

Chemical signalling **HL only**

What is a receptor?

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Ligand

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What is quorum sensing?

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How does *Vibrio fischeri* use quorum sensing?

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Name the four functional categories of signalling chemicals in animals.

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Three chemical groups of hormones, with an example of each.

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Chemical groups of neurotransmitters

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Contrast the spread of hormones and neurotransmitters.

The signalling chemical that binds to the binding site of a receptor.

A protein with a binding site for a specific signalling chemical.

Its signalling chemical builds up at high density, binds receptors, and promotes transcription of genes for bioluminescence.

Cell signalling by bacteria in which they detect their own population density and respond only when it is high.

Amines (epinephrine), proteins (insulin), steroids (oestradiol).

Hormones, neurotransmitters, cytokines and calcium ions.

Hormones are transported in the blood (distant effects); neurotransmitters diffuse across a synaptic gap (localized effects).

Amino acids (glutamate), peptides (endorphins), amines (dopamine) and the gas nitric oxide.

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Distribution of amino acids in a transmembrane receptor

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Which ligands bind intracellular receptors?

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Signal transduction pathway

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What happens when acetylcholine binds its receptor?

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How does a G protein-coupled receptor convey a signal into a cell?

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Epinephrine pathway in order

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Why do 'adrenaline' and 'epinephrine' both exist?

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What does the tyrosine kinase activity of the insulin receptor do?

Hydrophobic ligands such as steroid hormones, which pass through the plasma membrane into the cell.

Hydrophobic amino acids in the region within the membrane; hydrophilic amino acids in the parts facing water on either side.

An ion channel in the receptor opens, positive ions (Na^+) diffuse in and the membrane potential changes.

The sequence of responses within a cell set off by binding of a signalling chemical to a receptor.

Receptor $\rightarrow$ G protein $\rightarrow$ adenylyl cyclase $\rightarrow$ cAMP (second messenger) $\rightarrow$ protein kinase A $\rightarrow$ cascade, e.g. glycogen breakdown.

Ligand binding changes the receptor's shape, activating a G protein (GDP swapped for GTP) that activates or inhibits a target protein.

Phosphorylates tyrosine inside the cell, starting reactions that move vesicles of glucose transporters to the plasma membrane.

Both names refer to production by the adrenal gland above the kidney, from Latin and Greek roots; both persist in use.

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Why does insulin increase glucose uptake?

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How do steroid hormones affect gene expression?

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Target cells of oestradiol (IB example)

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Effect of progesterone on the endometrium

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Negative vs positive feedback

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Example of negative feedback in signalling

They bind and activate an intracellular receptor, which binds specific DNA sequences and promotes transcription.

More glucose transporters are inserted into the plasma membrane, so glucose enters faster by facilitated diffusion.

Maintains the thickened endometrium and its blood supply, ready for implantation.

Cells in the hypothalamus that secrete GnRH. Sustained high oestradiol late in the follicular phase increases GnRH secretion; lower levels inhibit it.

Insulin lowers blood glucose, and lower glucose reduces insulin secretion.

Negative: the response reduces the stimulus (stabilizes). Positive: the response increases the stimulus (amplifies).