CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR

SCHOOL OF PHARMACEUTICAL SCIENCE

TRANSDERMAL DRUG DELIVERY SYSTEM

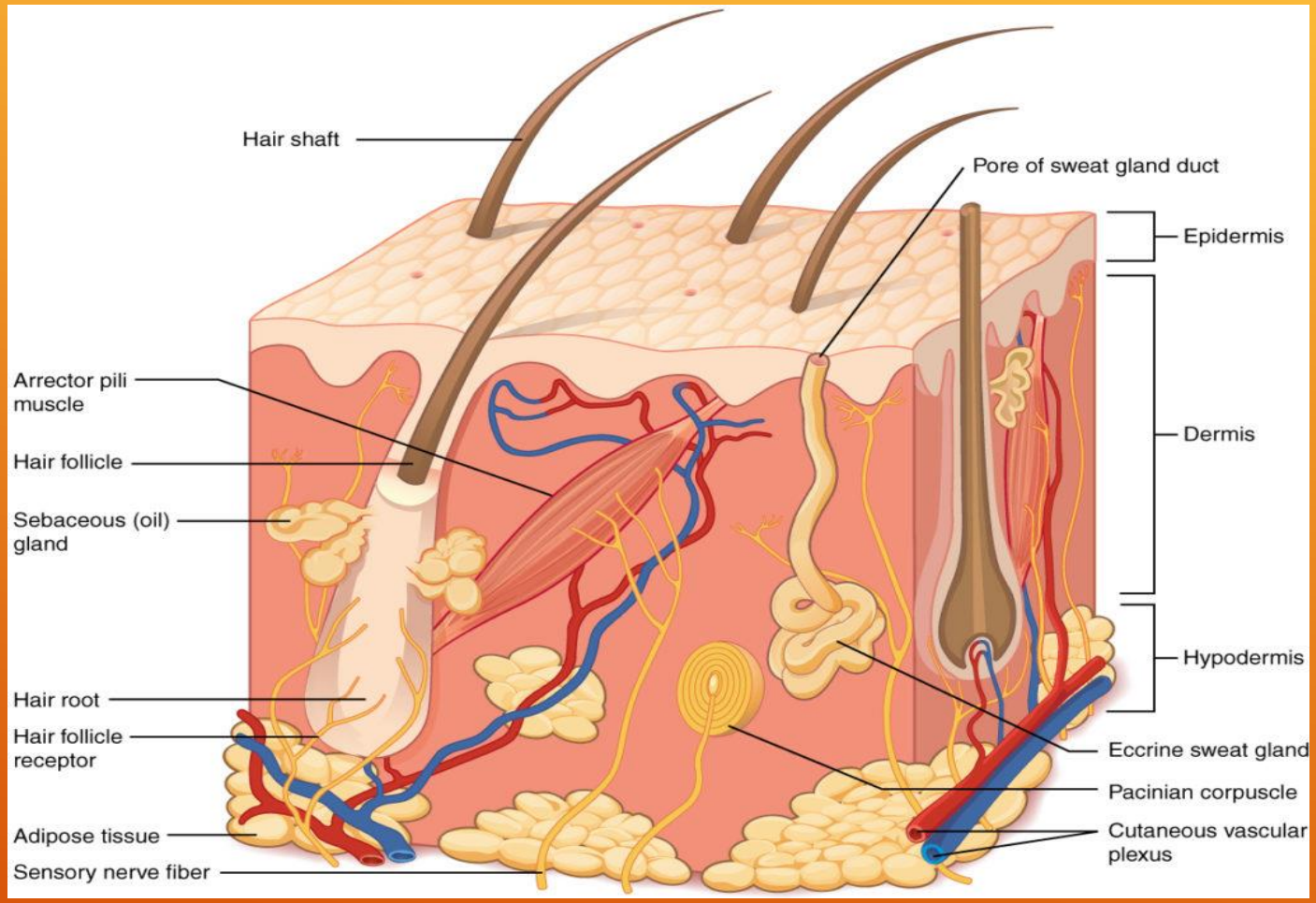
INTRODUCTION

- Transdermal therapeutic are defined as self contained discrete dosage form which when applied to the intact skin deliver the drugs, through the skin, at a controlled rate to the systemic circulation.
- Transdermal drug delivery system (TDDS) are systems that utilize skin as a site for continuous drug administration into the systemic circulation.

HISTORY

- The first Transdermal patch was approved in 1981 to prevent the nausea and vomiting associated with motion sickness.
- The FDA has approved, till 2003, more than 35 Transdermal patch products, spanning 13 molecules (In USA).
- The US Transdermal market approached $1.2 billion in 2001.
- It was based on 11 drug molecules: fentanyl, nitroglycerin, estradiol, ethinylestradiol, norethindroneacetate, testosterone, clonidine, nicotine, lidocaine, prilocaine, and scopolamine.
- Two new, recently approved Transdermal patch products (a contraceptive patch containing ethinylestradiol and nor elgestromin ,and a patch to treat overactive bladder, containing oxybutynin.

STRUCTURE OF SKIN



STRUCTURE OF SKIN

- Anatomically the skin has many histological layers, but it is divided into three layers.

  1. Epidermis .
  2. Dermis .
  3. Subcutaneous tissue.

EPIDERMIS

- The epidermis is divided into following parts The stratum corneum and stratum germinativum.
- The stratum corneum forms the outer most layer of the epidermis and consists many layers of compacted , flattened, dehydrated keratinized cells in the stratified layer .
- Water content of stratum corneum is around 20%.
- The moisture required for stratum corneum is around 10% (w/w) to maintain flexibility and softness.

- The stratum corneum is responsible for the barrier function of the skin and behaves as a primary barrier to the percutaneous absorption.
- It is made up of three layers in thicker parts – stratum granulosum,stratum lucidum, stratum spinosum.
- Removal of these layers results in increased permeability and water loss.

DERMIS

- The dermis is made up of regular network of robust collagen fibers of fairly uniform with regularly placed cross striations .
- This network or the gel structure is responsible for the elastic properties of the skin.
- Below the dermis there is a fat containing subcutaneous tissue .
- Upper portion of the dermis is formed into ridges containing lymphatics and nerve endings.

SUBCUTANEOUS TISSUE

- This is a sheet of the fat containing areolar tissue known as the superficial fascia. attaching the dermis to the underlying structures .

COMPONENTS OF TDDS

- The components of the transdermal drug delivery system include.
- Polymer matrix or matrices.
- The drug.
- The permeation enhancers.
- Other excipients.

POLYMER MATRIX

- It releases the drug from the device and should satisfy the following criteria.
- It should be stable , non reactive with the drug, easily manufactured and fabricated into the desired product.
- The polymer and its degradation products must be non toxic or non antagonistic to the host.
- The polymers used in the transdermal drug delivery systems are –
- Natural polymers – cellulose derivatives ,zein,gelatin , shellac.
- Synthetic elastomers- poly butadiene,hydrin rubber, poly siloxane silicone rubber,nitrile.
- Synthetic polymers-polyvinyl chloride, polyethylene, poly propylene, polyacrylate ,polyamide ,polyurea.

DRUG

- For successful development of a transdermal drug delivery, the following are the desirable properties of a drug for transdermal drug delivery.
- Physicochemical properties.
- Biological properties.

PHYSICOCHEMICAL PROPERTIES

- Non-ionic.
- Low molecular weight (less than 500 Daltons).
- Adequate solubility in oil and water . □ Low melting point (less than 200℃).
- Potent (dose is less than 50 mg per day, and ideally less than 10 mg per day)

BIOLOGICAL PROPERTIS

- The drug should be potent with a daily dose of order of a few mg/ day.
- The half life of the drug should be short.
- The drug must not induce a cutaneous irritant or allergic response.
- Drugs degraded in the GIT or inactivated by the hepatic first pass are suitable candidates for transdermal drug delivery.

PERMISSION ENHANCER

- These are compounds which promote skin permeability by altering the skin as a barrier to the flux of the desired penetrant .
- The flux of the drug (J) is given by-
- $J = D \frac{dc}{dx}$
- D= diffusion coefficient
- C = conc. of the diffusing species .
- X= spatial coordinate

REFERENCE

- Y. W. Chien, Novel drug delivery systems, 2nd edition, Revised & expanded, Marcel Dekker, Inc., New York, 1992.
- N. K. Jain, Controlled & Novel drug delivery, CBS Publishers & Distributors, New Delhi, First edition, 1997.
- Controlled drug delivery devices by Pravin Tyle, Marcel Dekker, Inc., New York, 1992, pg. no. 406 – 408.
- Mechanisms of Transdermal drug delivery system by Y. W. Chien, Marcel Dekker, Inc., New York. www.google.com

THANK YOU

BY- Shivam