ANTINEOPLASTIC AGENTS: AN BRIEF INTRODUCTION

Traditional antineoplastic drugs, which still constitute most of the anticancer drugs used today, generally target either the DNA inside the nucleus of a cell directly, or they inhibit the synthesis of new DNA strands, or they stop the mitotic processes of a cell. In the first case, the objective is to cause physical changes in the DNA itself, resulting in the formation of mutations if the DNA is then attempted to be replicated. In the second case, these agents usually stop the synthesis of DNA by stopping the synthesis of the necessary building blocks of DNA. In the third case, the objective is to "arrest" a cell in one of the stages of mitosis, often by inhibiting synthesis or breakdown of the mitotic spindles.

I. Antineoplastic agents which directly attack DNA in the nucleus belong to the following categories:

A. ALKYLATING AGENTS: These agents directly alkylate or covalently modify the nitrogenous bases of DNA molecules. This can result in mispairing of bases, or loss of bases, or actual scission of the DNA backbone.
Examples: Nitrogen Mustards, Thiotepa, Busulfan (Myleran), Dacarbazine (DTIC), Nitrosoureas, Procarbazene (Matulane), Cisplatin (Platinol)

B. INTERCALATING AGENTS: These agents bind tightly to the DNA double helix, preventing the unwinding of the double helix at that point.
Examples: Dactinomycin (Cosmegen), Daunorubicin (Cerubidine), Doxorubicin (Adriamycin), Plicamycin (Mithramycin)

C. DNA TOPOISOMERASE INHIBITORS: By inhibiting this enzyme involved in supercoiling, these agents somehow cause the actual scission or breakage of DNA strands in the nucleus.
Examples: Etoposide (VePesid, VP-16)

II. Antineoplastic agents which stop the synthesis of DNA precursors are:

A. FOLIC ACID ANTAGONISTS: These agents stop the formation of tetrahydrofolate, which is necessary for the synthesis of both purines and pyrimidines.
Examples: Methotrexate (MTX)

B. PURINE ANTAGONISTS: These agents are competitive inhibitors of enzymes in the purine nucleotide synthetic pathways.
Examples: Mercaptopurine (Purinethol), Thioguanine (Tablet)

C. PYRIMIDINE ANTAGONISTS: These agents are competitive inhibitors of enzymes in the pyrimidine nucleotide synthetic pathways.
Examples: Floxuridine (FUDR), Fluorouracil (5-FU), Cytarabine (Cytosar, ARA-C)

D. RIBONUCLEOTIDE DIPHOSPHATE REDUCTASE INHIBITORS: These agents will effectively stop the conversion of all ribonucleotides into deoxyribonucleotides, which are necessary for DNA construction.
Examples: Hydroxyurea (Hydrea)

III. Antineoplastic agents which effect the synthesis or breakdown of the mitotic spindles belong to the general category of alkaloid antineoplastic drugs.

A. ALKALOIDS WHICH EXERT THEIR ACTIONS ON TUBULIN SYNTHESIS/BREAKDOWN: These agents interfere with the turnover of tubulin, the protein which makes up the microtubules of the cell, including the mitotic spindles.
Examples: Vinblastine (Velban, Velsar), Vincristine (Vincasar, Oncovin), Pacitaxel (Taxol)