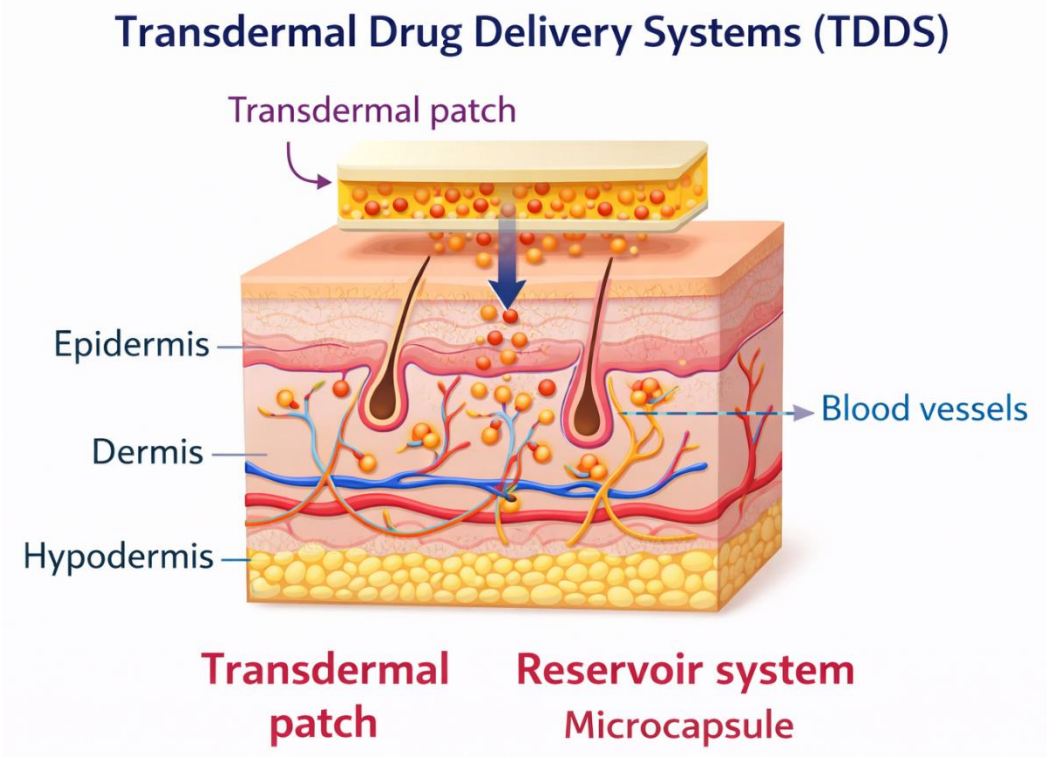
Transdermal Drug Delivery Systems

Introduction to Transdermal Drug Delivery Systems (TDDS)

- Transdermal Drug Delivery Systems (TDDS) are self-contained, discrete dosage forms designed to deliver drugs through the skin at a controlled rate directly into the systemic circulation.
- These systems, commonly available as patches or gels, provide a non-invasive and effective method for administering medications.



Advantages

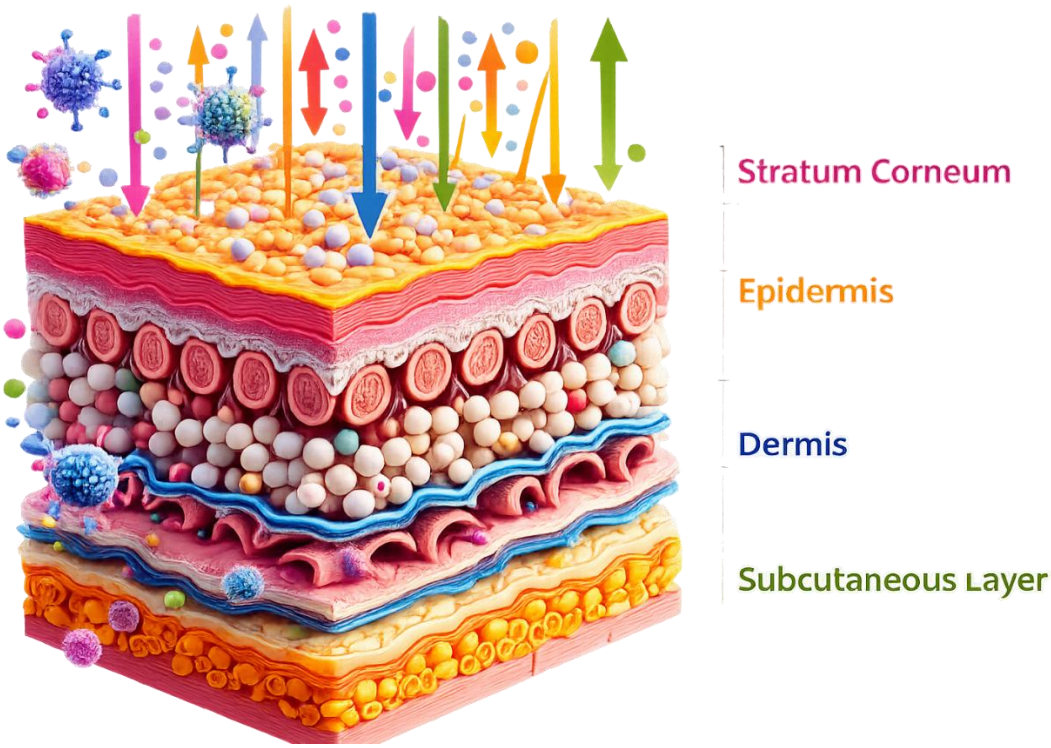
1. **Bypass First-Pass Metabolism:** Avoids liver metabolism, reducing drug degradation.
2. **Sustained Release:** Maintains constant drug levels, improving effectiveness and reducing side effects.
3. **Patient-Friendly:** Non-invasive, convenient, and reduces dosing frequency.
4. **Less Side Effects:** Targeted delivery minimizes systemic side effects.
5. **Easy Termination:** Therapy can be stopped by simply removing the patch.

Disadvantages

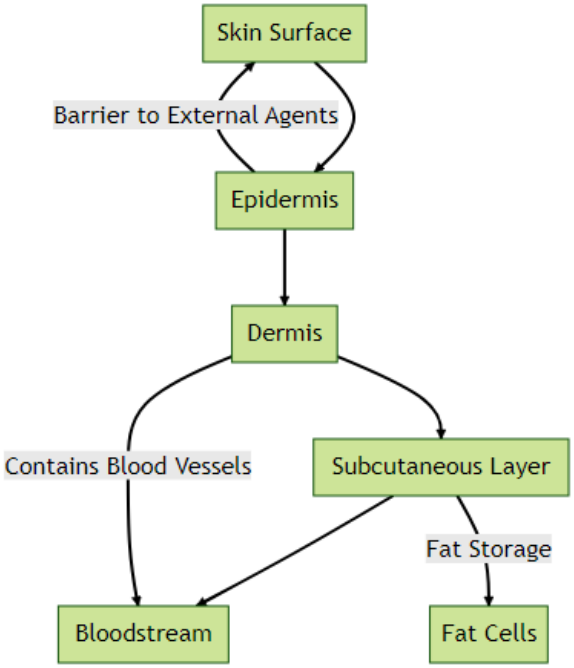
1. **Skin Irritation:** May cause local reactions.
2. **Skin Barrier:** The outer skin layer limits drug penetration.
3. **Drug Suitability:** Only works for potent drugs with specific properties.
4. **Drug Residue:** Wastage may occur due to leftover drug in the patch.
5. **Visibility:** Some patients may find patches cosmetically unappealing.

Permeation through Skin

- Permeation through the skin involves the drug passing through various layers:
  - **Stratum Corneum:** The outermost layer, composed of dead keratinized cells, acts as the primary barrier.
  - **Epidermis:** Below the stratum corneum, containing living cells and blood vessels.
  - **Dermis:** The deeper layer housing nerves, glands, and connective tissue.
  - **Subcutaneous Tissue:** The innermost layer with fat and connective tissue.



- For effective permeation, drugs must navigate these layers, primarily traversing the stratum corneum via intercellular (between cells), intracellular (through cells), or transappendageal (through hair follicles and sweat glands) pathways.



Anatomy of the Skin

- The skin, the body's largest organ, performs vital functions such as protection, sensation, temperature regulation, and vitamin D synthesis.

It consists of three main layers:

1. **Epidermis**

   Function:

   - Protection

   Sub-layers:

   - **Stratum Corneum:** Outermost layer of dead, keratin-filled cells; primary barrier to drug permeation.
   - **Stratum Lucidum:** Thin layer found only in palms and soles.
   - **Stratum Granulosum:** Produces keratin for skin strength.
   - **Stratum Spinosum:** Contains immune cells to fight infections.
   - **Stratum Basale:** Site of new skin cell formation and melanin production.

2. **Dermis**

   Function:

   - Structural integrity

   Components:

   - Collagen and elastin fibers for strength and elasticity
   - Blood and lymph vessels for nourishment and immune responses
   - Nerve endings for sensation
   - Sweat and sebaceous glands for temperature regulation and skin hydration
   - Hair follicles

3. **Hypodermis (Subcutaneous Layer)**

   Note:

   - Not technically part of the skin

   Components:

   - Adipose tissue for insulation and cushioning
   - Larger blood vessels
   - Connective tissue

Accessory Structures

- **Hair:** Protection, sensory input, thermoregulation

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