for this reason, can be used in high-dose therapy regimens. Examples of alkylating agents include cyclophosphamide, ifosfamide, cisplatin (Platinol), and dacarbazine. Antimetabolites resemble essential metabolic elements needed for cell growth but are sufficiently altered in molecular structure to inhibit further synthesis of DNA or RNA; their maximum effect occurs in cells that are actively producing DNA. Examples of antimetabolites include methotrexate and mercaptopurine. Plant alkaloids arrest cells in metaphase (a phase of mitosis) by binding to microtubular protein needed for spindle formation. Examples include vincristine and vinblastine. Antitumor antibiotics are natural products that interfere with cell division by reacting with DNA in such a way as to prevent further replication of DNA and transcription of RNA. Examples include doxorubicin and daunomycin.

A number of agents are not categorized according to the preceding classifications. For example, L-asparaginase is an enzyme isolated from extracts of bacterial cultures of *Escherichia coli* or *Erwinia carotovora.* It hydrolyzes L-asparagine, an amino acid, to L-aspartic acid, which prevents the cell from synthesizing protein needed for DNA and RNA synthesis. Because L-asparagine is synthesized by normal cells but must be exogenously supplied to certain leukemia and lymphoma cells, administration of the enzyme destroys the essential exogenous supply while sparing normal cells of untoward effects.

An understanding of the actions and side effects of these drugs is essential to nursing care of children with cancer. Unfortunately, almost all drugs are not selectively cytotoxic for malignant cells, and other cells with a high rate of proliferation (such as the bone marrow elements, hair, skin, and epithelial cells of the gastrointestinal tract) are also affected. Frequently the problems related to the destruction of these normal cells require more nursing care than the disease itself.

A number of targeted agents called *tyrosine kinase inhibitors* have been developed and are being used in a variety of pediatric and adult malignancies. Examples of some of these agents include imatinib, sunitinib, and sorafenib.

Precautions in Administering and Handling Chemotherapeutic Agents