
SOLUTION-PHARMACY

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# Route of Drug Elimination

# Pharmacology

Route of Administration and Route of Drug Elimination

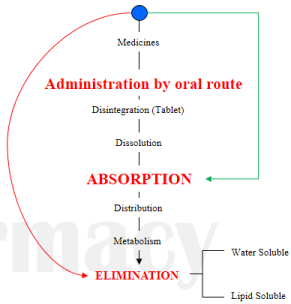
**Pharmacology**- Pharmacology is a complete study of effect by a drug and response by the body for the drug taken. Simply we can say it is the study of Pharmacokinetic and Pharmacodynamics properties. The route of drug administration and route of drug elimination comes under the Pharmacokinetic. Which means what does body do to the drug. Because only body can absorb and eliminate the drug. Example of Pharmacokinetic are- ADME- Absorption, Distribution, Metabolism and Elimination.

**Route of drug administration**- Route of drug administration means the way from which or route from which any drug is administered in the body. It is classified according to its site of administration (Solution has Already uploaded a lecture video on- Route of drug administration)

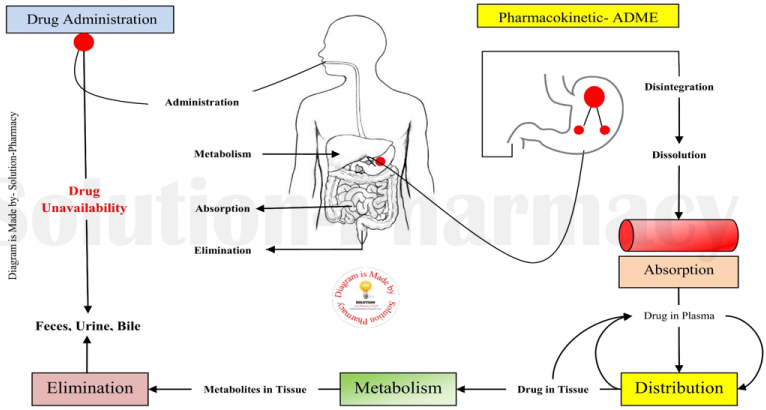
**Route of drug Elimination**- Route of drug elimination means the way or route by which drug either in active form or inactive form get excreted or eliminated from the plasma. Elimination of drugs basically depends on various parameters but here we are discussing about the routes only.

Route of drug Elimination- Urine (kidney) Stools, Milk, Sperm, Exhaled air, Sweating, Saliva,






1. Oral Route- Tablet or Capsule, Syrup, Solution
2. Sublingual- Nitro-glycerine (Anti Asthmatic)
3. Buccal- Buccal Patches
4. Inhalational- Anaesthetic and anti asthmatic drugs
5. Intravenous- Injection of medicines
6. Intramuscular- Injection of Medicine
7. Topical- Cream and lotion
8. Vaginal- Suppositories
9. Rectal- Suppositories and Anti Piles creams
10. Nasal- Nasal decongestant
11. Ophthalmic- Eye drops of atropine and other
12. Subcutaneous- Injection of Insulin

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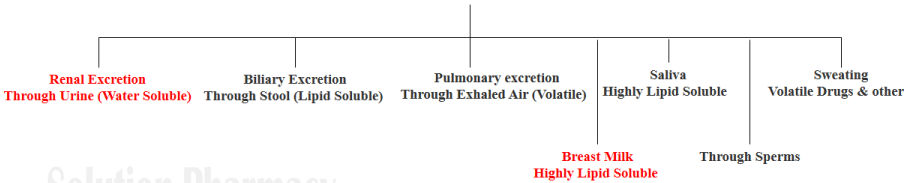
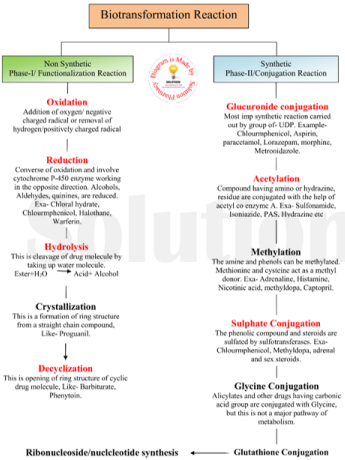
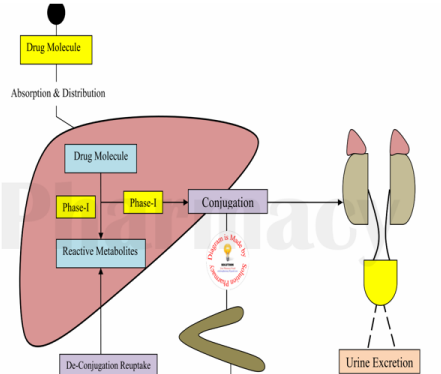
# Route of Drug Elimination

Drug excretion is the removal of drugs from the body, either as a metabolite or unchanged drug. There are many different routes of excretion, including urine, bile, sweat, saliva, tears, milk, and stool. By far, the most important excretory organs are the kidney and liver. In kidney, excretion of drugs depends on glomerular filtration, active tubular secretion, and passive tubular absorption. A drug, which is either biologically active itself or a prodrug, may be excreted in its original chemical state. Alternatively, all or a portion of a drug may undergo chemical modification and be eliminated as biologically active, or inactive, metabolites.





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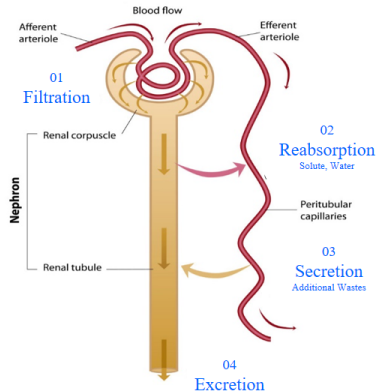
# Renal Excretion Through Urine (Water Soluble)

The major organ for the excretion of drugs is the KIDNEY. The functional unit of the kidney is the nephron and components of the nephron include Bowman's capsule, Proximal Tubule, Loop of Henle, Distal Tubule and the Collecting Duct. Low molecular weight molecules are filtered in Bowman's capsule. Active secretion of weak electrolyte drugs (acids) and reabsorption of water occurs in the proximal tubules. Additional reabsorption of water occurs in the Loop of Henle. Passive reabsorption of water and lipid soluble drugs occur in the distal tubule. Several factors, including certain characteristics of the drug, affect the kidneys' ability to excrete drugs. To be extensively excreted in urine, a drug or metabolite must be water soluble and must not be bound too tightly to proteins in the bloodstream. In people whose kidney function has declined, the "normal" dosage of a drug that is eliminated primarily through the kidneys may be too much and may cause side effects.



# Biliary Excretion
# Through Faeces (Lipid Soluble)

Some drugs pass through the liver unchanged and are excreted in the bile. Other drugs are converted to metabolites in the liver before they are excreted in the bile. In both scenarios, the bile then enters the digestive tract. From there, drugs are either eliminated in feces or reabsorbed into the bloodstream and thus recycled.

If the liver is not functioning normally, the dosage of a drug that is eliminated primarily by metabolism in the liver may need to be adjusted. However, there are no simple ways to estimate how well the liver will metabolize (and thus eliminate) drugs like there are for kidney function. Once ingested food reaches the small intestine, the bile starts to work by breaking down fat so it can be distributed in the body. This is called emulsification.

Example- relatively large (mw >500Da) amphipatic molecules, Cholephilic organic anions

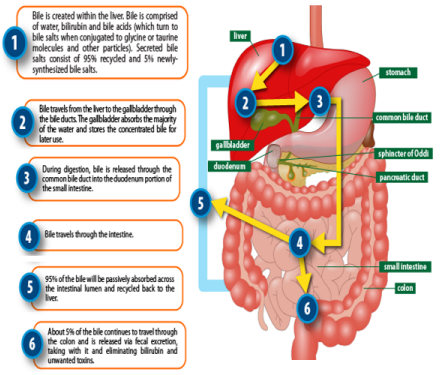



Image reference- https://cdn6.bigcommerce.com/s-yk70z5i/product_images/uploaded_images/bile-circulation-rev03.png?t=1488943253

# Pulmonary Excretion Through Exhaled Air (Volatile)

The lung is the major organ of excretion for gaseous and volatile substances. The Breathalyzer test is based on a quantitative pulmonary excretion of ethanol. Most of the gaseous anesthetics are extensively eliminated in expired air. Any volatile materials irrespective to its route of administration has the potential for pulmonary excretion. Certainly gas and other volatile substances that enter the blood primarily through respiratory tract can be expected to be excreted by this route. No specialized transport system are involved in loss of substance in exhaled air simple diffusion across cell membrane is responsible for excretion. The degree of solubility of gas in blood will also affect the loss of drug through pulmonary route of excretion.

Example- Gas such as nitrous oxide which is not very soluble in blood will be excreted rapidly.

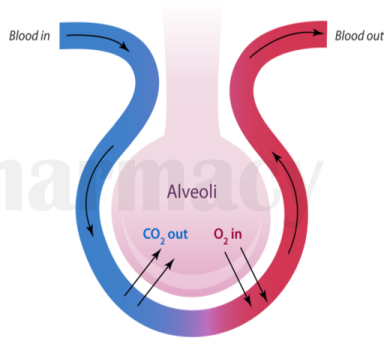



Image Reference- https://www.ck12.org/book/CBSE_Biology_Book_Class_XI/section/18.3/

# Salivary and Sweat Excretion

## (Lipid Soluble Substances)

Drug can also get excreted via saliva and sweat, but these are very minor importance for many drugs. The mechanism involve in the excretion of drug in sweat and saliva are same. Excretion of drug via these routes depends mainly on the unionized and lipid soluble form of the drugs across the epithelial gland of the cell, that's why the $pK_a$ of the drug and the pH of the individual secretion formed in the gland are very important determination of the total quantity of the drug appearing in the particular body fluids like saliva and sweat. Lipid insoluble substance like Urea and glycerol enter saliva and sweat at rate proportional to there molecular weight because of the aqueous channel in the secretory cell membrane. Substance secreted by saliva usually swallowed therefore their fate is same as that of orally administered drugs. Examples- Caffeine, Phenytoin, and Theophylline

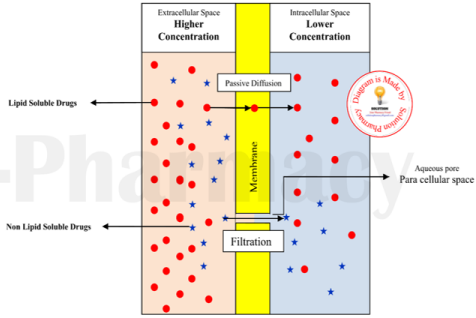



**Diagram made by Solution Pharmacy. Idea- KD Tripathi**

Passive diffusion and filtration across the lipoid biological membrane.

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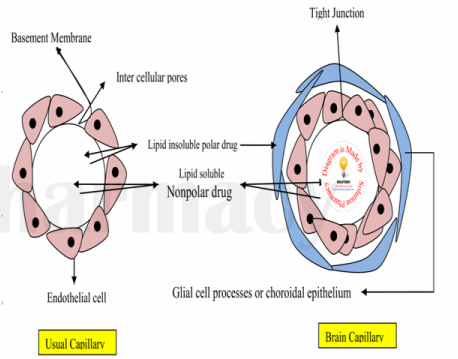
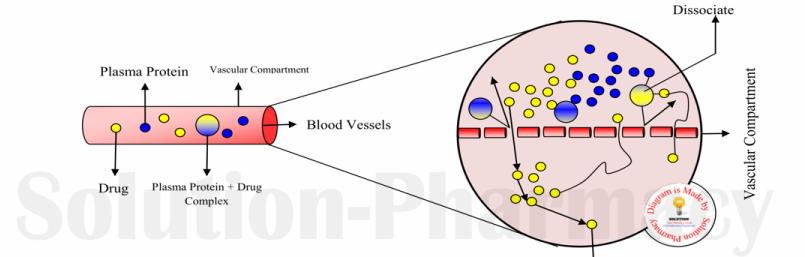
# Excretion

## Through Mother Milk (Lipid Soluble Substances)

Drug passage into mature milk depends on several factors, including the molecular weight, lipid solubility, protein binding, degree of ionization, volume of distribution, half-life, and pKa of the drug. Agents that easily cross the blood-brain barrier usually enter breast milk more readily. The mammary epithelium is a lipid membrane, making lipid-soluble drugs more likely to penetrate into milk. Water-soluble agents weighing less than 200 Da cross into milk readily, passing through aqueous pores surrounding alveoli in the breast. Drugs up to 800–1000 Da can cross into milk; however, larger molecules enter milk in lower quantities. High protein binding, ionization, and low serum concentrations decrease the likelihood of the drug entering the milk. Most drugs enter milk by simple diffusion; some pass by carrier-mediated diffusion. Examples- nitrofurantoin, cimetidine, ranitidine, acyclovir, iodides) are actively transported.








Plasma Protein Binding

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