## The Transdermal Route of Administration ©

The skin has evolved to minimize entrance of noxious chemicals and UV radiation into the body. But from a pharmacological perspective, delivering drugs across the skin is an important goal. Transdermal delivery would avoid numerous problems with the oral route, including drastic pH changes, the deleterious presence of food and enzymes, variable transit times, pulse entry (rapidly fluctuating drug plasma concentrations), side effects and inadequate patient compliance, while also eschewing needle delivery and its associated inconvenience and even patient phobia. (*Journal of Nature Biotechnology* 22, 165-167 [2004]).

Impregnated polymers (transdermal patches) can safely store and deliver controlled amounts of medication across the epidermis for systemic distribution.

Transdermal medications have been in clinical use for many years. Some of the products that have been medicated in this fashion include: nitroglycerin, estradiol, clonidine, fentanyl, nicotine and scopolamine. (Deputy for Acquisition and Advanced Development, USAMRMC). Recently, the FDA has approved the use of transdermal patches to deliver medications for treating Parkinson's Disease, Alzheimer's Disease, depression, menopause and osteoporosis. In an article written for the general public, "Top Health Breakthroughs" in *Parade* magazine, December 9, 2007, under the heading of *A Better Way to Take Medicines*:, Dr. Isadore Rosenfeld profiles the increasing use of transdermal patches in medicine:

> "More medications are being delivered topically via the skin rather than by mouth or injection. This includes male and female hormone supplements and weekly birth-control medications, as well as treatment for Alzheimer's disease, early Parkinson's disease, depression, attention-deficit/hyperactivity disorder in children (ADHD) and post-shingles pain. These patches have the advantage of not causing gastric irritation and they're less likely to affect the liver."

An important advantage of transdermal patches is ease of compliance. It is generally accepted in the medical community that the less frequently a drug is dosed, the higher patient compliance will be. Because of its sustained release capability, a single patch can be used in place of several repeated doses of oral medications, leading to better compliance. In fact, it may be said that transdermal administration combines the relative ease of oral medication with many of the advantages of IV (intravenous) administration (see above).

Another advantage of transdermal patches is that a lower total dose of the medication is required and that the patches maintain an even level of medicine within the blood.

However, many substances are not amenable to the transdermal route of administration. The substance to be transmitted in this fashion must be composed of small enough molecules (low molecular weight) that it can be absorbed across the skin. There is a limited number of drugs and chemicals that are candidates for such delivery because *few molecules yield skin permeability coefficients sufficiently high to develop clinically active plasma levels***.** An example of a molecule that is <u>not</u> capable of being medicated in this fashion is insulin. Clearly, the transdermal route of administration would be preferable to injection; however, the insulin molecules are simply too large to be absorbed across the skin. By comparison, thiamin hydrochloride (B-1 thiamin) molecules are of sufficiently low molecular weight to be medicated across the skin.

In sum, transdermal medication offers a readily accepted, non-toxic, carefully regulated dosing system that eliminates the need for multiple dosings over a sustained period.

For a small number of persons who are allergic to adhesive, patches may cause skin irritation.