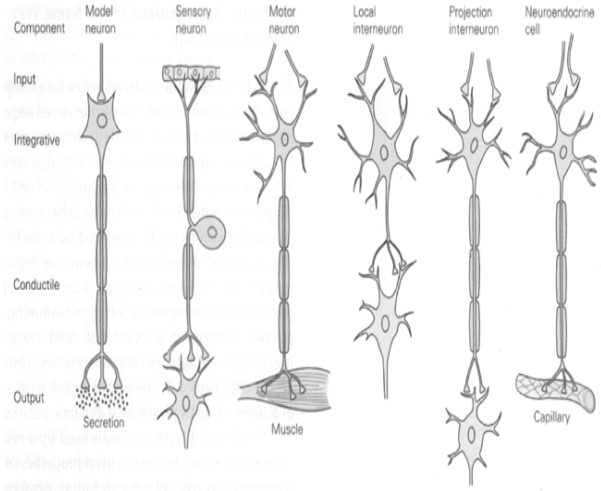
SN2
Potencial de membrana o de reposo.
Potencial de acción.
Canales iónicos

SN3
Sinapsis
Neurotransmisores
Sistemas perceptuales



Potencial de membrana o reposo

- Concepto de potencial
- Bases iónicas del potencial de reposo
- Permeabilidad de la membrana
- Modelo de circuito equivalente
- El potencial de membrana en reposo viene determinado por los canales iónicos de reposo.
-

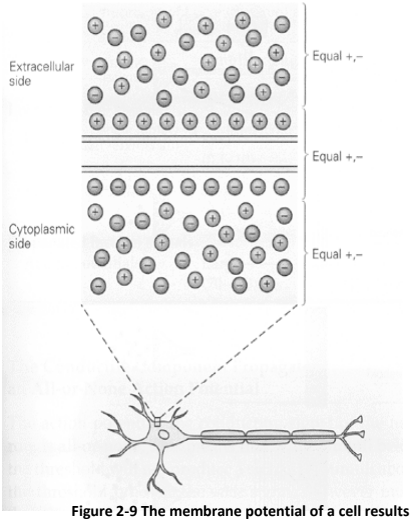
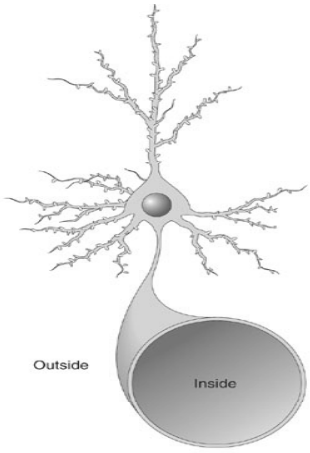


Figure 2-9 The membrane potential of a cell results from a difference in the net electrical charge on either side of its membrane. When a neuron is at rest there is an excess of positive charge outside the cell and an excess of negative charge inside it.



Ecuación de Goldman

$$V = 58 \log \frac{P_K[K_2] + P_{Na}[Na]_2 + P_{Cl}[Cl]_1}{P_K[K1] + P_{Na}[Na]_1 + P_{Cl}[Cl]_2}$$

V = voltaje a través de la membrana
P = permeabilidad de la membrana al K, Na y Cl
Entre corchetes, las concentraciones iónicas

Outside	Inside	Ratio Outside:Inside	E_{ion} (at 37°C)
$[K^+]_o$ = 5 mM	$[K^+]_i$ = 100 mM	1:20	−80 mV
$[Na^+]_o$ = 150 mM	$[Na^+]_i$ = 15 mM	10:1	62 mV
$[Ca^{2+}]_o$ = 2 mM	$[Ca^{2+}]_i$ = 0.0002 mM	10,000:1	123 mV
$[Cl^-]_o$ = 150 mM	$[Cl^-]_i$ = 13 mM	11.5:1	−65 mV

Aproximate ion concentration on either side of a neuronal membrane

Ecuación de Nernst

Ecuación de Nernst

$$E_x = \frac{RT}{zF} \ln \frac{[X]_2}{[X]_1}$$

E = diferencia de potencial en el equilibrio
R = constante de los gases
T = temperatura absoluta
z = carga eléctrica del ión considerado
F = constante de Faraday
X1 y X2 = concentraciones iónicas

$$E_x = \frac{58}{z} \log \frac{[X]_2}{[X]_1}$$

Ion	Potencial de equilibrio
K+	-95 mV
Cl-	-90 mV
Na+	+65 mV
Potencial de reposo celular	-90 mV

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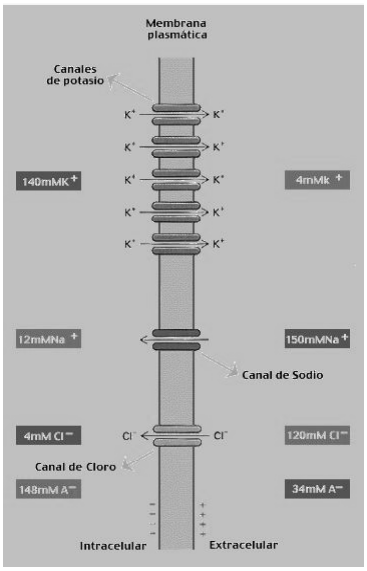
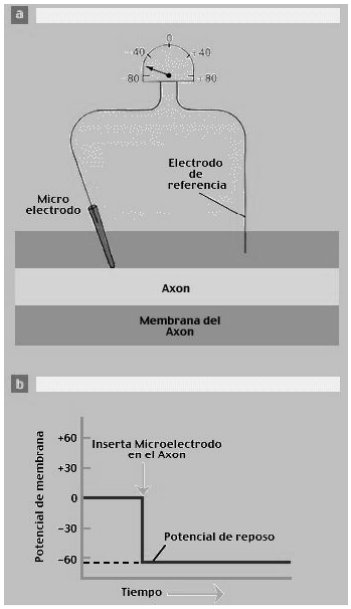


Esquema que muestra los iones más importantes involucrados en el potencial de reposo celular. Se observa alta concentración de sodio (150 mM) y baja de potasio (4 mM potasio) en el extracelular. En el intracelular la situación es inversa]



Esquema que muestra el registro del potencial de reposo o de membrana de una célula

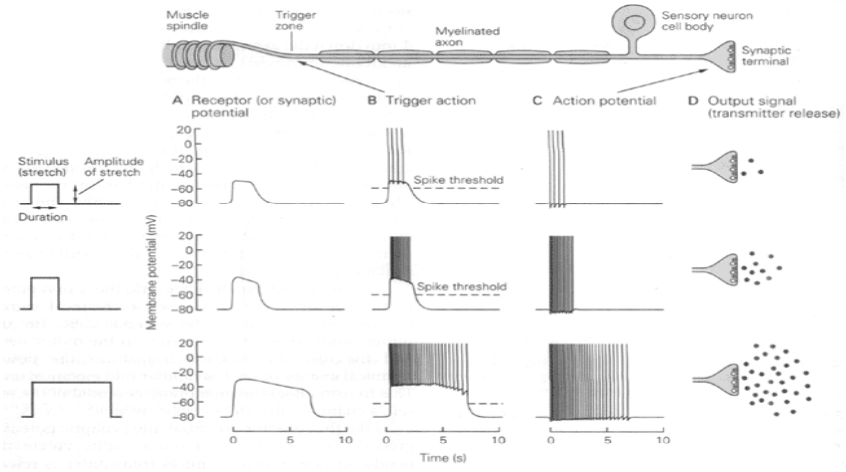
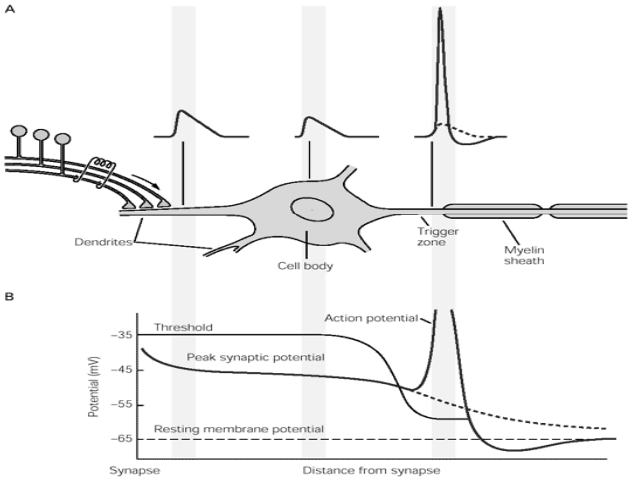
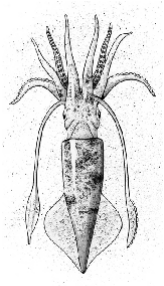


Figure 2-10 A sensory neuron transforms a physical stimulus (in our example, a stretch) into electrical activity in the cell. Each of the neuron's four signaling components produces a characteristic signal.
A. The input signal (a receptor or synaptic potential) is graded in amplitude and duration, proportional to the amplitude and duration of the stimulus.
B. The trigger zone integrates the input signal—the receptor potential in sensory neurons, or synaptic potential in motor neurons—into a trigger action that produces action potentials that will be propagated along the axon. An action potential is generated only if the input signal is greater than a certain *spike threshold. Once the input signal surpasses this threshold, any further increase in amplitude of the input signal increases the frequency with which the action potentials are generated, not their amplitude. The duration of the input signal determines the number of action potentials. Thus, the graded nature of input signals is translated into a frequency code of action potentials at the trigger zone.*
C. Action potentials are all-or-none. Every action potential has the same amplitude and duration, and thus the same wave form on an oscilloscope. Since action potentials are conducted without fail along the full length of the axon to the synaptic terminals, the information in the signal is represented only by the frequency and number of spikes, not by the amplitude.
D. When the action potential reaches the synaptic terminal, the cell releases a chemical neurotransmitter that serves as the output signal. The total number of action potentials in a given period of time determines exactly how much neurotransmitter will be released by the cell.



A. An excitatory synaptic potential originating in the dendrites decreases with distance as it propagates passively in the cell. Nevertheless, an action potential can be initiated at the trigger zone (the axon hillock) because the density of the Na+ channels in this region is high, and thus the threshold is low.
B. Comparison of the threshold for initiation of the action potential at different sites in the neuron (corresponding to drawing A). An action potential is generated when the amplitude of the synaptic potential exceeds the threshold. The dashed line shows the spatial decay of the synaptic potential if no action potential were generated at the axon hillock

Potencial de acción.



- **BASES IÓNICAS**
- En 1954, dos investigadores llamados Hodgkin y Huuxley midieron las corrientes iónicas que suceden durante el potencial de acción.
- Las bases iónicas son:
- Permeabilidad al sodio y al potasio
- Despolarización al sodio y al potasio
- Repolarización al sodio y al potasio

• PERÍODOS REFRACTARIOS

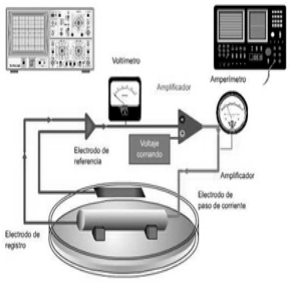
Supone una situación de inexicitabilidad de la membrana cuando una célula acaba de ser estimulada y acaba de generar un potencial de acción, el potencial de acción inmediatamente no puede generar otro.

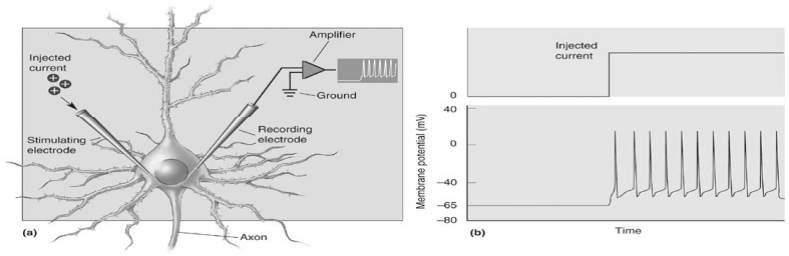
•*Absoluto*: período de tiempo inmediatamente después de un potencial de acción en donde no hay respuesta independientemente de la intensidad del estímulo que se le aplique.

•*Relativo:* período de tiempo después del período absoluto en donde si que hay respuesta pero sólo si se le aplica una intensidad de estímulo por encima del umbral de excitación de la célula

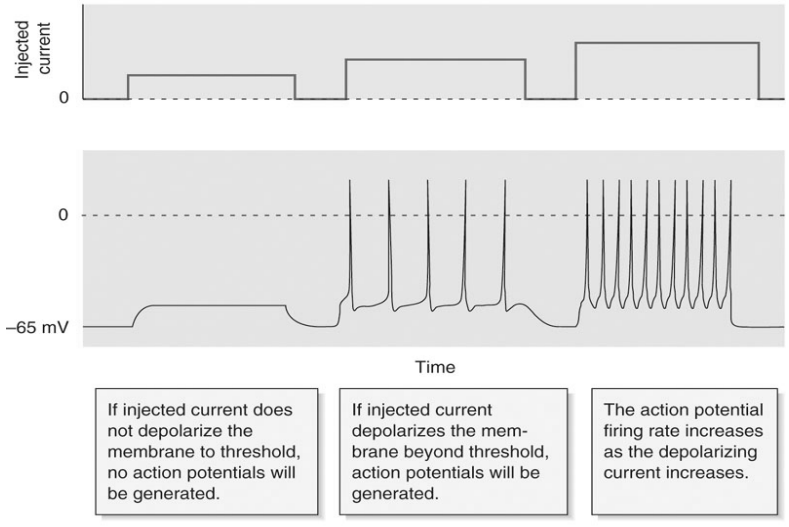
- **Factores que condicionan la velocidad de conducción**
- **El diámetro de la fibra. A mayor diámetro, mayor velocidad de conducción. Existe una relación entre el incremento del diámetro y en incremento de la velocidad de conducción.**
- **La temperatura. La velocidad de conducción se eleva progresivamente al elevar la temperatura, desde 5ºC hasta 40ºC, a partir de los 40ºC se estabiliza.**
- **Si se superan los 45ºC hay un bloqueo de la conducción nerviosa y como consecuencia la muerte, por eso es tan importante controlar la temperatura del organismo. Una fiebre que supere los 40ºC se debe bajar porque podría causar daños irreversibles en el sistema nervioso.**

La edad de la fibra. La velocidad de la fibra es mayor en función de la edad y se detiene manteniendo una velocidad fija cuando se llega a la pubertad





The effect of injecting a positive charge into a neuron



The dependence of action potential firing frequency on the level of depolarization

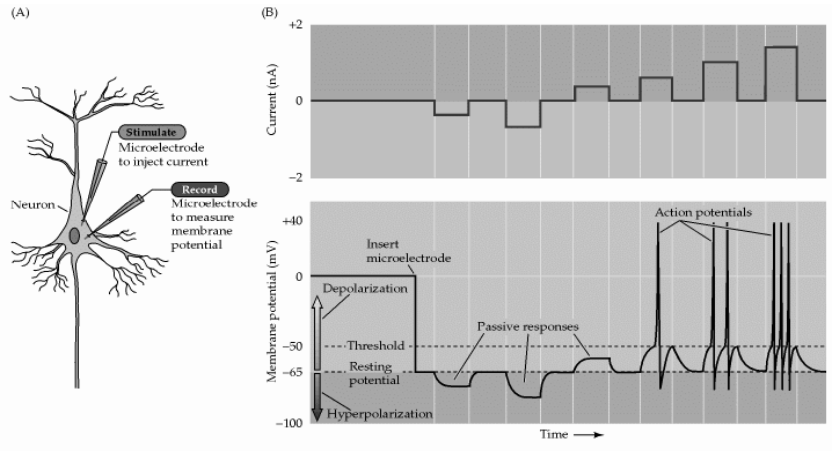
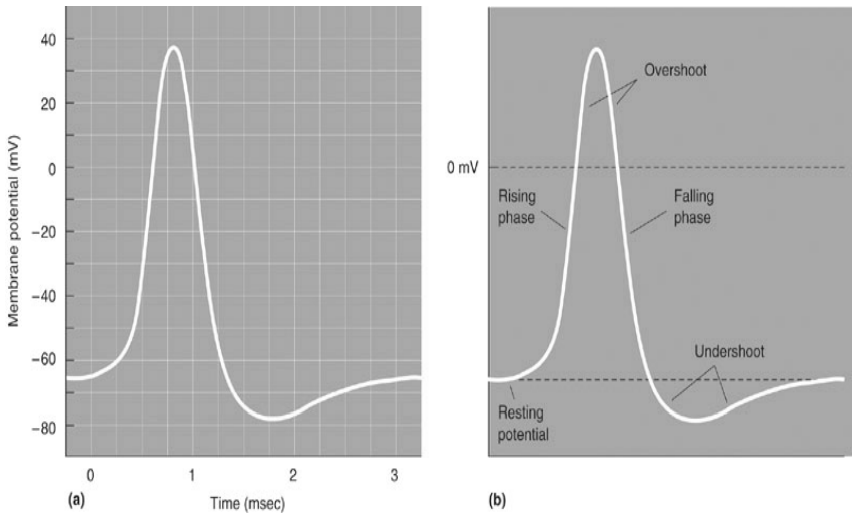
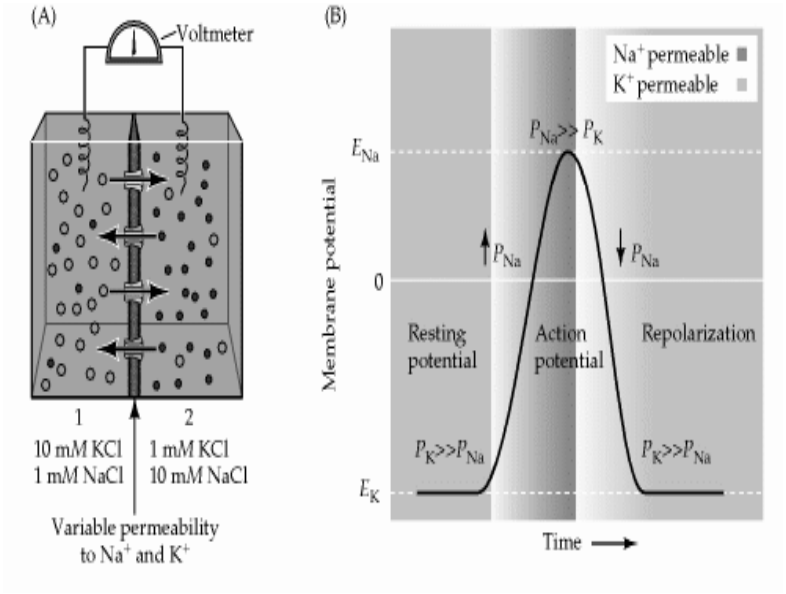


Figure 2.1. **Recording passive and active electrical signals in a nerve cell.**
(A) Two microelectrodes are inserted into a neuron; one of these measures membrane potential while the other injects current into the neuron.

(B) Inserting the voltage-measuring microelectrode into the neuron reveals a negative potential, the resting membrane potential. Injecting current through the current-passing microelectrode alters the neuronal membrane potential. Hyperpolarizing current pulses produce only passive changes in the membrane potential. While small depolarizing currents also elict only passive responses, depolarizations that cause the membrane potential to meet or exceed threshold additionally evoke action potentials. Action potentials are active responses in the sense that they are generated by changes in the permeability of the neuronal membrane.



An action potential



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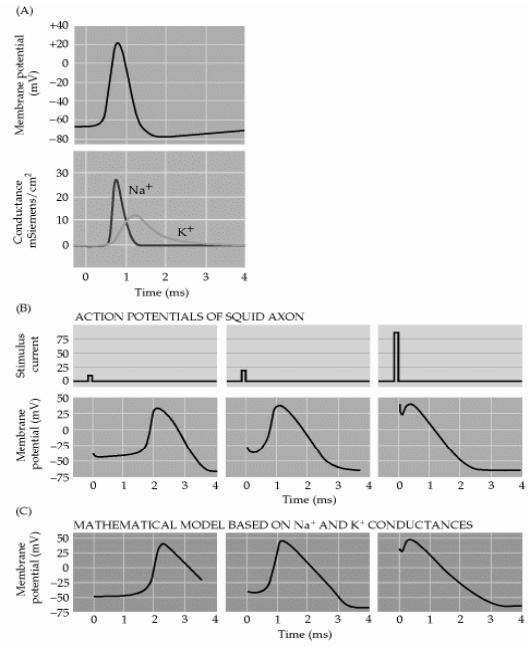
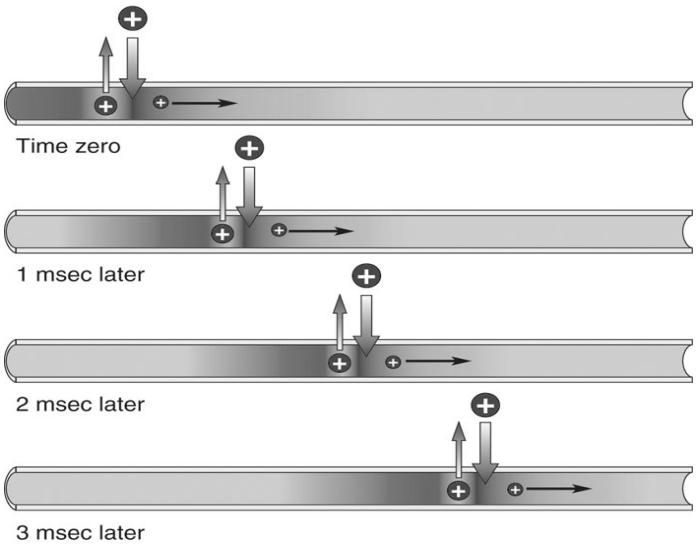


Figure 3.8. Mathematical reconstruction of the action potential.

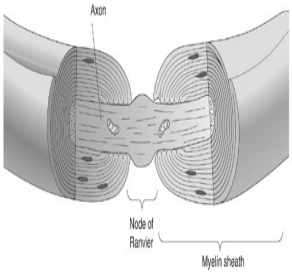
(A) Reconstruction of an action potential (black curve) together with the underlying changes in Na+ (red curve) and K+ (yellow curve) conductance.

The size and time course of the action potential were calculated using only the properties of *g*Na and *g*K measured in voltage clamp experiments.

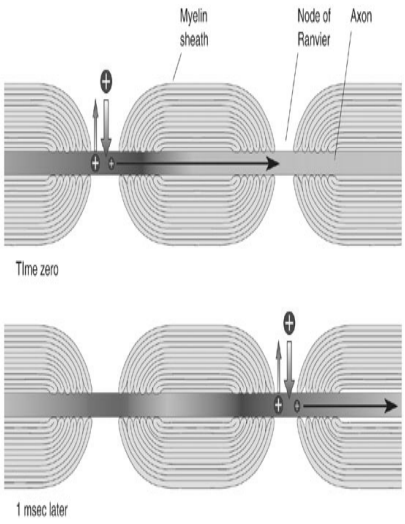
Real action potentials evoked by brief current pulses of different intensities (B) are remarkably similar to those generated by the mathematical model (C). (After Hodgkin and Huxley, 1952d.)



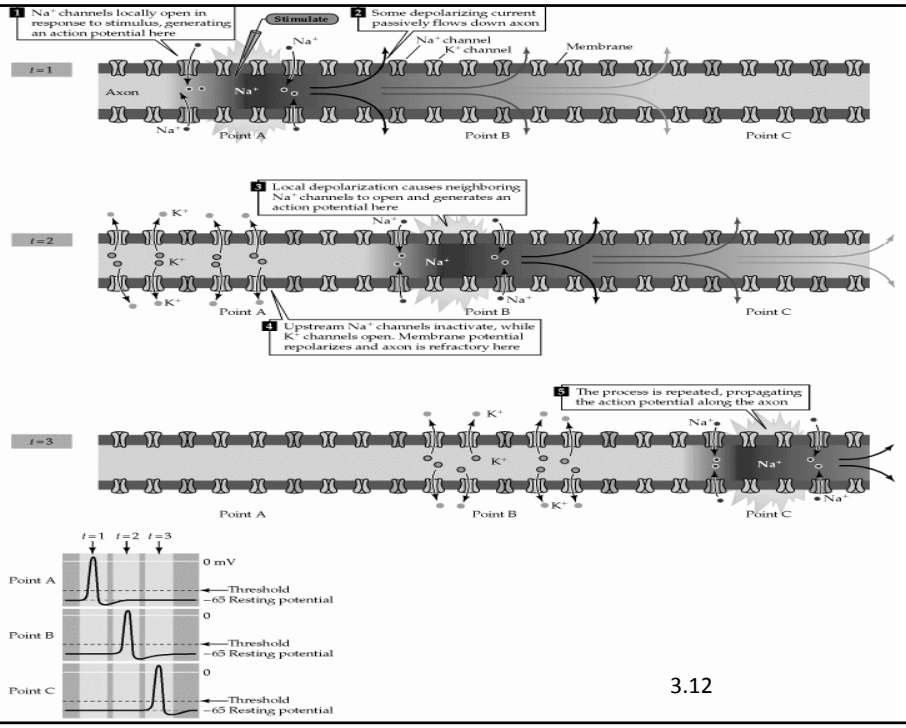
Action potential conduction



The myelin sheat and node of Ranvier



Saltatory conduction



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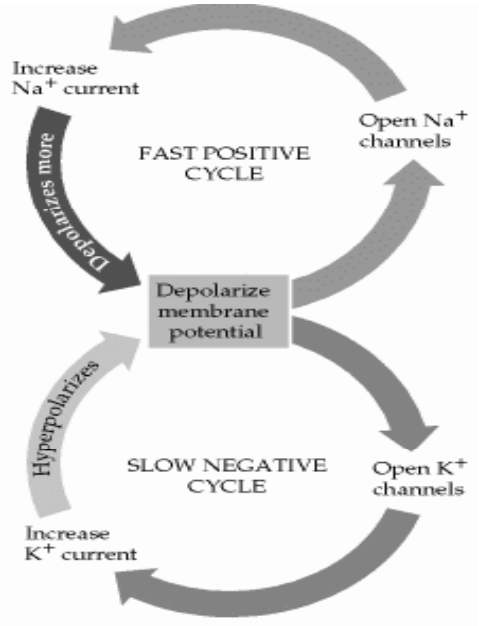


Figure 3.9. Feedback cycles responsible for membrane potential changes during an action potential.

Membrane depolarization rapidly activates a positive feedback cycle fueled by the voltage-dependent activation of Na+ conductance. This phenomenon is followed by the slower activation of a negative feedback loop as depolarization activates a K+ conductance, which helps to repolarize the membrane potential and terminate the

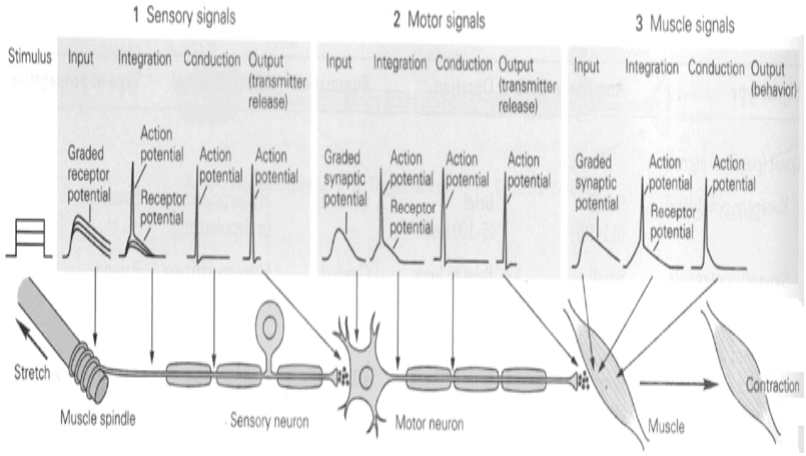
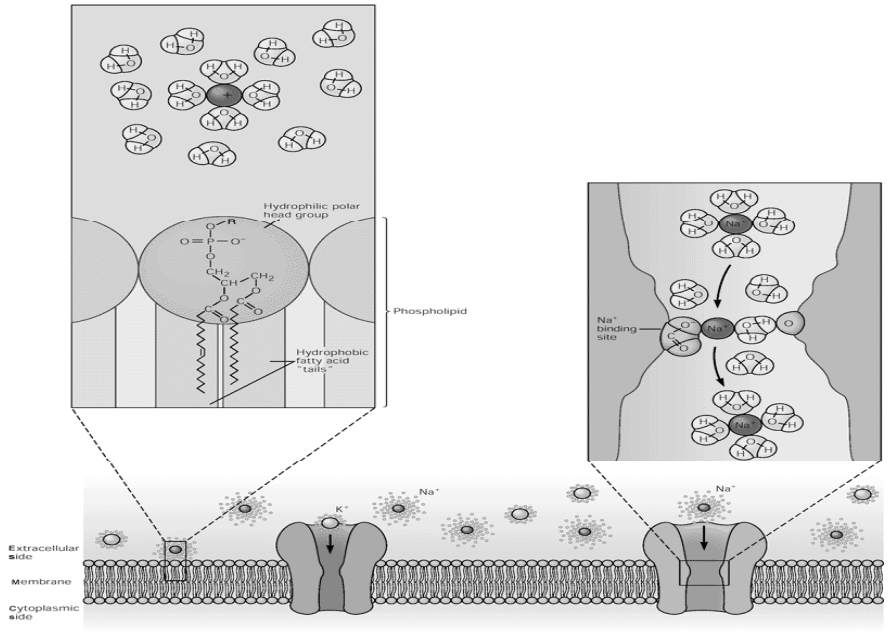


Figure 2-11 The sequence of signals that produces a reflex action.
1. The stretching of a muscle produces a receptor potential in the terminal fibers of the sensory neuron (the dorsal root ganglion cell). The amplitude of the receptor potential is proportional to the intensity of the stretch. This potential then spreads passively to the integrative segment, or trigger zone, at the first node of Ranvier. There, if the receptor potential is sufficiently large, it triggers an action potential, which then propagates actively and without change along the axon to the terminal region. At the terminal the action potential leads to an output signal: the release of a chemical neurotransmitter. The transmitter diffuses across the synaptic cleft and interacts with receptor molecules on the external membranes of the motor neurons that innervate the stretched muscle. 2. This interaction initiates a synaptic potential in the motor cell. The synaptic potential then spreads passively to the trigger zone of the motor neuron axon, where it initiates an action potential that propagates actively to the terminal of the motor neuron. The action potential releases transmitter at the nerve-muscle synapse. 3. The binding of the neurotransmitter with receptors in the muscle triggers a synaptic potential in the muscle. This signal produces an action potential in the muscle, causing con-traction of the muscle fiber.

Canales iónicos

- **Figure 6-1 (Opposite) The ionic permeability properties of the membrane are determined by the interactions of ions with water, the membrane lipid bilayer, and ion channels**
- **Ion channels are integral membrane proteins that span the lipid bilayer, providing a pathway for ions to cross the membrane. Phospholipids form self-sealing lipid bilayers that are the basis for all cellular membranes. Phospholipids have a hydrophilic head and a hydrophobic tail. The hydrophobic tails join to exclude water and ions, while the polar hydrophilic heads face the aqueous environment of the extracellular fluid and cytoplasm.**
- **Left enlargement: Ions in solution are surrounded by a cloud of water molecules (waters of hydration) that are attracted by the net charge of the ion. This cloud is carried along by the ion as it diffuses through solution, increasing the effective size of the ion. It is energetically unfavorable, and therefore improbable, for the ion to leave this polar environment to enter the nonpolar environment of the lipid bilayer. In the illustration, a positively charged ion (red) attracts the electronegative oxygen atoms of the surrounding water molecules. The inset also shows the structure of a phospholipid. It is composed of a backbone of glycerol in which two of its -OH groups are linked by ester bonds to fatty acid molecules. The third -OH group of glycerol is linked to phosphoric acid. The phosphate group is further linked to one of a variety of small, polar, alcohol head groups (R).**
- **Bottom: A model showing how ion channels are able to select for either K+ or Na+ ions.**
- *Potassium channel (left): Although a Na+ ion itself is smaller than a K+ ion, its effective diameter in solution is larger because its local field strength is more intense, causing it to attract a larger cloud of water molecules. Thus, a channel can select for K+ over Na+ by excluding hydrated ions whose diameter is larger than the pore.*
- *Sodium channel (right): Sodium channels have a selectivity filter somewhere along the length of the channel, with a site that weakly binds Na+ ions. According to the hypothesis developed by Bertil Hille and colleagues, a Na+ ion binds transiently at an active site as it moves through the filter* ***(right enlargement). At the binding site the positive charge of the ion is stabilized by a negatively charged amino acid residue on the channel wall and also by a water molecule that is attracted to a second polar amino acid residue on the other side of the channel wall. It is thought that a K+ ion, because of its larger diameter, cannot be stabilized as effectively by the negative charge and therefore will be excluded from the filter. (Modified from Hille 1984.)***



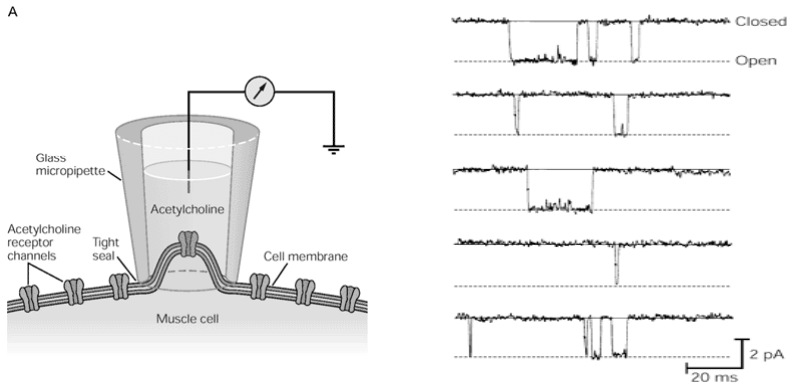


Figure 6-3B Patch-clamp record of the current flowing through a single ion channel as the channel switches between closed and open states. (Courtesy of B. Sakmann.)

Christopher Miller independently developed a method for incorporating channels from biological membranes into planar lipid bilayers. With this technique, biological membranes are first homogenized in a laboratory blender; centrifugation of the homogenate then separates out a portion composed only of membrane vesicles. Under appropriate ionic conditions these membrane vesicles will fuse with a planar lipid membrane, incorporating any ion channel in the vesicle into the planar membrane. This technique has two experimental advantages. First, it allows recording from ion channels in regions of cells that are inaccessible to patch clamp; for example, Miller has successfully studied a K+ channel isolated from the internal membrane of skeletal muscle (the sarcoplasmic reticulum). Second, it allows researchers to study how the composition of the membrane lipids influences channel function.

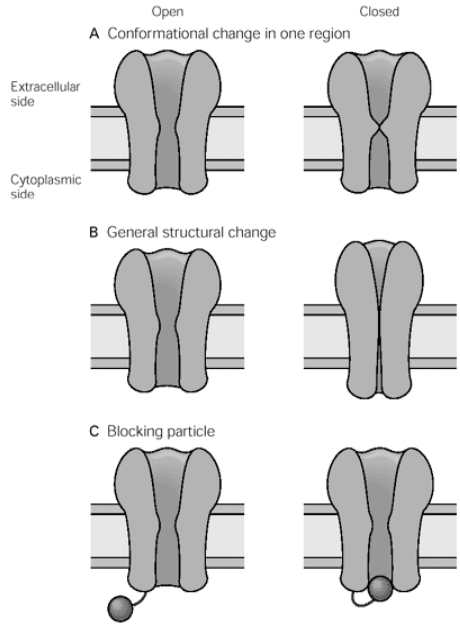


Figure 6-5 Three physical models for the opening and closing of ion channels.

A. A localized conformational change occurs in one region of the channel.

B. A generalized structural change occurs along the length of the channel.

C. A blocking particle swings into and out of the channel mouth.

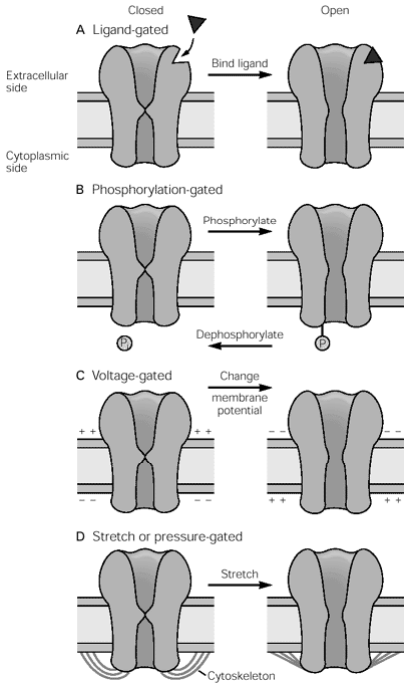


Figure 6-6 Several types of stimuli control the opening and closing of ion channels.

A. Ligand-gated channels open when the ligand binds to its receptor. The energy from ligand binding drives the channel toward an open state.
B. Protein phosphorylation and dephosphorylation regulate the opening and closing of some channels. The energy for channel opening comes from the transfer of the high-energy phosphate, Pi.

C. Changes in membrane voltage can open and close some channels. The energy for channel gating comes from a change in the electrical potential difference across the membrane, which causes a conformational change by acting on a component of the channel that has a net charge.

D. Channels can be activated by stretch or pressure. The energy for gating may come from mechanical forces that are passed to the channel through the cytoskeleton.

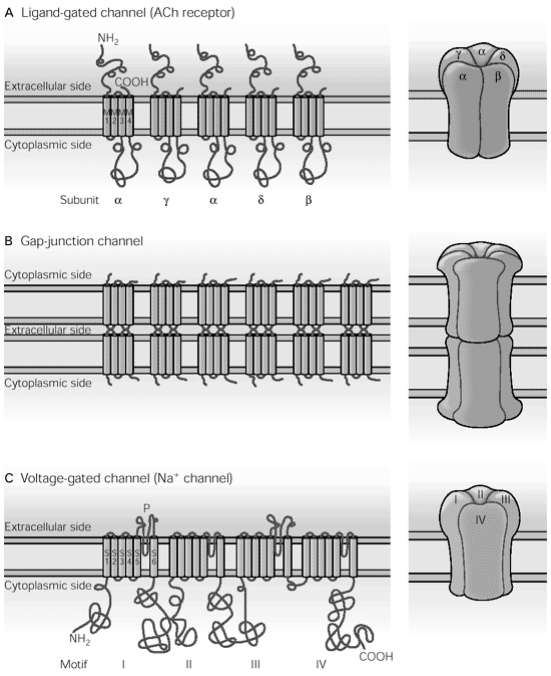


Figure 6-11 Three families of ion channels.

A. Certain ligand-gated channels, including the nicotinic acetylcholine (ACh) receptor-channel, have five subunits, and each subunit consists of four transmembrane regions (M1-M4). Each cylinder represents a single transmembrane a-helix. A three-dimensional model of the channel is shown on the right.

B. The gap-junction channel, found at electrical synapses, is formed from a pair of hemichannels in the pre- and postsynaptic membranes that join in the space between two cells. Each hemichannel is made of six subunits, each with four transmembrane regions. A three-dimensional model of the two apposite hemichannels is illustrated on the right.

C. The voltage-gated Na+ channel is formed from a single (a) polypeptide chain that contains four homologous domains or repeats (motifs I-IV), each with six a-helical membrane-spanning regions (S1 to S6) and one P region thought to line the pore. The figure at the right shows a hypothetical model of the channel.

Sinapsis

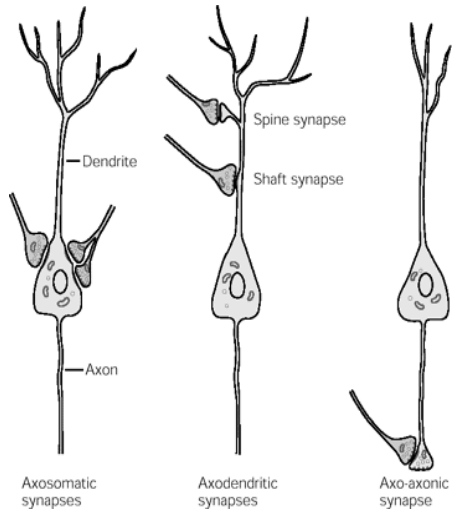


Figure 12-14 Synaptic contact can occur on the cell body, the dendrites, or the axon of the postsynaptic cell.

The names of various kinds of synapses—axosomatic, axodendritic, and axo-axonic—identify the contacting regions of both the presynaptic and postsynaptic neurons (the presynaptic element is identified first). Note that axodendritic synapses can occur on either the main shaft of a dendrite branch or on a specialized input zone, the spine.

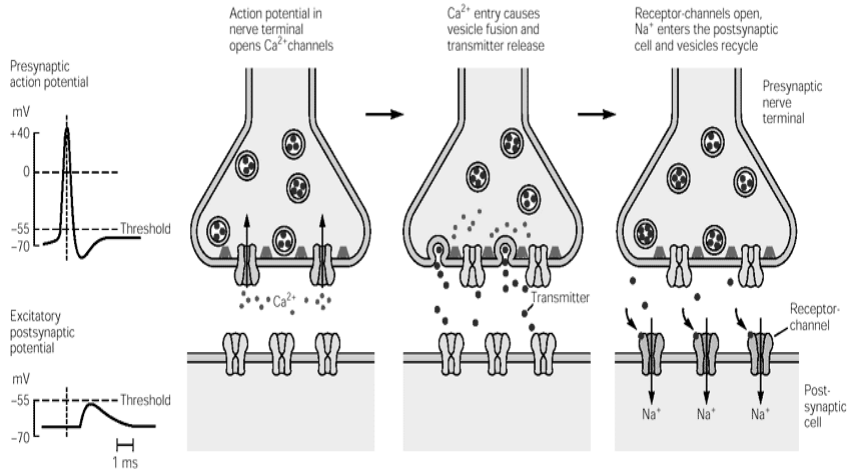


Figure 10-7 Synaptic transmission at chemical synapses involves several steps. An action potential arriving at the terminal of a presynaptic axon causes voltage-gated Ca2+ channels at the active zone to open. The influx of Ca2+ produces a high concentration of Ca2+ near the active zone, which in turn causes vesicles containing neurotransmitter to fuse with the presynaptic cell membrane and release their contents into the synaptic cleft (a process termed exocytosis).

The released neurotransmitter molecules then diffuse across the synaptic cleft and bind to specific receptors on the post-synaptic membrane. These receptors cause ion channels to open (or close), thereby changing the membrane conductance and membrane potential of the postsynaptic cell. The complex process of chemical synaptic transmission is responsible for the delay between action potentials in the pre- and post-synaptic cells compared with the virtually instantaneous transmission of signals at electrical synapses (see Figure 10-2B). The gray filaments represent the docking and release sites of the active zone.

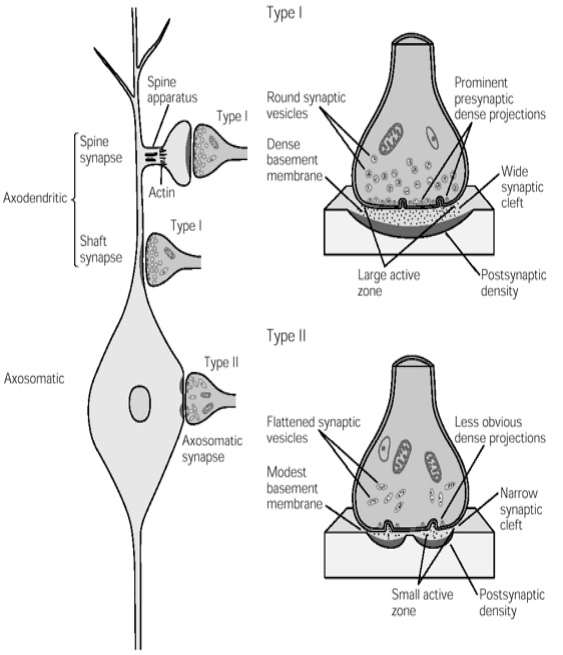


Figure 12-3 The two most common morphologic types of synapses in the central nervous system are Gray type I and type II.

Type I is usually excitatory, exemplified by glutamatergic synapses; type II is usually inhibitory, exemplified by GABA-ergic synapses.

Differences include the shape of vesicles, prominence of presynaptic densities, total area of the active zone, width of the synaptic cleft, and presence of a dense basement membrane. Type I synapses typically contact specialized projections on the dendrites, called spines, and less commonly contact the shafts of dendrites. Type II synapses often contact the cell

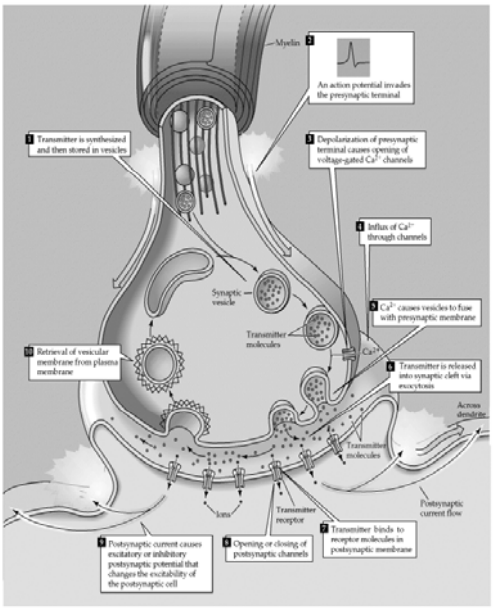


Figure 5.3. Sequence of events involved in transmission at a typical chemical synapse.

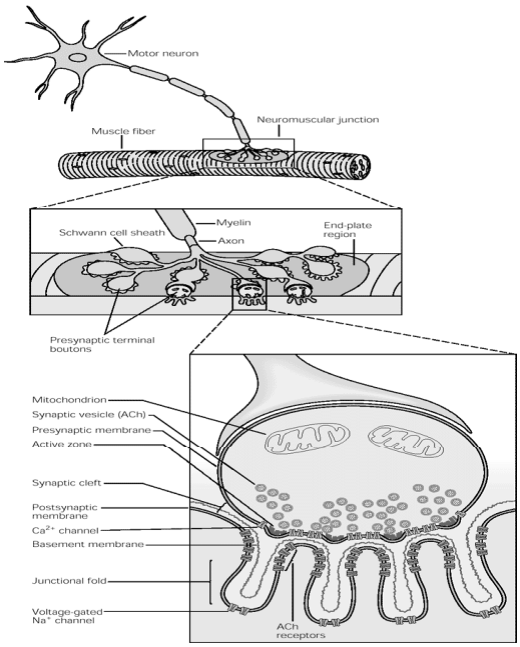
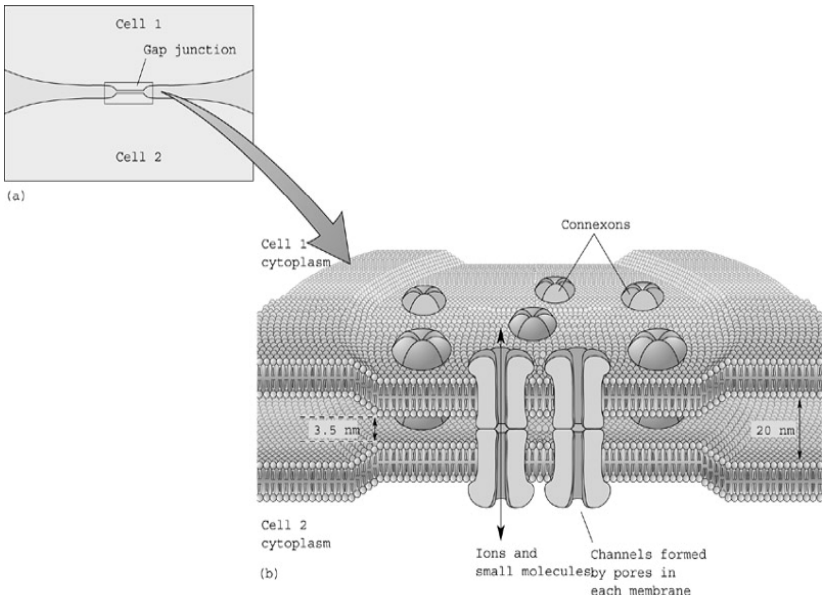


Figure 11-1 The neuromuscular junction is readily visible with the light microscope. At the muscle the motor axon ramifies into several fine branches approximately 2 µm thick. Each branch forms multiple swellings called presynaptic boutons, which are covered by a thin layer of Schwann cells.

The boutons lie over a specialized region of the muscle fiber membrane, the *end-plate, and are separated from the muscle membrane by a 100 nm synaptic cleft. Each presynaptic bouton contains mitochondria and synaptic vesicles clustered around active zones, where the acetylcholine (ACh) transmitter is released. Immediately under each bouton in the end-plate are several junctional folds, which contain a high density of ACh receptors at their crests. The muscle fiber is covered by a layer of connective tissue, the basement membrane (or basal lamina), consisting of collagen and glycoproteins. Both the presynaptic terminal and the muscle fiber secrete proteins into the basement membrane, including the enzyme acetylcholinesterase, which inactivates the ACh released from the presynaptic terminal by breaking it down into acetate and choline. The basement membrane also organizes the synapse by aligning the presynaptic boutons with the postsynaptic junctional folds. (Adapted in part from McMahan and Kuffler 1971.)*



A gap juction

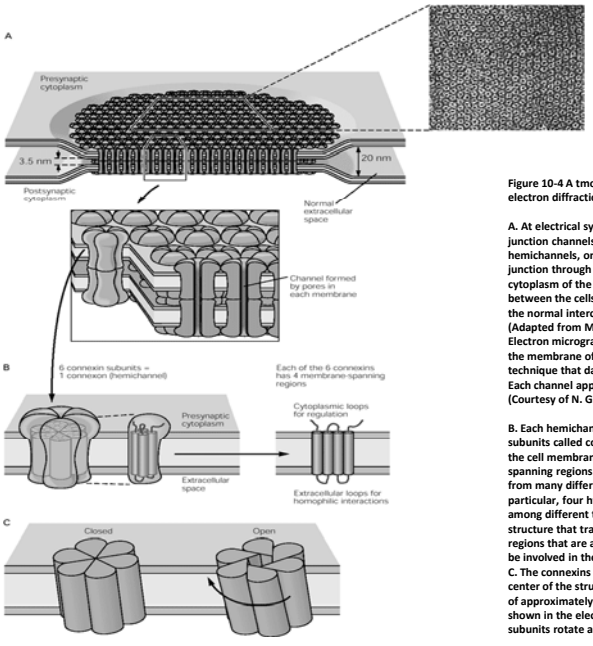


Figure 10-4 A tmodel of the gap-junction channel, based on X-ray and electron diffraction studieshree-dimensional.

A. At electrical synapses two cells are structurally connected by gap-junction channels. A gap-junction channel is actually a pair of hemichannels, one in each apposite cell, that match up in the gap junction through homophilic interactions. The channel thus connects the cytoplasm of the two cells and provides a direct means of ion flow between the cells. This bridging of the cells is facilitated by a narrowing of the normal intercellular space (20 nm) to only 3.5 nm at the gap junction. (Adapted from Makowski et al. 1977.)
Electron micrograph: The array of channels shown here was isolated from the membrane of a rat liver. The tissue has been negatively stained, a technique that darkens the area around the channels and in the pores. Each channel appears hexagonal in outline. Magnification × 307,800. (Courtesy of N. Gilula.)

B. Each hemichannel, or connexon, is made up of six identical protein subunits called connexins. Each connexin is about 7.5 nm long and spans the cell membrane. A single connexin is thought to have four membrane-spanning regions. The amino acid sequences of gap- junction proteins from many different kinds of tissue all show regions of similarity. In particular, four hydrophobic domains with a high degree of similarity among different tissues are presumed to be the regions of the protein structure that traverse the cell membrane. In addition, two extracellular regions that are also highly conserved in different tissues are thought to be involved in the homophilic matching of apposite hemichannels.
C. The connexins are arranged in such a way that a pore is formed in the center of the structure. The resulting connexon, with an overall diameter of approximately 1.5-2 nm, has a characteristic hexagonal outline, as shown in the electron micrograph in A. The pore is opened when the subunits rotate about 0.9 nm at the cytoplasmic base in a clockwise direction. (From Unwin and Zampighi 1980.)

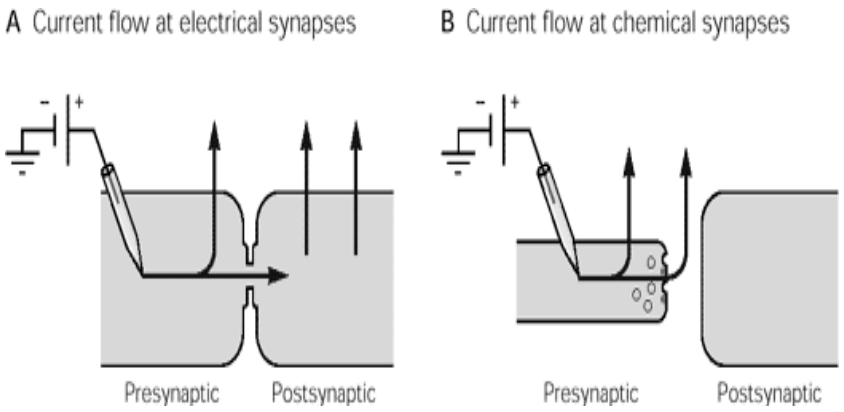
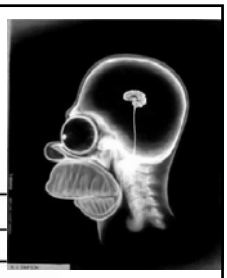


Figure 10-1 Current flows differently at electrical and chemical synapses.
A. At an electrical synapse some of the current injected into a presynaptic cell escapes through resting ion channels in the cell membrane. However, some current also flows into the postsynaptic cell through specialized ion channels, called gap-junction channels, that connect the cytoplasm of the pre- and postsynaptic cells.
B. At chemical synapses all of the injected current escapes through ion channels in the presynaptic cell. However, the resulting depolarization of the cell activates the release of neurotransmitter molecules packaged in synaptic vesicles (open circles), which then bind to receptors on the postsynaptic cell. This binding opens ion channels, thus initiating a change in membrane potential in the postsynaptic cell.

Neurotransmisores



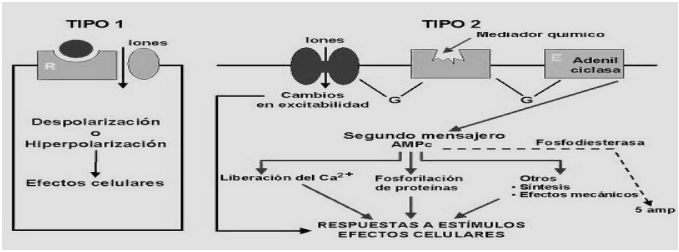
Neurotransmisores en el SNC

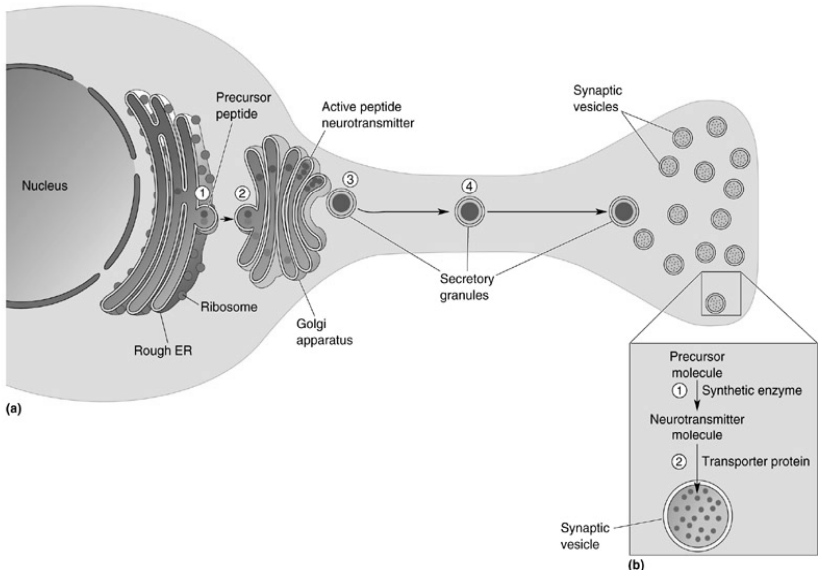
Moléculas pequeñas	*Péptidos*
Aminoácidos	**Péptidos opioides**
γ-aminobutirato (GABA)	β-endorfina
Glicina	Dinorfina
Glutamato	Metionina
Aspartato	**Péptidos neurohipofisiarios**
Taurina	Vasopresina
Aminas biógenas	Oxitocina
Acetilcolina	**Taquicininas**
Dopamina	Sustancia P
Noradrenalina	Casinina
Adrenalina	Neurocinina
Serotonina	**Otros**
Histamina	Secretina
Nucleótidos	Péptido Intestinal Vasoactivo
Adenosina	Glucagón
ATP	Neuropéptido Y
Otros	Somatostatina
Óxido nítrico	Colescistoquinina
Monóxido de carbono	Angiotensina

Receptores

- **Receptores ionotrópicos:**
  Producen una respuesta rápida al abrir o cerrar canales iónicos, que producen despolarizaciones o generando potenciales de acción o respuestas excitatorias o producen hiperpolarizaciones o respuestas inhibitorias. En el primer caso, actúan canales de cationes monoiónicos como los de Sodio y Potasio, mientras que en el segundo caso, son los canales de Cloruro los que se activan.

- **Receptores metabotrópicos:**
  Liberan mensajeros intracelulares, como AMP cíclico, Calcio, y fosfolípidos por el mecanismo de transducción de señales. Estos segundos mensajeros activan proteínas quinasas, las cuales, fosforilan activando o desactivando canales al interior de la célula. En el caso de una despolarización, son los canales de Potasio que se cierran, en caso de hiperpolarización, los mismos canales son abiertos produciendo el aumento de cationes intracelulares.





The synthesis and storage of different types neurotransmitter

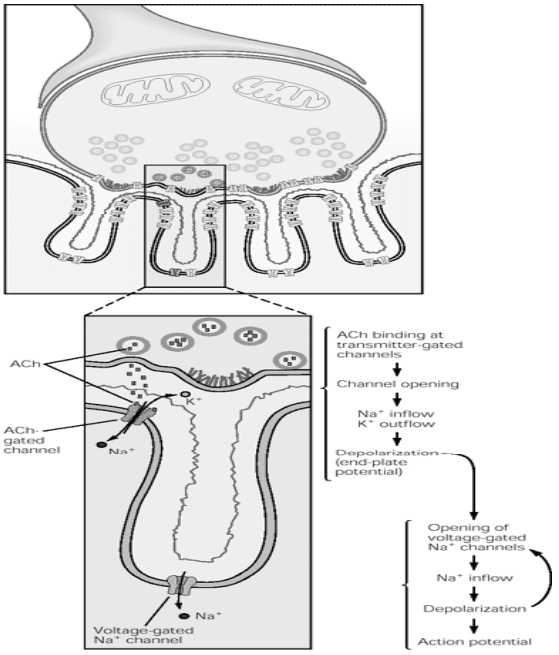
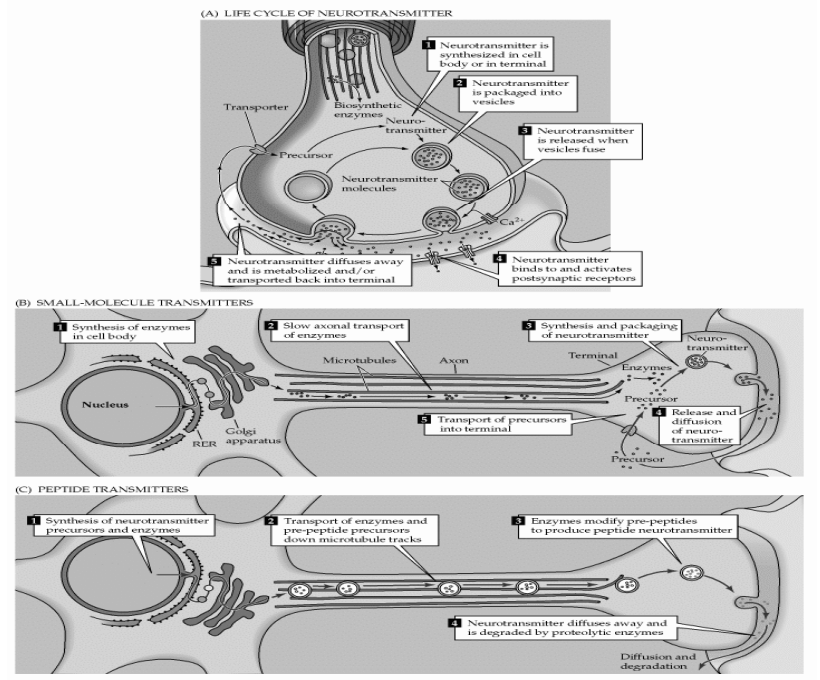


Figure 11-12 The binding of ACh in a postsynaptic muscle cell opens channels permeable to both Na+ and K+.

The flow of these ions into and out of the cell depolarizes the cell membrane, producing the end-plate potential. This depolarization opens neighboring voltage-gated Na+ channels in the muscle cell. To trigger an action potential, the depolarization produced by the end-plate potential must open a sufficient number of Na+ channels to exceed the cell's threshold. (After Alberts et al. 1989.)



6.6

Drogas y neurotransmisores

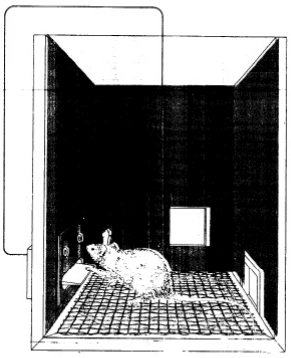


FIGURA 18-4
Aparato para experimentos de autoestimulación. (*Adaptado de Olds.*)

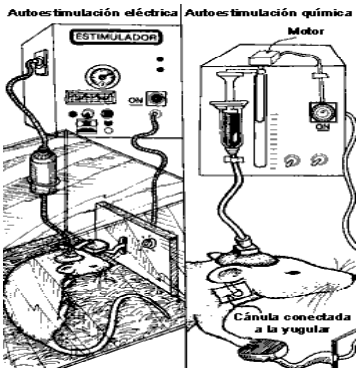
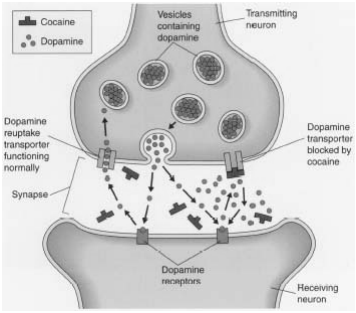


FIGURA V.I. ***Experimento de autoestimulación. Dispositivo utilizado para la estimulación eléctrica o química del cerebro. Esta puede ser controlada por el investigador, o como se ve aquí, por el mismo animal. La rata busca la "autoestimulacion" cuando esta le produce efectos placenteros o le evita el dolor. Apretando el pedal, el animal activa el estimulador eléctrico o el motor que controla la jeringa que contiene la droga.***

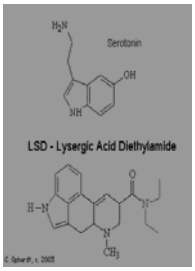
Tipos de drogas

1. DROGAS DOPAMINÉRGICAS-NORADRENÉRGICAS: cocaína

Anfetamina Efedrina



2. DROGAS SEROTONINÉRGICAS , ALUCINÓGENAS INDOLES: LSD



- ENTACTÓGENAS/ALUCINÓGENAS NO INDOLES : éxtasis

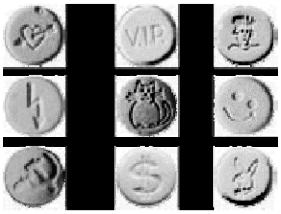
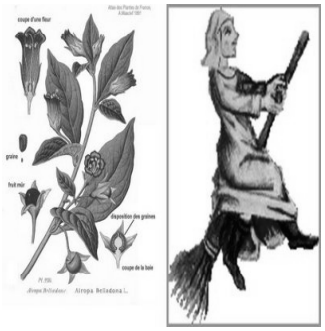


Figura 9. Diversos tipos de pastillas de "éxtasis", decomisadas por la policía.

La MDMA incrementa la liberación de serotonina, dopamina y norepinefrina, inhibe la recaptación de estos neurotransmisores a nivel presinaptico e interfiere la accion degradadora de la monoamino-oxidasa, aumentando también la síntesis de dopamina. Todo esto comporta un acumulo de serotonina, dopamina y norepinefrina en los espacios sinápticos intra y extracraneales, dando lugar a los efectos clínicos que se describen posteriormente, y que son parecidos a los que induce la anfetamina y la cocaína

- **Alucinógenos clásicos , DROGAS ANTICOLINÉRGICAS : Belladona**



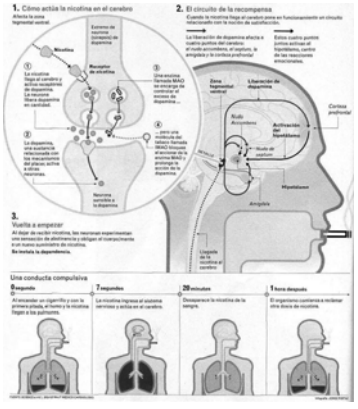
Dada la amplia distribución central y periférica de este receptor , los efectos de estos alcaloides ocurren a muy diversos niveles: sequedad de la boca, taquicardia, aumento de la temperatura corporal, disminución del peristaltismo gastrointestinal (p. ejem., constipación), dilatación pupilar, confusión mental, obnubilación de la consciencia, pérdida de la memoria reciente, y somnolencia, delirio y coma a dosis elevadas. A diferencia de otros alucinógenos, los anticolinérgicos no incrementan la percepción sensorial

uso.....

- **DROGAS DISOCIATIVAS, (Anestésicas), ANTIGLUTAMATÉRGICAS, Arilciclohexilaminas, Análogos a la fenciclidina: PCP**

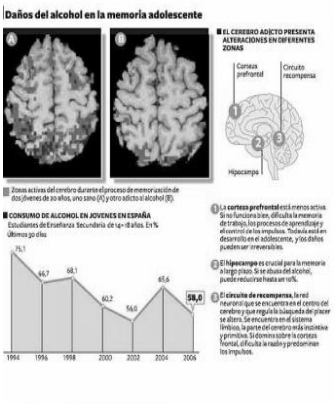
PCP (Phencyclidine) is a dissociative drug formerly used as an anesthetic agent, exhibiting hallucinogenic and neurotoxic effects. It is commonly known as Angel Dust, but is also known as Wet, Sherm, Sherman Hemsley, Rocket Fuel, Ashy Larry, Shermans Tank, Wack, Halk Hogan, Ozone, HannaH, Hog, Manitoba Shlimbo, and Embalming Fluid, among other names.

- **DROGAS COLINÉRGICAS, Alcaloides de núcleo pirídico: nicotina**

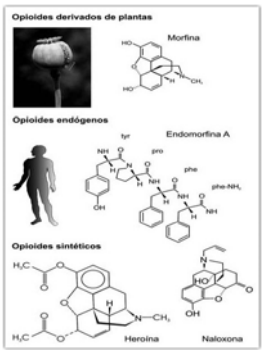


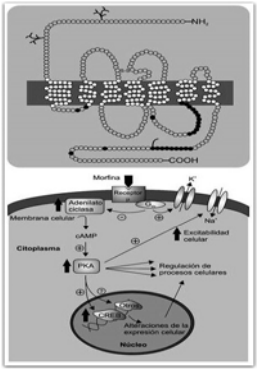
abuso……

- **DROGAS GABAÉRGICAS: alcohol**



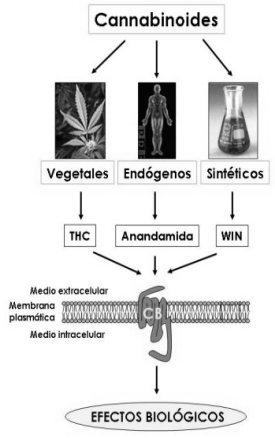
- **DROGAS OPIÁCEAS (Analgésicas): morfina**





Y …Usted que opina?

- **DROGAS CANABINOIDES , Inhibición del GABA y el Glutamato: marihuana**



- **DROGAS XANTINAS (Estimulantes suaves) : cafeina**
- La cafeína existe en un gran número de plantas, como las nueces de kola, hojas de té, semillas de cacao, y, por supuesto, granos de café. La cafeína estimula el cuerpo, afectando el sistema nervioso central. También bloquea la acción de una sustancia neuroquímica conocida como adenosina, cuya función en el organismo es ordenarle que disminuya su ritmo de actividad.

- **SOLVENTES E INHALANTES**

Neurotransmisor	Localización	Función
Transmisores pequeños		
Acetilcolina	Sinapsis con músculos y glándulas; muchas partes del sistema nervioso central (SNC)	Excitatorio o inhibitorio Envuelto en la memoria
Aminas		
Serotonina	Varias regiones del SNC	Mayormente inhibitorio; sueño, envuelto en estados de ánimo y emociones
Histamina	Encéfalo	Mayormente excitatorio; envuelto en emociones, regulación de la temperatura y balance de agua
Dopamina	Encéfalo; sistema nervioso autónomo (SNA)	Mayormente inhibitorio; envuelto en emociones/ánimo; regulación del control motor
Epinefrina	Areas del SNC y división simpática del SNA	Excitatorio o inhibitorio; hormona cuando es producido por la glándula adrenal
Norepinefrina	Areas del SNC y división simpática del SNA	Excitatorio o inhibitorio; regula efectores simpáticos; en el encéfalo envuelve respuestas emocionales
Aminoácidos		
Glutamato	SNC	El neurotransmisor excitatorio más abundante (75%) del SNC
GABA	Encéfalo	El neurotransmisor inhibitorio más abundante del encéfalo
Glicina	Médula espinal	El neurotransmisor inhibitorio más común de la médula espinal
Otras moléculas pequeñas **Óxido nítrico**	Incierto	Pudiera ser una señal de la membrana postsináptica para la presináptica
Transmisores grandes		
Neuropéptidos **Péptido vaso-activo intestinal**	Encéfalo; algunas fibras del SNA y sensoriales, retina, tracto gastrointestinal	Función en el SN incierta
Colecistoquinina	Encéfalo; retina	Función en el SN incierta
Sustancia P	Encéfalo;médula espinal, rutas sensoriales de dolor, tracto gastrointestinal	Mayormente excitatorio; sensaciones de dolor
Encefalinas	Varias regiones del SNC; retina; tracto intestinal	Mayormente inhibitorias; actuan como opiatos para bloquear el dolor
Endorfinas	Varias regiones del SNC; retina; tracto intestinal	Mayormente inhibitorias; actuan como opiatos para bloquear el dolor

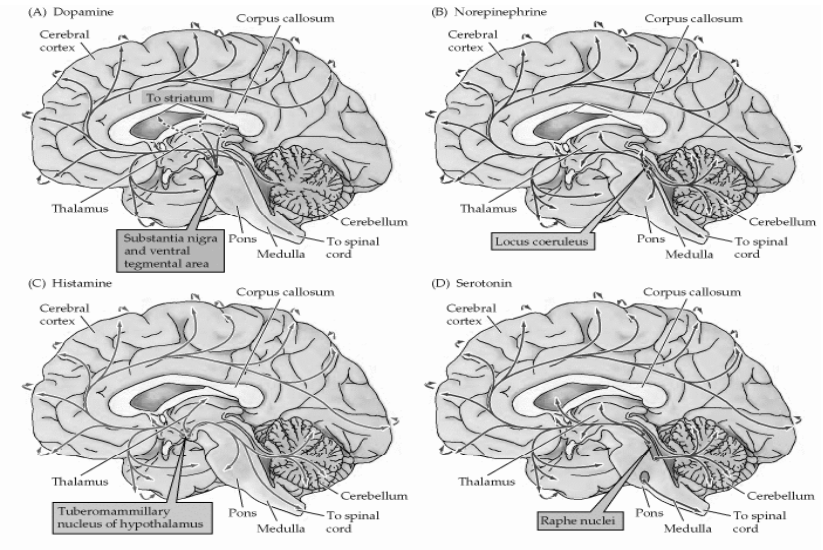
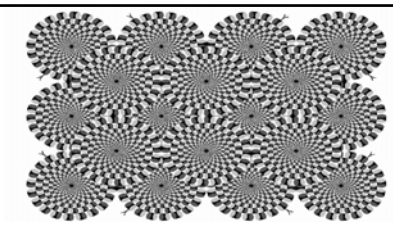


Figure 6.12. The distribution in the human brain of neurons and their projections (arrows) containing biogenic amine neurotransmitters. Curved arrows along the perimeter of the cortex indicate the innervation of lateral cortical regions not shown in this midsagittal plane of section.



Correlación senso-motora

- Sistemas perceptuales
- Sistema motor
- Integración sensorial