Chemical Communications
Neurotransmitters & Hormones
Monoamine messengers

- These monoamines transmit signals by a mechanism whose beginning is similar to the action of acetylcholine, that is, they are absorbed on a receptor.

Epinephrine (salt form)

Norepinephrine (salt form)
End 10/5/16 class
Removal of the signal:

- When the neurotransmitter or hormone dissociates from the receptor, the adenylate cyclase stops the synthesis of cAMP.
- The cAMP already produced is destroyed by the enzyme phosphodiesterase, which catalyzes the hydrolysis of one of the phosphodiester bonds to give AMP.
- The amplification through the secondary messenger (cAMP) is relatively slow. It may take from 0.1 s to a few minutes.
- In cases where transmission must be fast, a neurotransmitter, such as acetylcholine, acts on membrane permeability directly without a second messenger.
Removal of neurotransmitter:

- The body inactivates monoamines by oxidation to an aldehyde, catalyzed by monoamine oxidases (MAOs).

MAO inhibitors: antidepressants or antihypertensive agents
The action of **histamine** is similar to that of other monoamines. It is synthesized from His by decarboxylation.

\[
\text{His} \xrightarrow{\text{decarboxylation}} \text{Histamine}
\]

- **H₁ receptors** are found in the respiratory tract where they affect the vascular, muscular, and secretory changes associated with **hay fever and asthma**; **antihistamines** that block H₁ receptors relieve these symptoms. (Benadryl)
- **H₂ receptors** are found mainly in the stomach and affect the secretion of HCl; cimetidine and ranitidine block H₂ receptors and thus reduce acid secretion. (zantac, tagamet)
The first brain peptides isolated were the **enkephalins**.

- These pentapeptides are present in certain nerve cell terminals.
- They bind to specific pain receptors and seem to control pain perception.

Neuropeptide Y, a potent orexic (appetite-stimulating) agent, affects the hypothalamus.

Substance P, an 11-amino acid peptide is involved in the transmission of pain signals.
Figure 24-8 The insulin receptor has two types of subunits $\alpha$ and $\beta$. 
A large number of **hormones are steroids.**

- These hormones are hydrophobic and, therefore, cross plasma membranes by diffusion.
- Steroid hormones interact inside cells with **protein receptors.**
- Most of these receptors are located in the nucleus, but small numbers also exist in the cytoplasm.
- Once inside the nucleus, the steroid-receptor complex can either bind directly to DNA or combine with a transcription factor, a protein that binds to DNA and alters the expression of a gene, thereby influencing the synthesis of certain key proteins.
End Chapter 24