocent, implying that it will remain localized, will not spread to other sites, and is amenable to local surgical removal;** understandably, the patient generally survives. However, "benign" tumors may cause significant morbidity and are sometimes even fatal.

In general, benign tumors are designated by attaching the suffix *-oma* to the name of the cell type from which the tumor originates. Tumors of mesenchymal cells generally follow this rule. For example, a benign tumor arising in fibrous tissue is called a *fibroma*, whereas a benign cartilaginous tumor is a *chondroma.* In contrast, the nomenclature of benign epithelial tumors is more complex; some are classified based on their cells of origin, others on microscopic pattern, and still others on their macroscopic architecture.

Adenoma is applied to benign epithelial neoplasms derived from glands, although they may or may not form glandular structures. On this basis, a benign epithelial neoplasm that arises from renal tubular cells growing in the form of numerous tightly clustered small glands is termed an *adenoma*, as is a heterogeneous mass of adrenal cortical cells growing as a solid sheet. Benign epithelial neoplasms producing microscopically or macroscopically visible fingerlike or warty projections from epithelial surfaces are referred to as *papillomas*. Those that form large cystic masses, such as in the ovary, are referred to as *cystadenomas.* Some tumors produce papillary patterns that protrude into cystic spaces and are called papillary cystadenomas. When a neoplasm—benign or malignant—produces a macroscopically visible projection above a mucosal surface and projects, for example, into the gastric or colonic lumen, it is termed a *polyp*. If the polyp has glandular tissue, it is called an adenomatous polyp (Fig. 7-1).

Malignant Tumors. Malignant tumors are collectively referred to as *cancers*, derived from the Latin word for crab, because they tend to adhere to any part that they seize on in an obstinate manner. **Malignant tumors can invade and destroy adjacent structures and spread to distant sites (metastasize) to cause death.** Not all cancers pursue so deadly a course. Some are discovered early enough to be excised surgically or are treated successfully with chemotherapy or radiation, but the designation *malignant* always raises a red flag.

The nomenclature of malignant tumors essentially follows the same schema used for benign neoplasms, with certain additions. Malignant tumors arising in solid mesenchymal tissues are usually called *sarcomas* (Greek *sar* = fleshy; e.g., fibrosarcoma, chondrosarcoma, leiomyosarcoma, and rhabdomyosarcoma), whereas those arising from blood-forming cells are designated *leukemias* (literally, white blood) or *lymphomas* (tumors of lymphocytes or their precursors). Malignant neoplasms of epithelial cell origin, derived from any of the three germ layers, are called *carcinomas.* Thus, cancers arising in the ectodermally derived epidermis, the mesodermally derived renal tubules, and the endodermally derived lining of the gastrointestinal tract are all termed carcinomas. Carcinomas may be further qualified. *Squamous cell carcinoma* denotes a cancer in which the tumor cells resemble stratified squamous epithelium, and *adenocarcinoma* denotes a lesion in which the neoplastic epithelial cells grow in a glandular pattern. Sometimes the tissue or organ of origin can be identified and is added as a descriptor, as in renal cell adenocarcinoma or bronchogenic squamous cell carcinoma. Not infrequently, a cancer is composed of cells of unknown tissue origin, and must be designated merely as an undifferentiated malignant tumor.

Mixed Tumors. In most benign and malignant neoplasms, all of the parenchymal cells closely resemble one another. Infrequently, however, divergent differentiation of a single neoplastic clone creates a *mixed tumor,* such as the mixed tumor of salivary gland. These tumors contain epithelial components scattered within a myxoid stroma that may contain islands of cartilage or bone (Fig. 7-2). All of these elements arise from a single clone capable of capable of