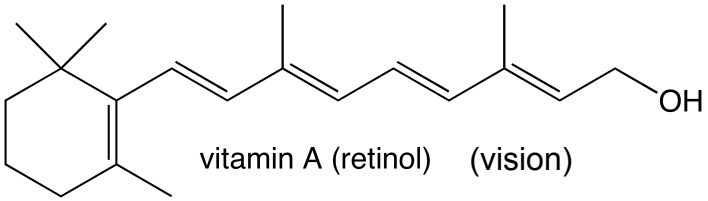
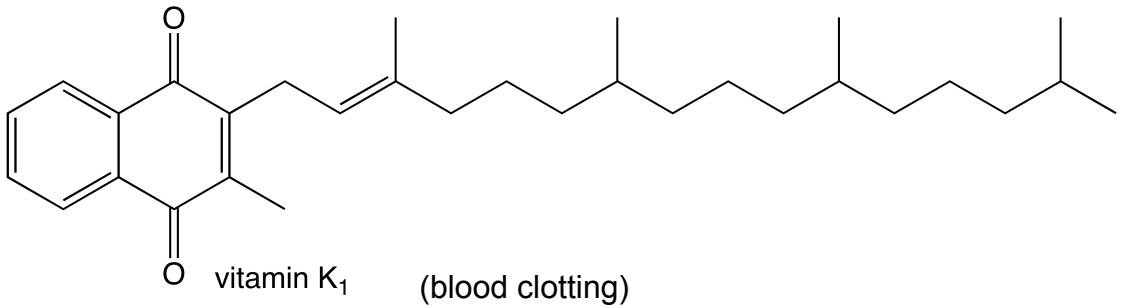
Vitamins, NSAIDS, & Alcohol

Vitamins

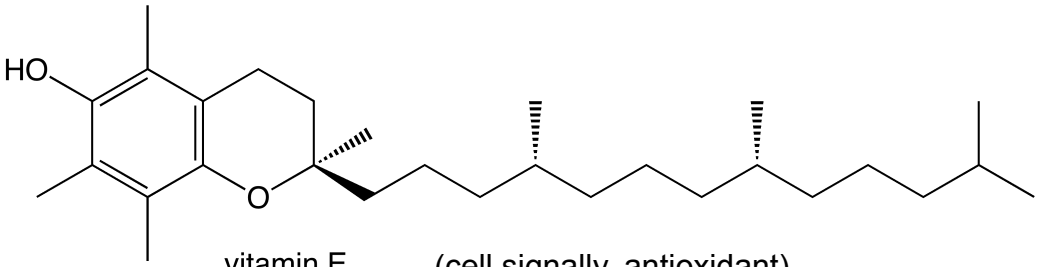
Fat soluble



vitamin A (retinol) (vision)

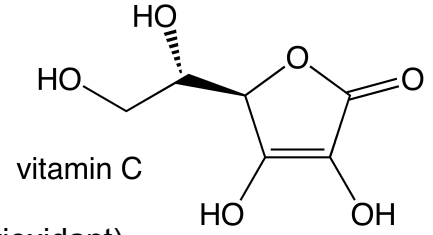


vitamin K_1 (blood clotting)



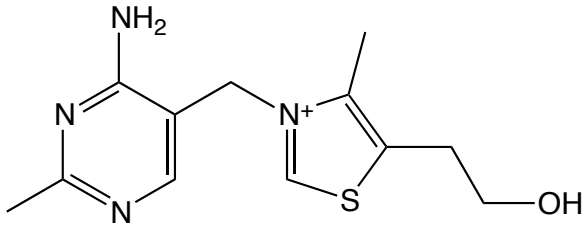
vitamin E (cell signally, antioxidant)

Water soluble



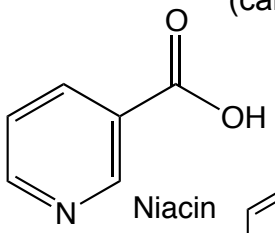
vitamin C

(scurvy, antioxidant)



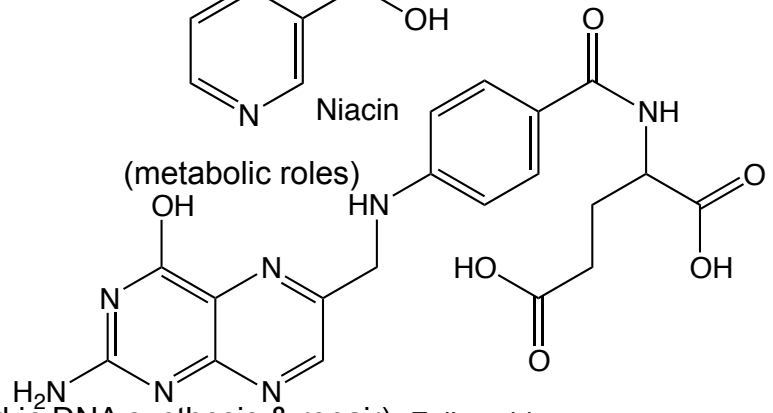
Thiamine

(carbohydrate use)



Niacin

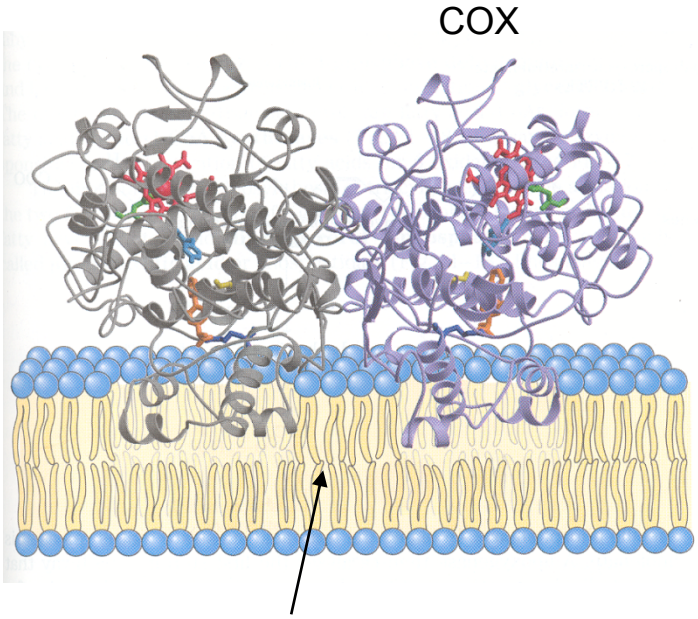
(metabolic roles)



(precursor to folate,used in DNA synthesis & repair) Folic acid

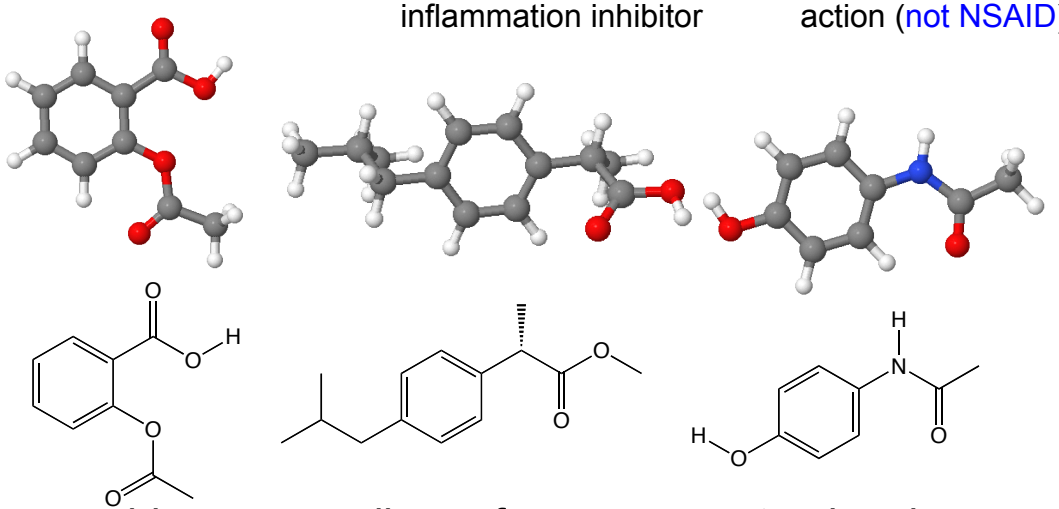
(Fatty) Functional Groups and NSAIDs (non-steroidal anti-inflammatory drugs)

Asprin and its "relations" : aromatic ring helps the drug stay in nonpolar areas, like fats and cell membranes



Better enzyme blocker & inflammation inhibitor

Only blocks COX, no anti-inflammatory action (not NSAID)



aspirin ibuprofen acetaminophen

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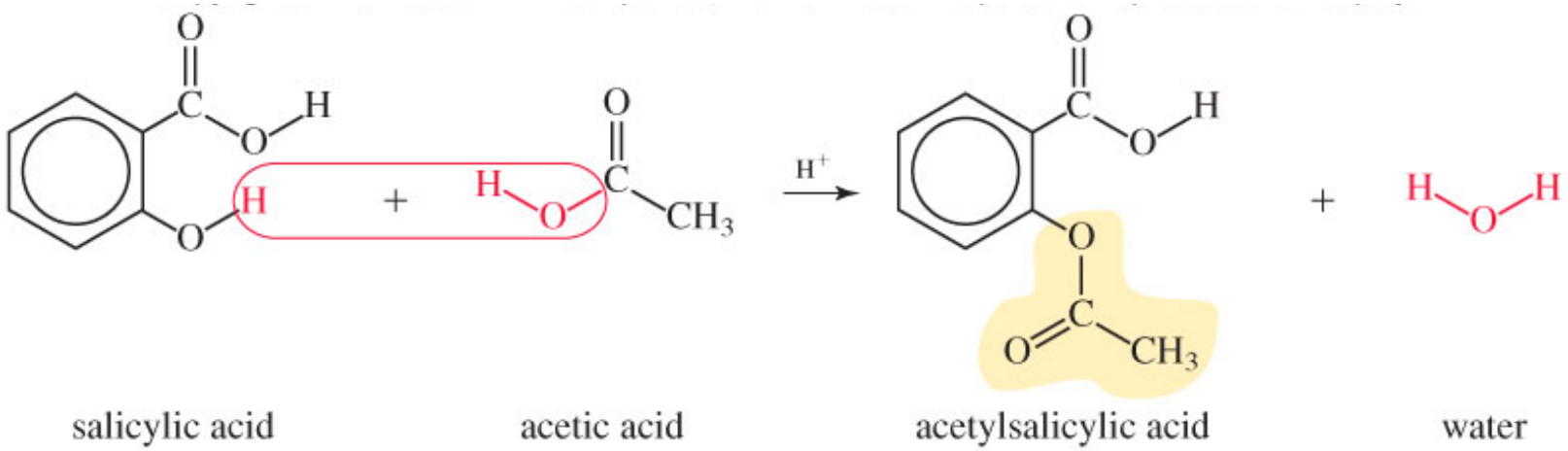
Note how the cell membrane has structural similarity with triglycerides (Ch. 11.2)…

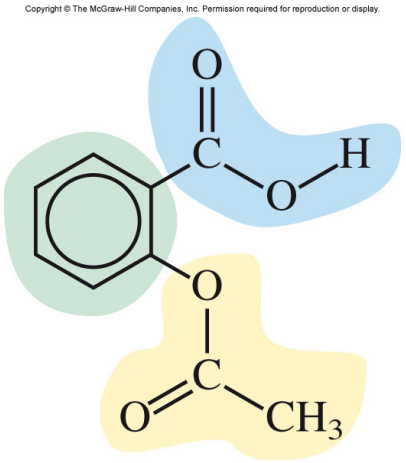
cyclooxygenase

Synthesis of Aspirin

Yet another condensation reaction (makes water as a side product)…



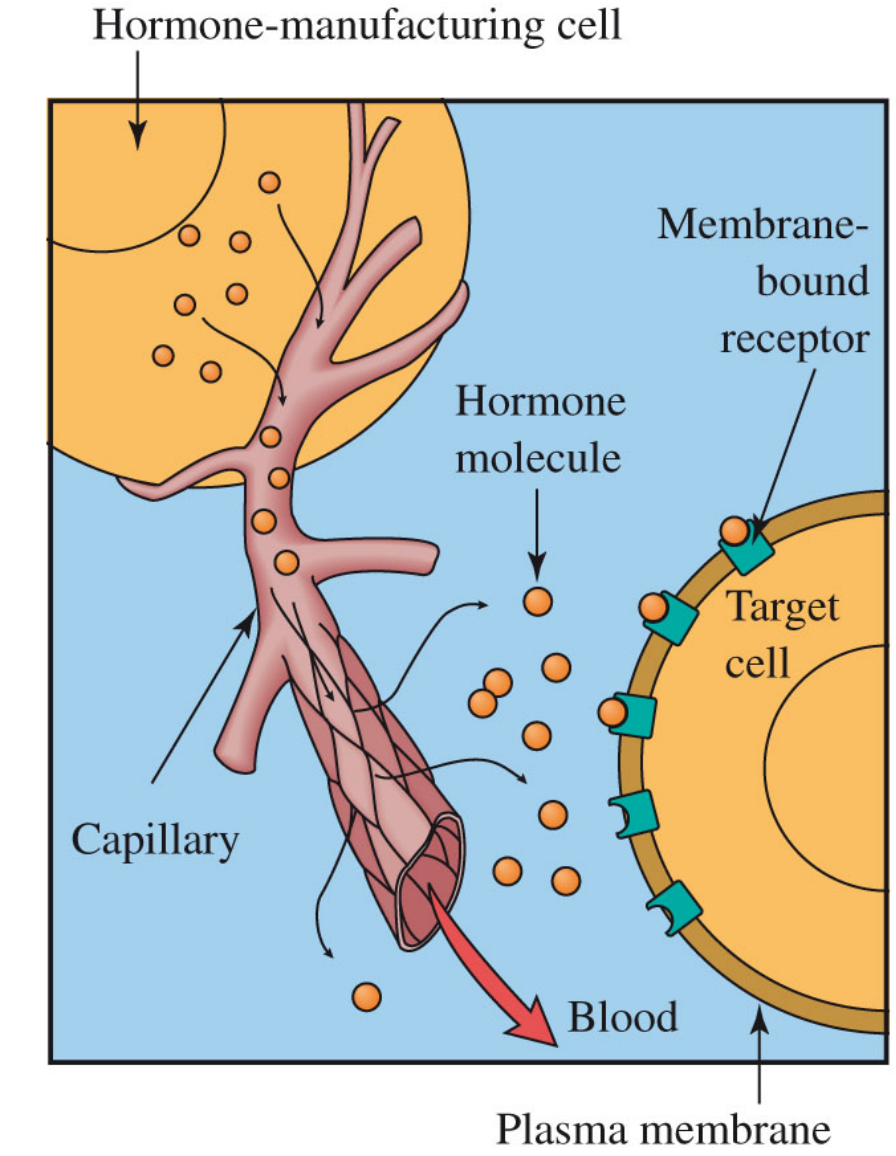
salicylic acid acetic acid acetylsalicylic acid water



Functional groups (see table 10.3)

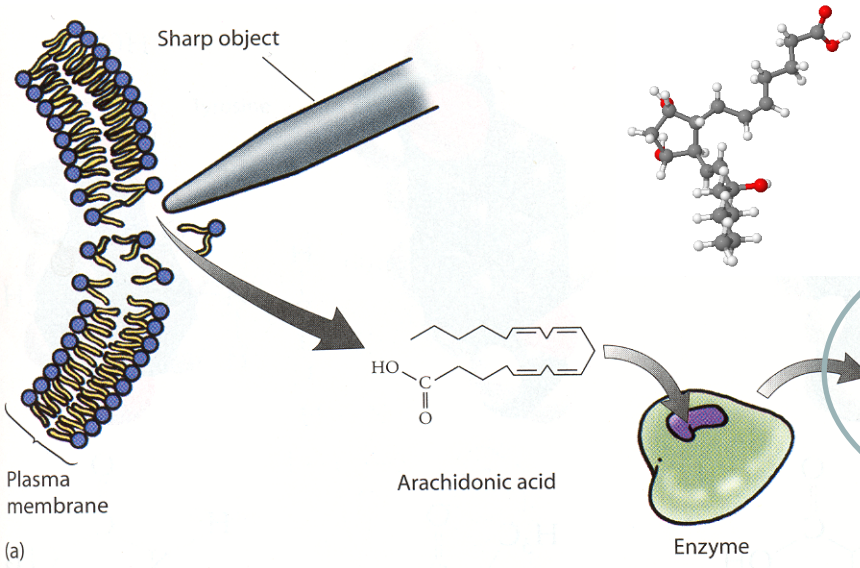
blue: carboxylic acid
green: benzene (phenyl) ring
yellow: acetyl (ester) group

Hormones as Chemical Messengers (10.4)



Prostaglandins

When cells are damaged, prostaglandins are produced via an enzymatic transformation of arachidonic acid:



Prostaglandins:

produce fever & swelling
increase sensitivity of pain receptors
inhibit blood vessel dilation
regulate production of acid & mucus
assist kidney function

pain

blood clotting

stomach mucus

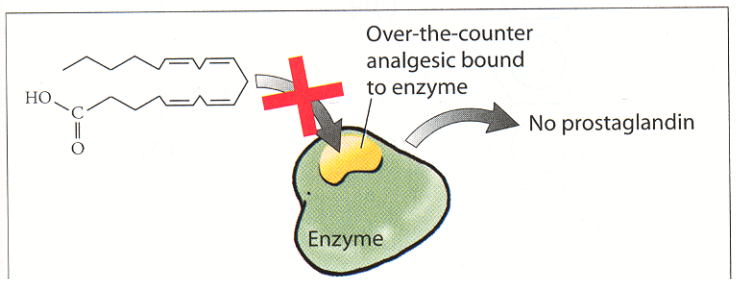
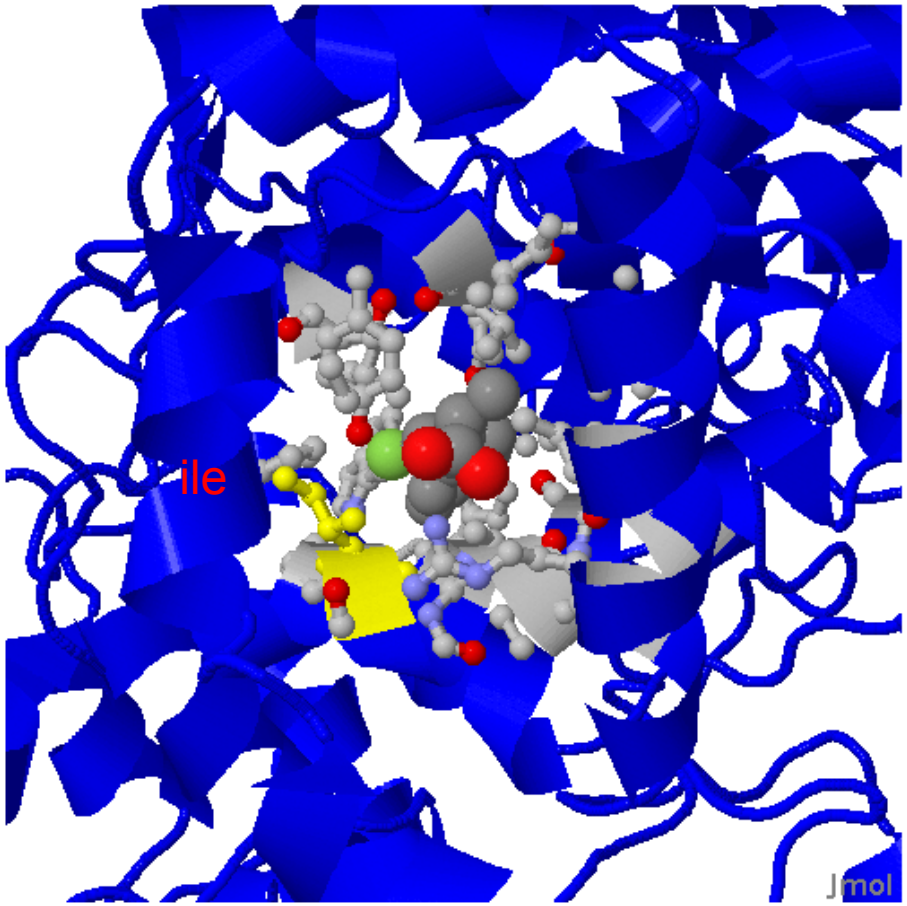


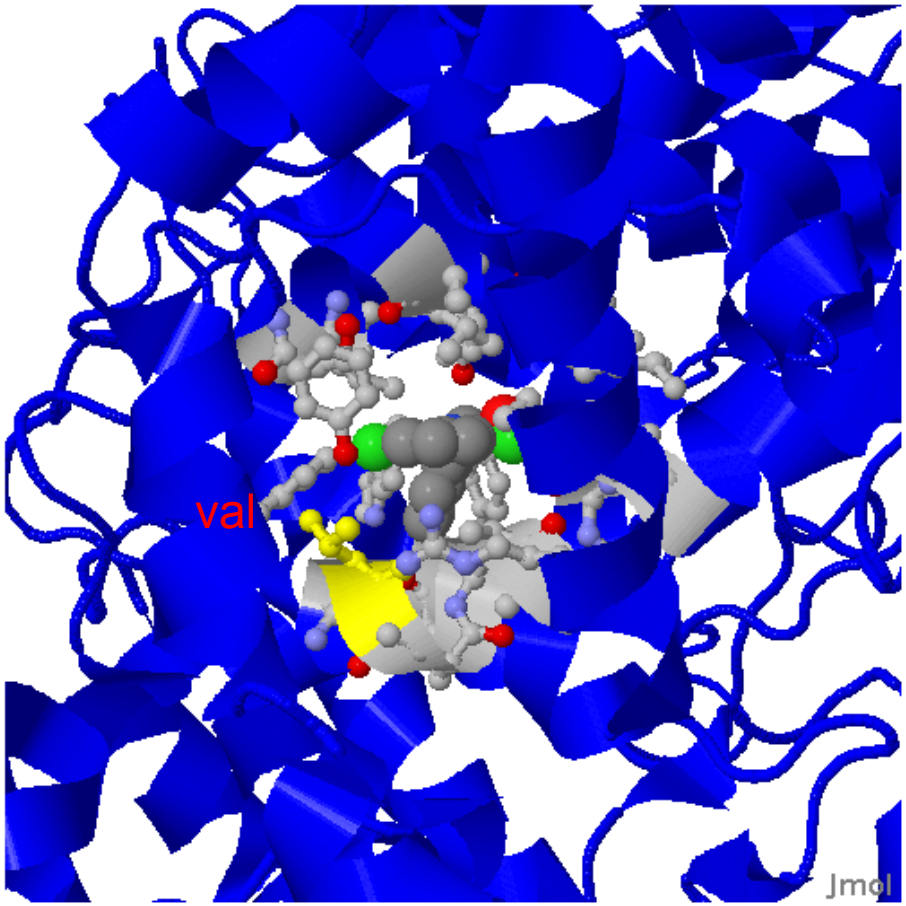
Figure 14.41
(a) Prostaglandins, which cause pain signals to be sent to the brain, are synthesized by the body in response to injury. The starting material for all prostaglandins is arachidonic acid, which is found in the plasma membrane of all cells. Arachidonic acid is transformed to prostaglandins with the help of an enzyme. There are a variety of prostaglandins, each having its own effect, but all have a chemical structure resembling the one shown here. (b) Analgesics inhibit the synthesis of prostaglandins by binding to the arachidonic acid receptor site on the enzyme. With no prostaglandins, no pain signals are generated.

Prostaglandin production is blocked by analgesics

"Conceptual Chemistry" 2nd Ed. John Suchocki 2004 Pearson Education, Inc. p. 485

COX Active Sites

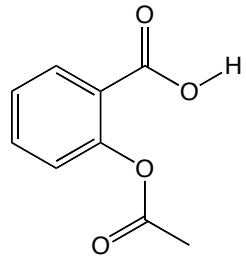




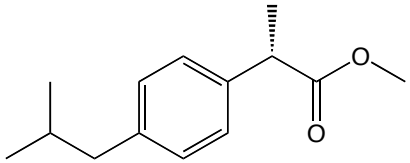
COX-1 is responsible for kidney function & stomach lining

COX-2 is responsible for prostaglandins production (resulting in inflammation, pain, and fever)

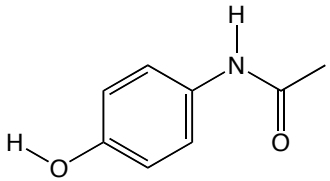
Toward COX-2-Specific NSAIDs



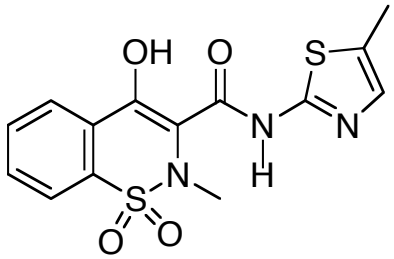
Aspirin



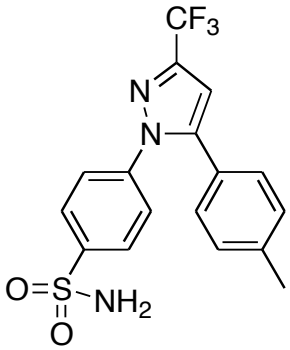
Ibuprofen
(Advil, Motrin)



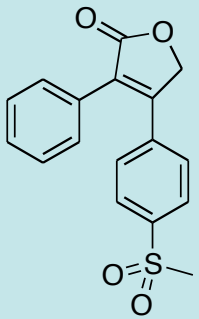
Acetaminophen
(Tylenol)



Meloxicam
(Matacam, Mobic)



Celebrex



Vioxx

A multimillion dollar fly in the ointment: Blocking Cox-2 in mice, according to the new study, also stimulates the production of a protein called tissue factor, or TF, which initiates blood clotting. As heart attacks and strokes are often triggered by blood clots, it is possible that the production of TF is in part responsible for the drug's adverse side-effects in humans.

Journal of Experimental Medicine (2007, August 29). Vioxx Side-effects: Possible Explanation. *ScienceDaily.*

Nervous Communication

Dendrite

Cell nucleus

Electrical impulse travels down axon via opening and closing of ion channels

Impulse direction

Axon

Synaptic terminals

Neuron

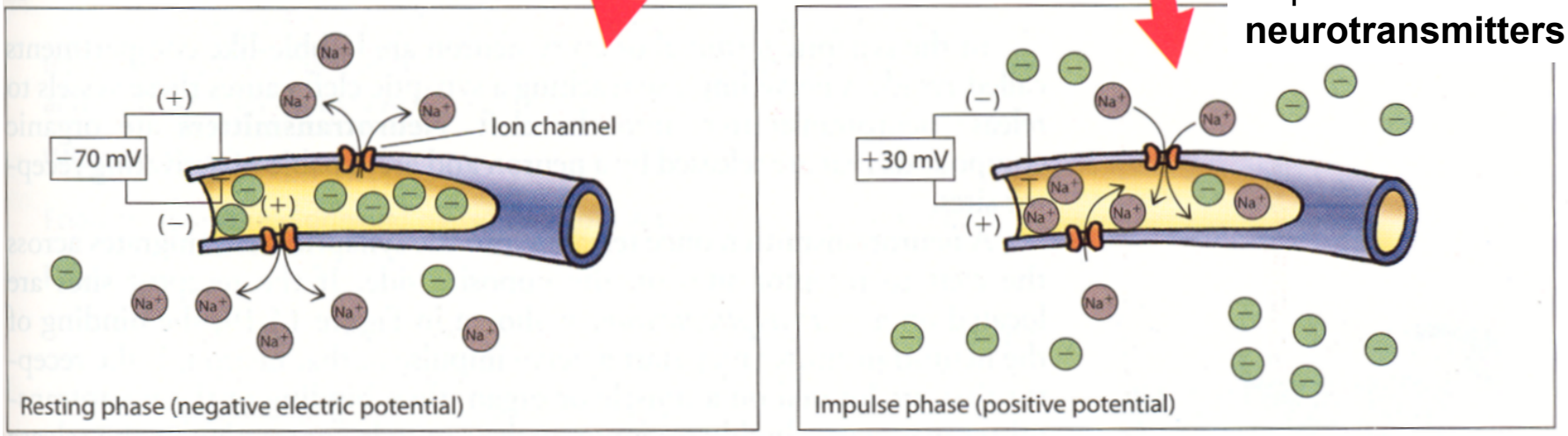
Stimulants enhance the firing of neurons in one of many ways…

nerve "fires" in ~1μs

Getting the signal to the next neuron requires **neurotransmitters**

Negative ion

Sodium ion



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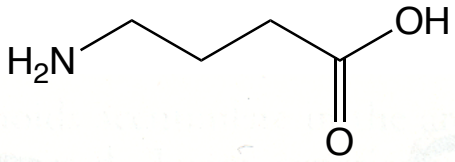
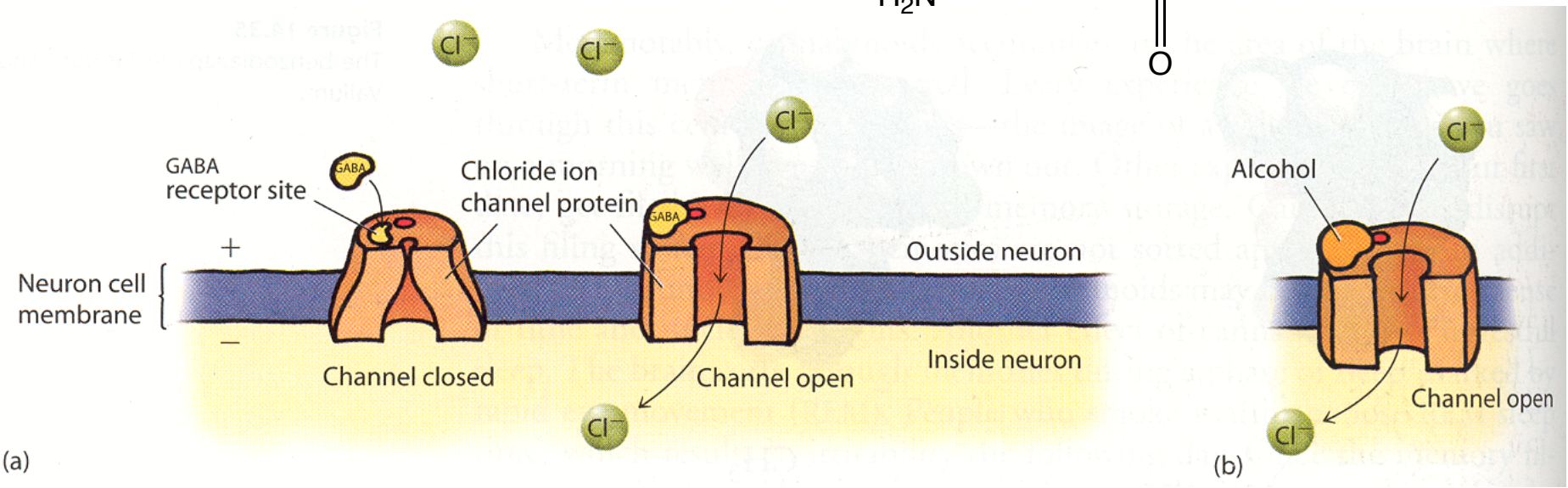
Ethanol's Mode of Action

GABA (an inhibitory neurotransmitter) keeps electrical impulses from passing through a neuron membrane by keeping the ion channel open, thereby preventing the buildup of charge imbalance needed to generate a signal.

Ethanol binds to the GABA binding site, also preventing the buildup of charge imbalance.

GABA (gamma amino butyric acid)





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Summary

We've learned what
- alcohols (hydroxyl)
- carboxylic acids
- esters
- aromatic rings (phenyl)
- amines
- amides
- are & look like (Table 9.2 p. 383)

We've learned about
- starch/amylose
- cellulose
- fats/fatty acids/triglycerides
- Hydrogen bonding
- primary/secondary/tertiary/quaternary structure of proteins
- alpha helices and beta sheets
- enzymes & receptor sites & oxygen carriers
- mRNA, tRNA, replication, transcription, protein synthesis

We've learned what
- sugars
- fats
- proteins
- DNA
- are & look like

We've learned that
- carbon makes 4 bonds
- nitrogen makes 3 bonds
- oxygen makes 2 bonds
- like dissolves like

We've seen
- the condensation reaction
- where hydrogen bonding shapes structure (proteins, starch/amylose, DNA)