

Drug Receptors

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molecular targets for drugs

- receptors
- ion channels
- enzymes
- carrier molecules
- DNA
- non specific

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non specific targets

- osmotic diuretics
- radioactive iodine

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DNA

- many antibiotics
 - bacterial DNA
 - mammalian DNA
- anticancer drugs

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carrier molecules

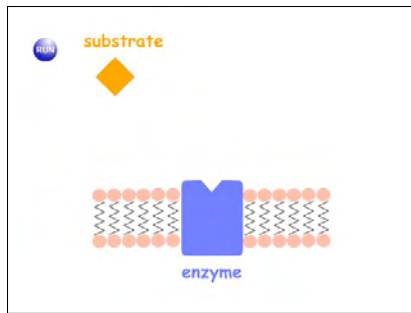
- transport small molecules into or out of cells
 - many antidepressants
 - ivermectin

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enzymes

- compete with substrate
- false substrate
- prodrugs

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enzymes

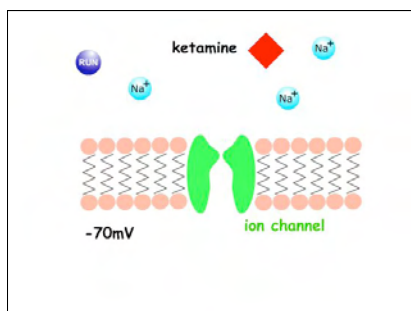
- most antibiotics
- organophosphate insecticides
- aspirin type drugs

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ion channels

- most drugs block rather than open channels
- do not confuse with ionotropic receptors!!

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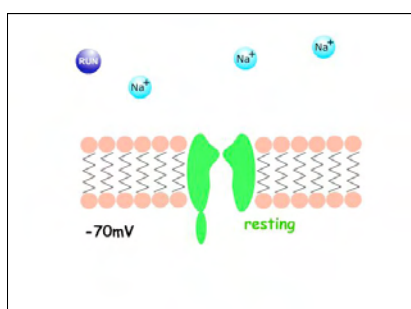


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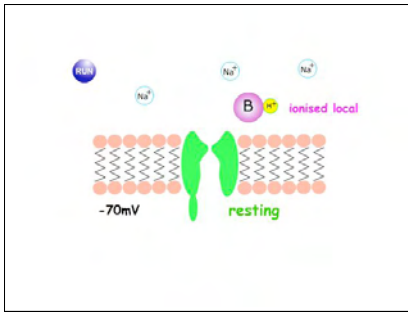
ion channels

- ketamine
- local anaesthetics

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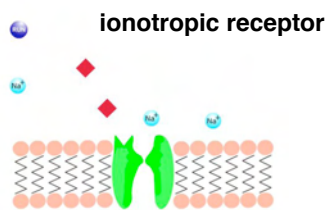


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receptors

- ionotropic receptors
- metabotropic (G protein coupled) receptors
- tyrosine kinase coupled receptors
- nuclear receptors

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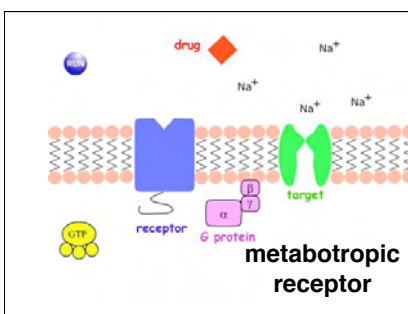


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ionotropic receptors

- milliseconds
 - nicotinic ACh receptors
 - AMPA receptors
 - GABA receptors

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Metabotropic receptors

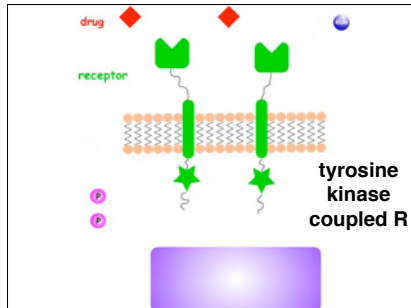
- 7 trans membrane regions
- At least 4 different G protein α subunits

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Metabotropic receptors

- Seconds to minutes
 - opioid receptors - morphine
 - adrenergic receptors - xylazine
 - muscarinic ACh receptors - atropine

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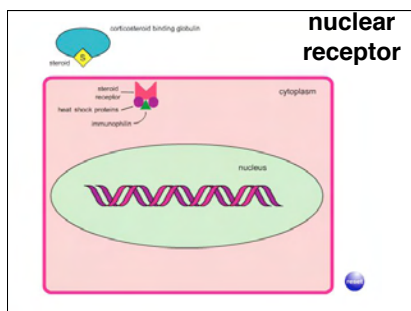


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tyrosine kinase coupled receptors

- minutes to hours
- many hormones
 - insulin
 - thyroid hormone

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nuclear receptors

- hours - days
 - corticosteroids
 - oestrogen

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receptor complexity

- transmitters act at more than one receptor
- activation of more than one receptor may be necessary for effect
- receptor numbers change according to use & disease
 - “paradoxical pharmacology”
- may be different in different tissues

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effects of disease

- autoantibodies to receptors
- mutations in genes for receptors

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Second messengers

- lots of different systems
- can get complicated!!

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receptor subtypes

- adrenergic receptors
 - α receptors
 - $\alpha1$ receptors
 - $\alpha2$
 - $\alpha2A$
 - $\alpha2B$
 - $\alpha2C$
 - $\alpha2D$
 - β receptors
 - $\beta1$
 - $\beta2$
 - $\beta3$

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specificity

- physical barriers
- receptors in tissue
- receptor subtypes
- receptor collaboration / helpers

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studying receptors

- binding experiments
- sequencing receptors
- cloning receptors
- transfection & patch clamping

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Drug action

- Drugs can produce effects by binding to receptors, enzymes, carrier molecules; by blocking ion channels or by exerting a physical effect.
- There are 4 superfamilies of receptors: ionotropic, metabotropic, kinase coupled and nuclear.
- There may be several layers of reactions in the signal transduction system between drug binding and effect.

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