# EDITORIAL

## Novel Drug Delivery Systems

The present issue of the journal carries a review article on vaginal drug delivery systems which prompted the editor to base the editorial on this topic. Drug delivery technologies form a very rapidly growing sector of the pharmaceutical industry. There are several reasons for this. The oral and parenteral routes of drug administration have several shortcomings and these provide the impetus for the search for better delivery systems to improve bioavailability, control the rate at which drug is delivered, target specific sites in the body and in some cases avoid the first pass effect. It is also possible using the novel drug delivery systems (NDDS) to mimic the circadian rhythm so that the drug is delivered at desired times, for example in the morning. Novel drug delivery systems can improve patient compliance. Lastly it is common for research based pharmaceutical firms to prolong their hold on innovator drugs after expiry of the patent by use of NDDS. Common NDDS make use of depot, transdermal and transmucosal technologies. Use of liposomes and monoclonal antibodies to target specific sites in the body has been attempted.

In the case of depot preparations, the formulation is composed of biodegradable polymers dissolved in biocompatible barriers to form a liquid delivery system. The solution is mixed with the drug and injected intramuscularly or subcutaneously. A solid implant is formed *in situ* which biodegrades as drug is released over a predetermined period. Another NDDS in early stages of development consists of drug eluting beads which can be injected at a specific site such as a malignant tumor. It should also be possible to activate depot preparations by external remote control.

Currently the main focus of NDDS is on transmucosal biodegradable mucoadhesive systems. One such formulation consists of small discs approximately 1 cm in diameter with multilayer bio-erodible polymer-drug matrices that release drug at predetermined time intervals. The disc adheres to and interacts with mucosal surface such as inside the vagina or buccal cavity and releases the drug to systemic circulation or at a local site as the disc erodes within the cavity. Since the polymers are completely bio-erodible, there is no residue to be removed. The erosion rate can be varied. This system offers a rapid onset of action and improved bioavailability compared to the oral route, while avoiding drug inactivation through first pass effect. Bio-erodible discs have been used to deliver antimigraine and antiemetic drugs into systemic circulation as well as anaesthetic, antifungal and antiviral drugs topically. There are different types of mucoadhesive formulations but the common denominator is that the drug is trapped in a biodegradable polymer matrix.

Early polymers were of natural origin (for example collagen, cellulose, lactic acid and glycolic acid) but currently, semisynthetic polymers (such as polyanhydrides, polyacrylic acid and polyurethane) are also used. Polymers deliver drugs through dissolution, diffusion or osmosis. In dissolution, drug is released as the polymer dissolves. By mixing and layering polymers with varying dissolution rates, it is possible to control the release characteristics. In diffusion, release is controlled by the rate of diffusion out of the polymer. In osmosis, the drug is contained in a polymer compartment surrounded by a second one containing an inactive agent that pushes the drug out osmotically.

Transdermal drug delivery systems have had limited success. A medicated skin patch releases drug slowly over a period of time. A novel transdermal method consists of medicated powders pumped into the skin at supersonic speed.

Any discussion on NDDS would be incomplete without the mention of liposomes, even though these have not been as successful as was initially anticipated. Liposomes encapsulate drug within the layers or in the hollow space in the middle. Selective uptake of liposomes by specific target cells can be achieved by modifying their surface properties. The possibility of tagging drugs to monoclonal antibodies which will deliver them to specific sites can be the basis of drug targeting, particularly in malignant tumors.

The article on vaginal drug delivery systems by Dobaria *et al.* discusses the advantages and challenges associated with this transmucosal route of drug administration. The vagina offers a large highly vascular absorption area. Besides, the vaginal route of drug administration is noninvasive. There are however several variables such as hormonal changes, abnormal secretions and variations in secretion pH all of which pose serious challenges in the formulation of suitable dosage forms.

**Editor-in-Chief.**