#MUCOSAL DRUG DELIVERY SYSTEM

The drug delivery System through which drug attached to the Epethetia tissue or mucus coat of the tissue surface, Phenomenon is known as mucoadhesion

→ the polymer of can interact with ~~Syn~~ mucin surface

→ Polyma may be Synthetic or Natural.

→ These drug's Polymers can stick / adhere to the Surface on hydration and Provide effective action to the Target Site.

→ The drug / Polymer and Biological membrane / tissue held or attached together through Interfacial Forces.

☆ Biological System's adhesion classified in 3 Cases:

→ Interaction between 2 Biological Phases (Eg. Platelet aggregation and wound healing)

→ Interaction of Biological Phase to artificial Substrate (Eg. Cell adhesion / Interact to culture dishes)

→ Interaction of an artificial material to a biological substrate.

(e.g. adhesion of Synthetic hydrogels to soft tissue)

★ Advantages of Mucoadhesive Systems

→ Readily reach to the particular region to provide great Bioavailability of drugs.

eg- testosterone, vasopressin, Dopamine, Insulin and gentamycin etc.

→ Enhance contact of drug formulation with underlying absorption surface.

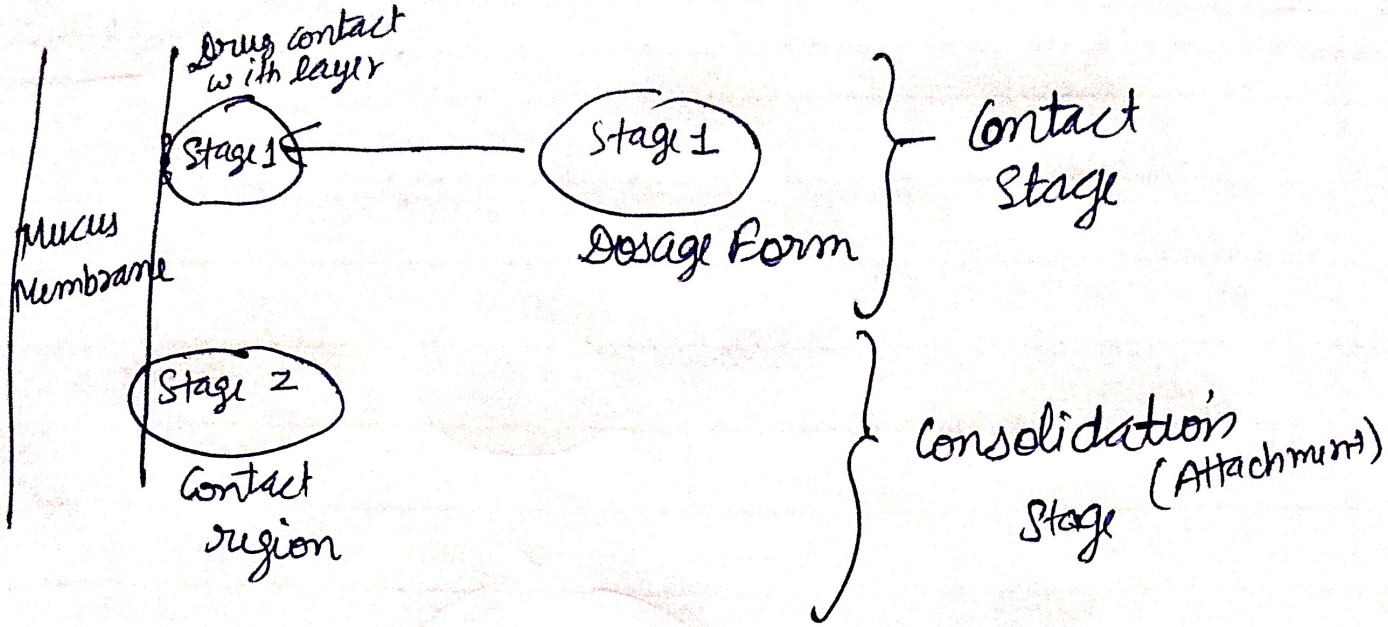
↓

Allow tissue permeability for absorption of macromolecules (Large molecules).

e.g- Peptides and Proteins.

→ Prolong residence time of dosage form at Site of Application

★ Stages of Mucoadhesion



Contact Region

When any dosage form can administered (Stage 1)

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To the site of Action having mucus membrane

↓

Then it (drug) can contact and start therapeutic effect.

★ Mechanism of Mucoadhesion

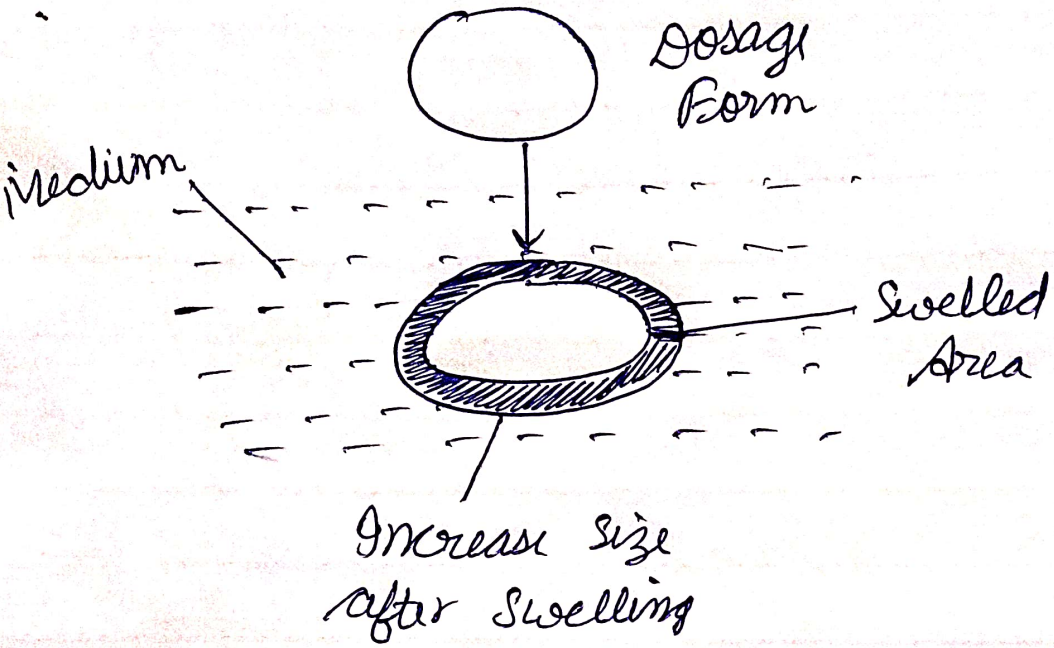
Steps

① Wetting & Swelling of Polymer

② Interpenetration between the Polymer chains and mucosal membrane

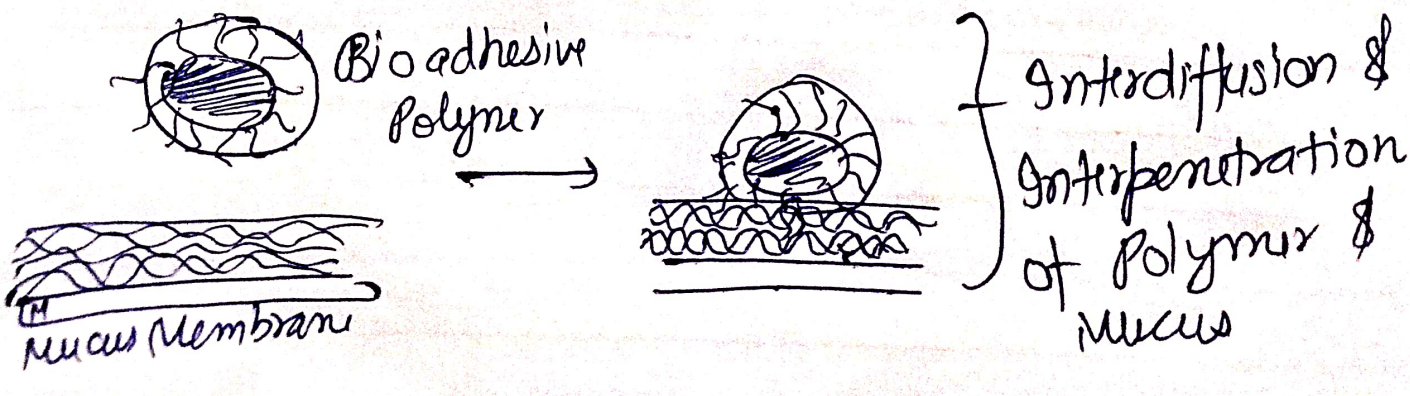
③ Formation of Chemical bonds b/w the Entangled chain.

Step-1 :- The polymer can wet and swelled over the mucosal membrane surface for develop contact with substrate.



Step-2 :- The Interdiffusion and Interpenetration takes place between chains of mucoadhesive polymers and mucous gel network crease great area contact.

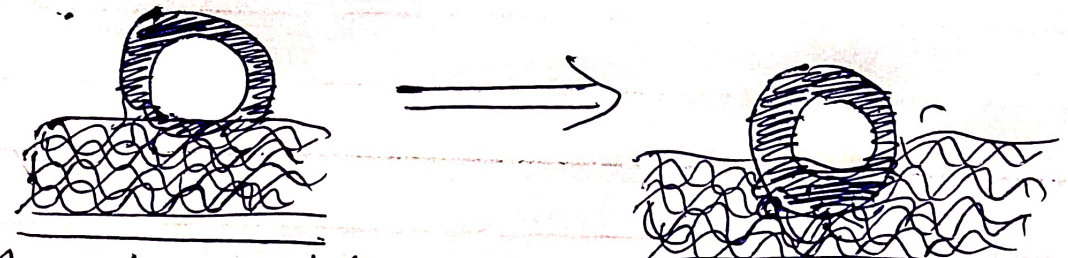
→ The strength (Strongness) of Bond depends on the degree of penetration between 2 polymer groups.



Step 3 :- In this step, formation of weak bonds as well as Secondary Bonds between Polymer chains & mucin molecules.

→ The types Bonding formed between the chains include Primary bonds such as covalent bonds and weaker interactions such as Vander waals Intesactions and hydrogen Bonds.

→ These Bonds help in formation in Strong adhesions between polymers.



Interpenetration b/w Polymer and mucus

Entanglement of Polymer and mucus

☆ The Phenomena of Bioadhesion occur By a complex mechanism. 6 theories have been proposed which will Explain mechanism of Bioadhesion.

Theories

- Electronic Theory
- Wetting Theory
- Adsorption Theory
- diffusion Theory
- Mechanical Theory
- Cohesive Theory

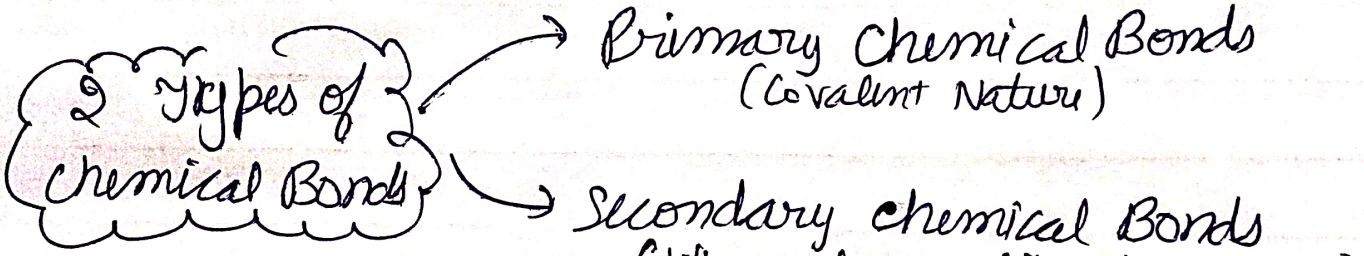
Electronic Theory :- It involves the formation of Electric double layer at the mucoadhesive interface by transfer of electrons between mucoadhesive Polymer and mucin glycoprotein network.

Wetting Theory :- It states that if contact angle of liquids on substrate surface is lower, the there is greater affinity for liquid to substrate surface.

→ If 2 substrate surfaces are brought in contact with each other in the presence

liquid, the liquid may act as an adhesive amongst the substrate surfaces.

Adsorption Theory :- According to this theory, after initial contact between 2 surfaces, the matial adheres because of surface force acting between the atoms in 2 surfaces.



contact angle $\propto \frac{1}{\text{adhesion}}$

Diffusion Theory: According to this Theory, polymer chains and mucus mix to create a semi-permanent adhesive Bond

→ The Exact depth to which the polymer chain penetrates the mucus depends

on diffusion coefficient and time of contact.

Mechanical Theory: It Explains the diffusion of liquid adhesives into micro-cracks and irregularities present on the substrate surface by forming an interlocked structure which gives rise to adhesion.

Cohesive Theory :- It Proposes the phenomena of adhesion are mainly due to intermolecular interaction amongst like molecules.

→ The Bio-adhesion can be broadly classified into 2 categories :

- Chemical :- Electronic and adsorption theory
- Physical :- Wetting, diffusion and cohesive Theory.

★ APPLICATION

→ Vaccine delivery for treatment of disease like :- hepatitis, influenza, birth control.

→ Passive targeting of leaky tumour vessels, active targeting of tumous cells, antigens, by IV application.

→ Chemoembolization is an Endovascular therapy, which involve arterial Embolization of tumour together with simultaneously local delivery the Chemotherapeutic agent.

→ These microspheres have been extensively studied and used for targeting purposes.

↳ Release of protein, hormones & peptides over Extended period of time

↳ Gene therapy with DNA plasmids & delivery of insulin.

⇒ Topical porous microspheres :- Micro Sponges are porous microspheres having interconnected Voids of particles size range 5- 300 μm. These micro Sponges having capacity to Entrap wide range of active ingredients Such as Emollients, fragrance, Essential oils etc used as topical carrier System.

⇒ Surface modified microspheres :- changes the surface properties of carriers to protect them against Phagocytic clearance and to change body distibution pattern.