

Drug penetration through membranes

A drug, like any other substance, can cross membranes by several different mechanisms.

Passive transition

Diffusion

Diffusion is a simple transition that always occurs after a concentration gradient. Can be described 1. Fick's law, in the case of transition through the membrane, the partial derivative can be replaced by the difference in concentrations on both sides of the membrane and the thickness of the membrane:

$$\frac{dm}{dt} = -DS \frac{\partial c}{\partial x} = -DSk \frac{\Delta c}{h}$$

where D is the diffusion coefficient, S is the area over which the diffusion takes place. Sometimes it is more convenient to study the flow of a substance defined by the relation:

$$J_m = \frac{1}{S} \frac{dm}{dt}$$

Filtration

Filtration is a non-specific transfer across pores driven by a pressure gradient. It allows the passage of only substances with a molecule smaller than the pore opening. It is not widely used in pharmacology.

Facilitated Diffusion

Facilitated diffusion is a special case of transfer across a membrane in the direction of a concentration gradient. A special carrier must be present for a given molecule, which allows it to pass through an otherwise impermeable membrane. From the macroscopic point of view, it differs from the previous phenomena primarily in that it is a saturable process. The kinetics is described by the Michaelis and Menten equation:

$$\frac{dc}{dt} = \frac{v_{max}c}{K_m + c}$$

Active transport

Active transport is the selective transfer of a substance across a membrane. This action consumes energy and can therefore also take place against the concentration gradient. Energy is obtained either by splitting ATP or by simultaneously transferring another substance down the concentration gradient. If only one substance is transported, we speak of a uniport. If two substances are transported, it can be symport, if both substances are transported in the same direction, or antiport, if they are transported in different directions. It is, of course, a saturable process with Michaelis and Menten kinetics.

Endocytosis

Endocytosis is an active non-specific process that consists in the absorption of part of the membrane. It takes place mainly in the tubules of the kidneys and in some sections of the small intestine. It is not of great importance in pharmacology.

Links

Related Articles

Used literature

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- LÜLLMANN, H, K MOHR a M WEHLING. *Farmakologie a toxikologie*. 15. vydání. Praha : Grada, 2004. ISBN 80-247-0836-1

