

# [Nano-based of the human body covering almost 2m2](https://assignbuster.com/nano-based-of-the-human-body-covering-almost-2m2/)

Nano-based transdermal and intravenous drugdelivery systemsIntroductionSkin is the readily accessible largest organ of the human bodycovering almost 2m2 and each cm2 contain approx 10-70 hair follicles and 180-250 sweatducts. In recent times, transdermal drug delivery system (TDDS) has gained much interest as noninvasive technique emerged in the medical science. With the advent ofnano-synthesis of drug molecules or formulations, TDDS got much need boostmajorly due to improved patientcompliance and increased efficacy.

In TDDS, drug in a self containeddiscrete form known as patch (2, 3), are appliedto skin and drug is delivered in controlled manner to systemic circulationthrough the skin 4 5. TDDS is designed in such away that it delivers drug at preset rate without inter and intra patientvariation. 3 Currentlytransdermal delivery is one of the most promising methods for drugapplication. 6 TDDS has many advantages likeimproved patient compliance, less side effects, and lesser drug overdosing etc. however, it is stillchallenging because skin is a protecting barrier to water as well as toendogenous or exogenous materials (drugs/chemicals) owing to its multilayeredstructure. The outer layer of the skin acts as a shield; as it is comprised ofcorneocytes interspersed in lipid rich complex which is the primary factor forits barrier like property. To overcome the barrier, many new improvedtechniques have been developed to enhance the drug bioavailability as well asdevelopment of new range drugs to be administered transdermal/ topically.

Rationale of TDDSWhy and When TDDS is important?? Intravenousdrug delivery is invasive and apprehensive in nature though it has advantage ofbypassing first pass metabolism. TDDS offers many advantages over otherdelivery systems e. g.

1) Skin is the largest readily accessible organ (1 to 2 m2)for absorption and its non invasive and patient compliant. 2) TDDS can releasedrugs (having short half life and narrow therapeutic indices) more systemicallyin to system. TDDS is not meant for achieving rapid bolus druginputs or for the drugs having high oral bioavailability and infrequent dosingregimen rather, TDDS is designed with the aim to give slow, sustained deliveryof the drug over a period of time. Drugs which cause tolerance development inpatients and drugs requiring chronopharmacological management are leastcandidates of TDDS.

The likely candidateof TDDS must be highly potent i. e. requiring therapeutic blood concentrationsin the ng/ ml range or less. Owing to selective diffusion of SC, not all typesof the drugs can cross this barrier and daily drug dose is limited to 10 mgonly systemically by a patch. Transdermal drug delivery systems possessnumerous advantages and disadvantages as given in table1.

Advantages Disadvantages Self-administration of drug in controlled /continuous manner is possible, in case of adverse effect drug administration can be  stopped by removal of  patch removal Large dose administration ( i. e. more than 10 mg/ day) is problematical   Delivery of drug is not affected by food and gastrointestinal (vomiting or diarrhea) problems Not suitable for drugs having size more than 500 Dalton   First pass metabolism in the liver does not take place, hence lower doses of drug given, leading to lesser chances of side effects. High plasma drug concentration is difficult to achieve   Hepatic induction likelihood lessens.   High drug dose may cause allergies/irritation It can be administered to patient having facial injuries. Ionic drugs not easy to administer and drugs having low or high partition coefficient do not reach systemic circulation It requires less frequent dosing regimen and non invasive and patient complaint.   Skin permeability variation within same person (from one site to another),  from person to person and with age Easy to prepare and transport Contact between skin and device/patch is problematic since they usually falloff due to wetting effect of sweat or water (during bathing)   Drug absorption route through theSkinIn skin, drug permeation takes place by diffusionthrough different layers of skin as well as through hair follicles and sweatglands and the intrinsic physicochemical properties of the drugs governs theflux of the molecules through these routes.

As discussed in previous section usually acts as a barrier for effectivedrug delivery but other routes of systemicabsorption are also present. Differentpermeation routes are recognized in TDDS (Fig.): a) Intercellular; b)intra/transcellular; c) transappendegeal route.