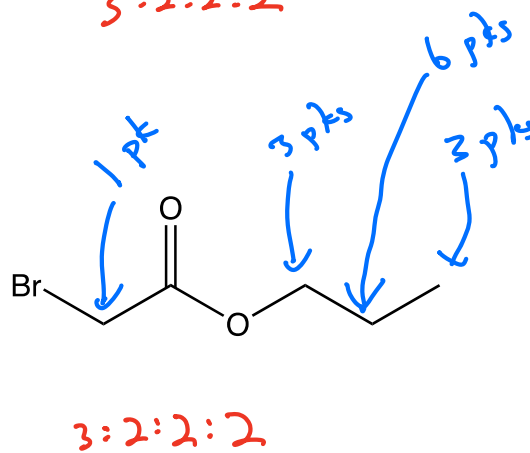
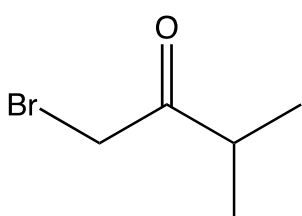
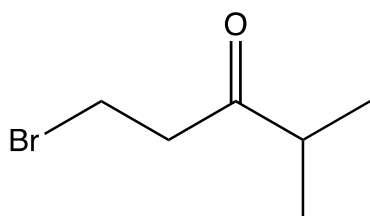
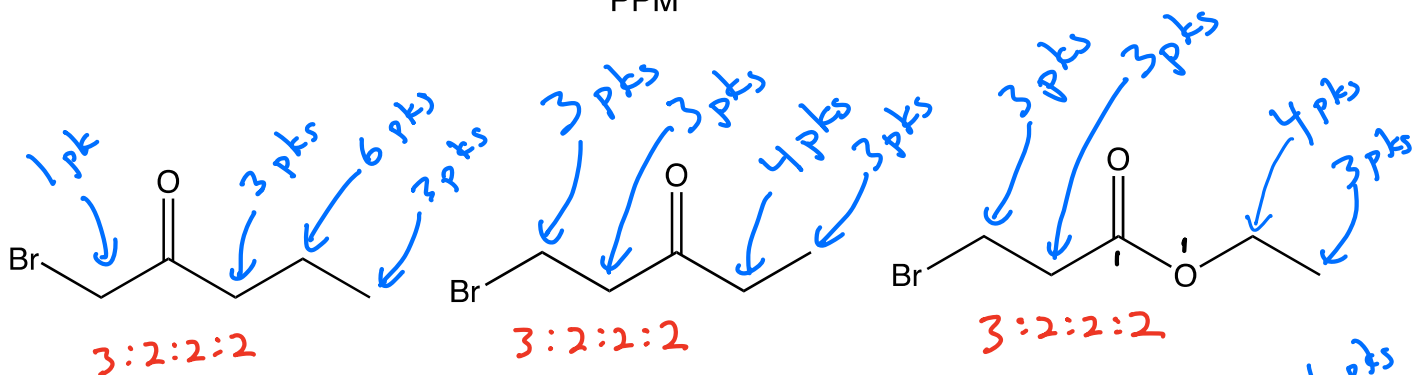
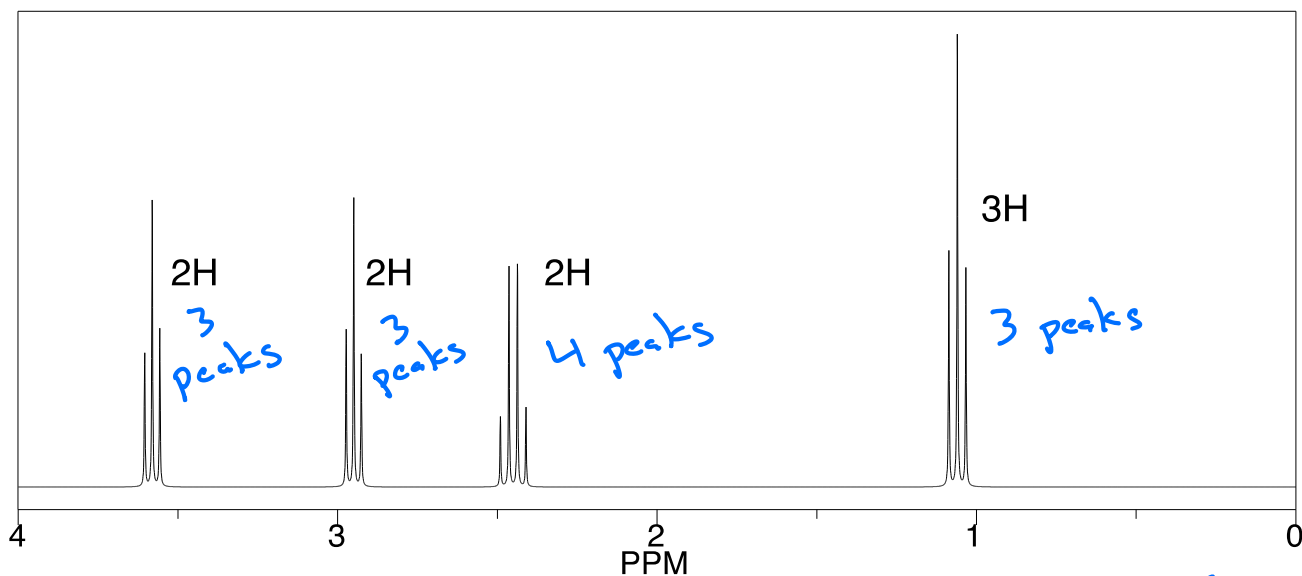


V. When solving NMR spectra problems:

- 1) Determine number and relative integrations of signals predicted for a given structure
- 2) Make sure the splitting pattern matches with the spectrum for each signal and
- 3) If the number and relative integrations as well as splitting patterns match with the spectra, compare expected chemical shifts with those of the signals in the spectra.



MRI – Nuclear Magnetic Resonance Imaging – Produces a 3-d image inside the body.

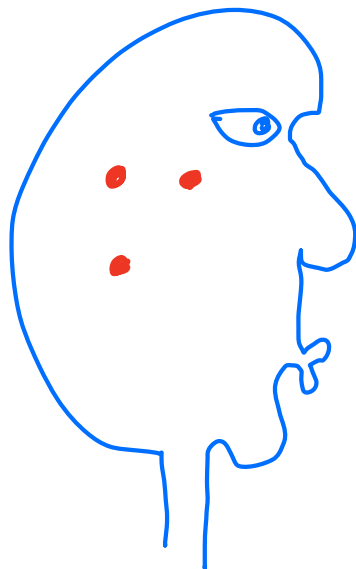
MRI is similar in approach, but complementary to, a CAT scan, which uses X-rays for imaging.

MRI is therefore safer than a CAT scan (no X-rays or other damaging radiation is used). Radiofrequency electromagnetic radiation does not cause DNA damage or any other kind of damage.

MRI primarily visualizes soft-tissue and especially cancer tumors while a CAT scan primarily visualizes bones or Calcium based dyes drunk to visualize the digestive tract.

MRI uses the same principles and NMR.

- 1) The patient is placed in a very strong magnetic field. Creating this very strong magnetic field is technically very demanding, explaining MRI machines are so expensive (~ 0.5 – 1.5 \$ million)
- 2) The patient is irradiated with radiofrequency electromagnetic radiation.
- 3) The flipping (resonance) of ^1H nuclear spins is monitored – Actually emitted photons are measured using the FT method.
- 4) Magnetic field gradients are used to gain imaging information. The magnetic field gradients are rotated around a central point and measurements are taken at each angle around 360° to gain 2-dimensional information. This technique is called **tomography**.



The same three spots seen from different angles –
By analyzing all angles the location and intensities can be calculated

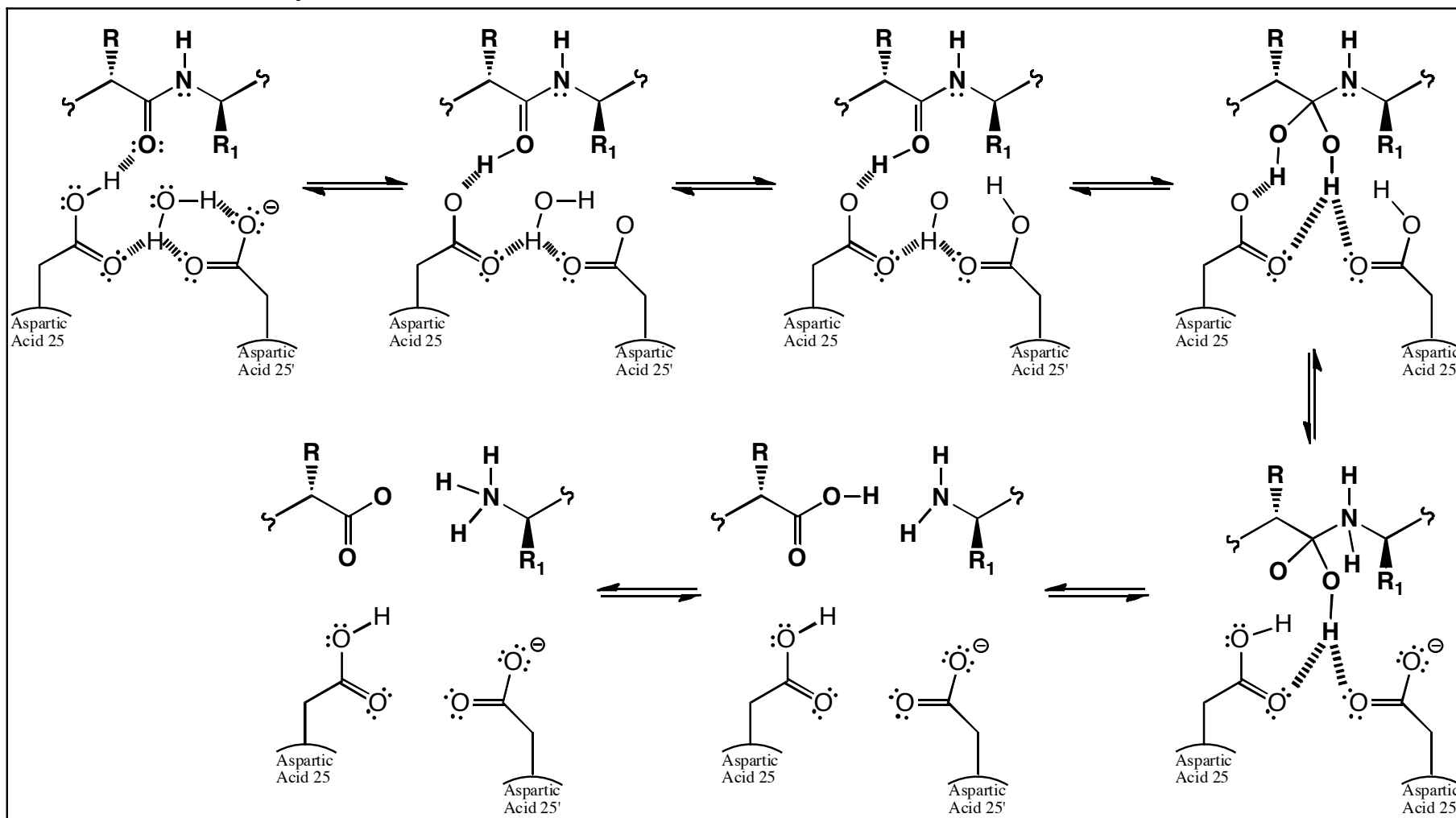
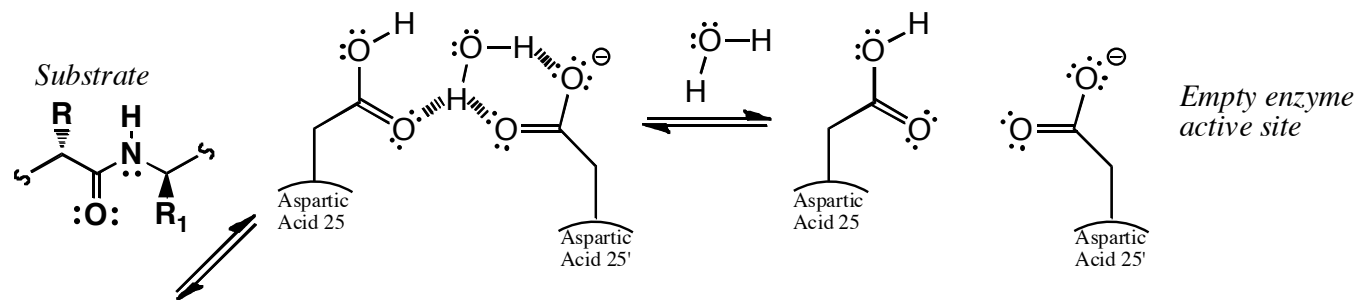
The overall **MRI** imaging approach involves looking at each 2-dimensional slice.

Each slice is added to give a 3-dimensional stack (analogous to stacking DVD's or CD's).

Each slice is shaded to indicate differences in the amount of ^1H atoms in different areas/tissues.

Water and fat have the highest density of ^1H atoms, so these are primarily being monitored in an **MRI** image.

The popular medical diagnostic technique of **magnetic resonance imaging (MRI)** is based on **the same principles as NMR**, namely the **flipping (i.e. resonance) of nuclear spins of H atoms by radio frequency irradiation** when a patient is placed in **a strong magnetic field**. **Magnetic field gradients are used to gain imaging information, and rotation of the gradient around the center of the object gives imaging in an entire plane (i.e. slice inside patient)**. In an MRI image, you are looking at **individual slices that when stacked make up the three-dimensional image of relative amounts of H atoms**, especially the H atoms from **water and fat, in the different tissues** [Memorize the preceding passage, as it will be worth 14 points on the final. No I am not kidding, 14 points right there.]



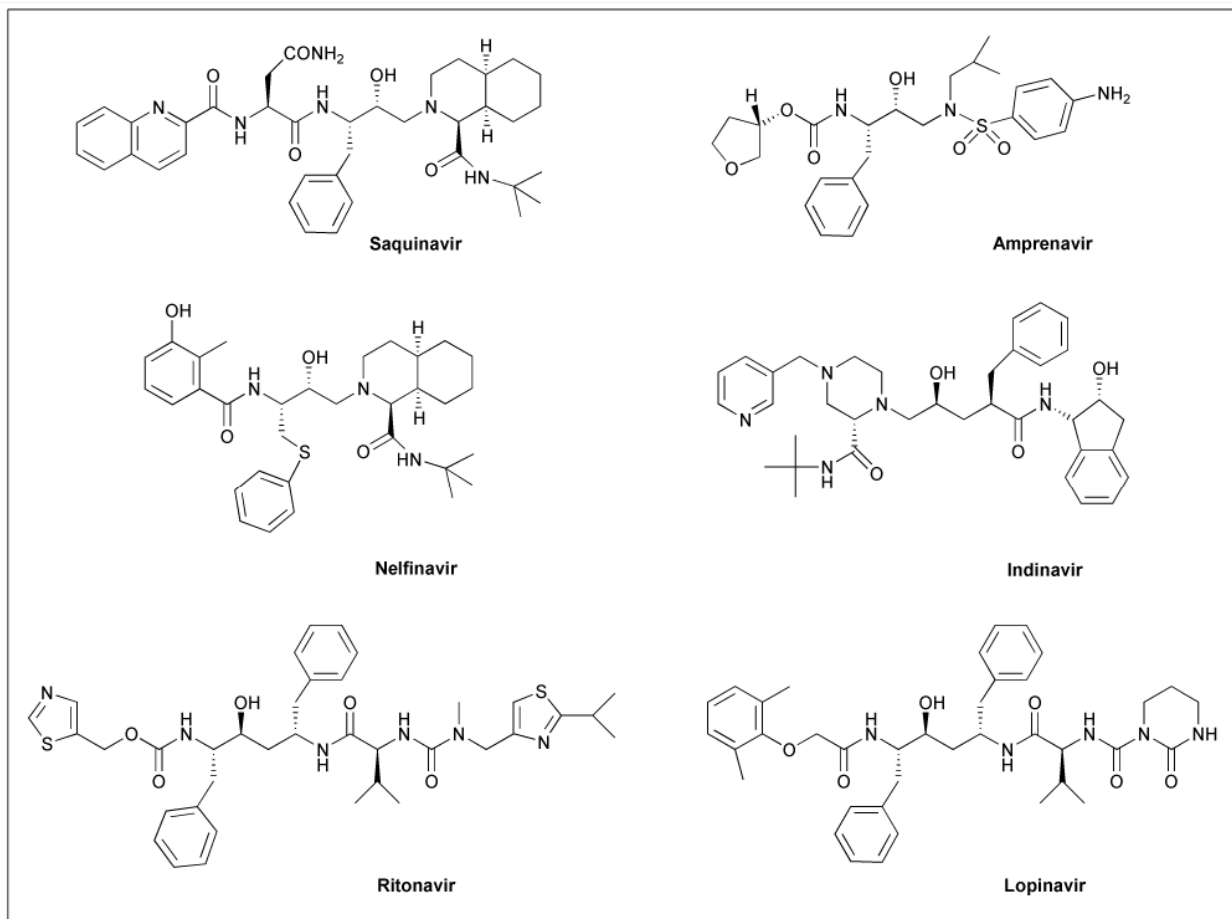


Fig. 10 FDA approved HIV-1 protease inhibitors.

Opiates (heroin, morphine, etc.)

The human body naturally produces its own opiate-like substances and uses them as neurotransmitters. These substances include endorphins, enkephalins, and dynorphin, often collectively known as endogenous opioids. Endogenous opioids modulate our reactions to painful stimuli. They also regulate vital functions such as hunger and thirst and are involved in mood control, immune response, and other processes.

The reason that opiates such as heroin and morphine affect us so powerfully is that these exogenous substances bind to the same receptors as our endogenous opioids. There are three kinds of receptors widely distributed throughout the brain: mu, delta, and kappa receptors.

These receptors, through second messengers, influence the likelihood that ion channels will open, which in certain cases reduces the excitability of neurons. This reduced excitability is the likely source of the euphoric effect of opiates and appears to be mediated by the mu and delta receptors.

This euphoric effect also appears to involve another mechanism in which the GABA-inhibitory interneurons of the ventral tegmental area come into play. By attaching to their mu receptors, exogenous opioids reduce the amount of GABA released (see animation). Normally, GABA reduces the amount of dopamine released in the nucleus accumbens. By inhibiting this inhibitor, the opiates ultimately increase the amount of dopamine produced and the amount of pleasure felt.

Chronic consumption of opiates inhibits the production of cAMP, but this inhibition is offset in the long run by other cAMP production mechanisms. When no opiates are available, this increased cAMP production capacity comes to the fore and results in neural hyperactivity and the sensation of craving the drug.

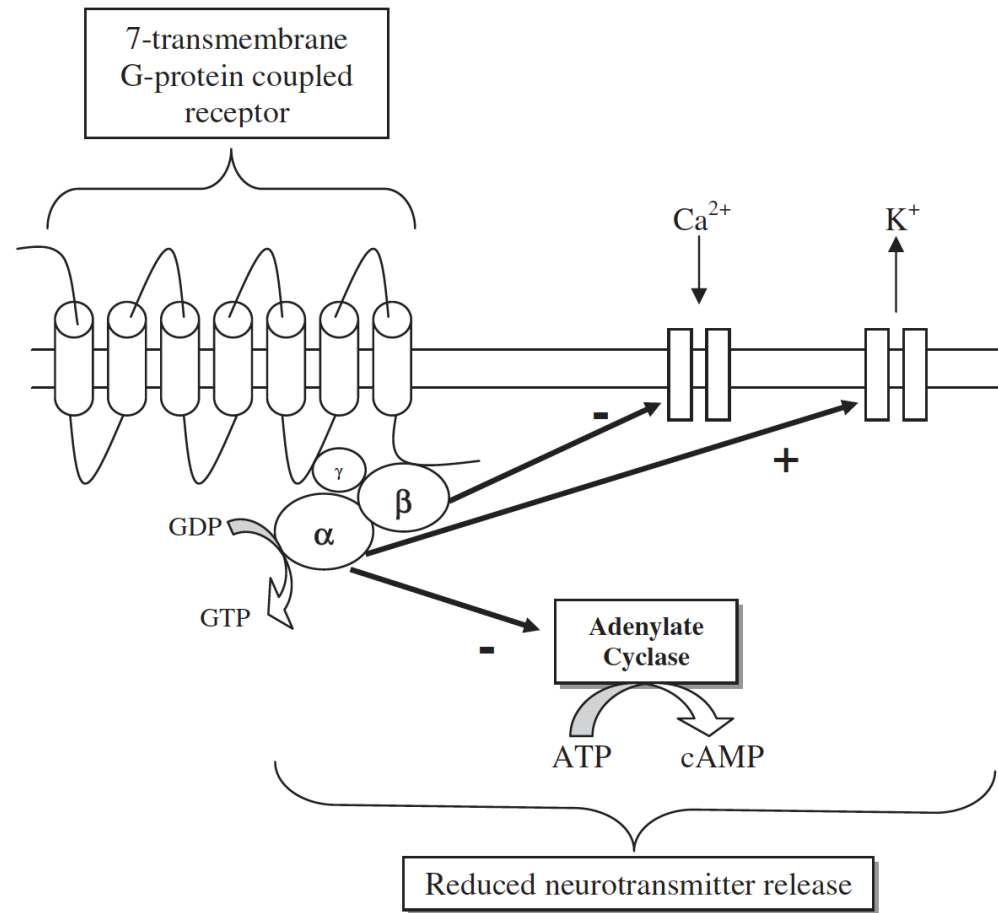
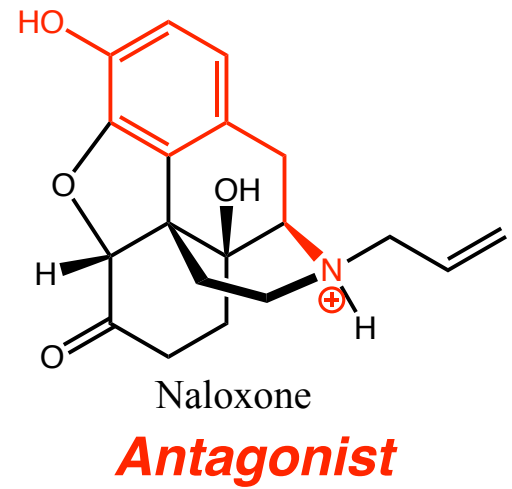
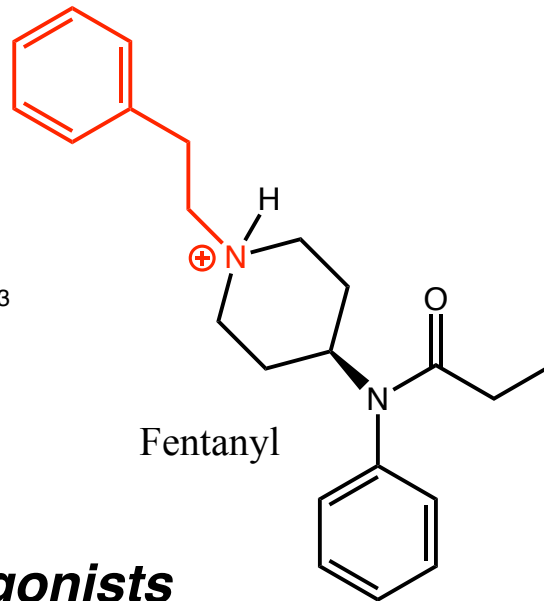
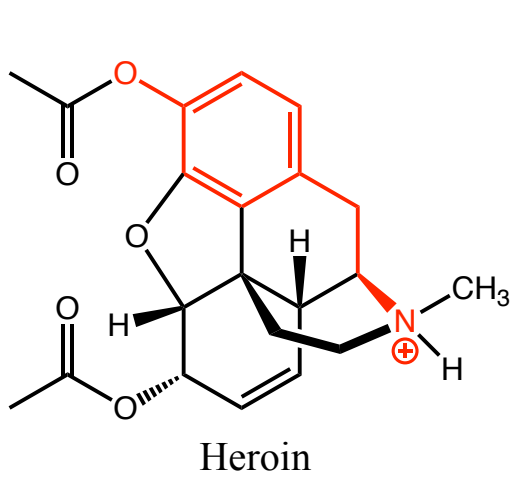
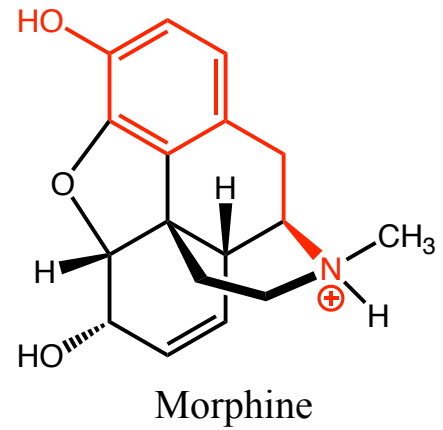
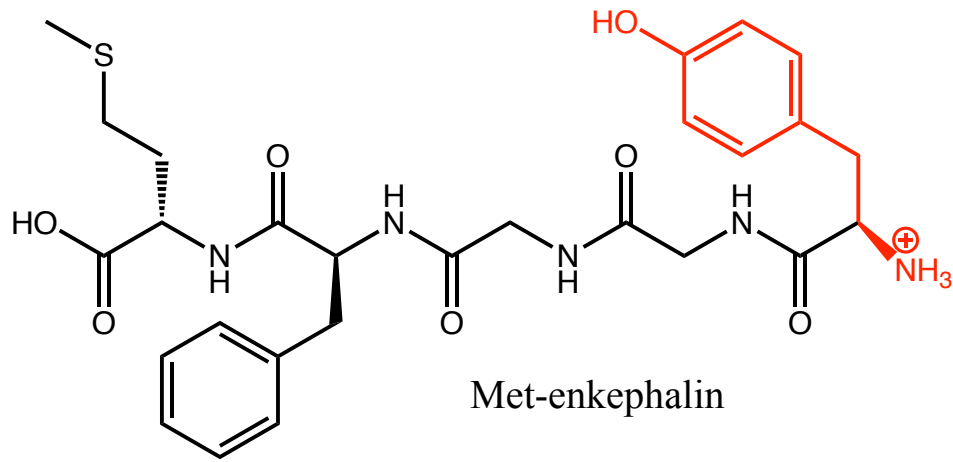
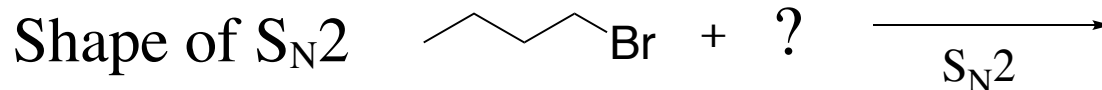


Fig. 1 Seven transmembrane structure of opioid G-protein-coupled receptor. Receptor activation by opioid receptor ligands leads to initiation of intracellular transduction pathways that include stimulation of potassium efflux, inhibition of VSCCs and inhibition of adenylate cyclase. In this diagram the G-protein is denoted α , β , γ but the α -subunit interacts with K^+/Ca^{2+} channel and adenylate cyclase.



Mu-Receptor Agonists



The club ain't the best place to find nucleophiles
So the lab is where I go
Me and my friends in solvent
Moving fast but reacting slow
Come over and start up a reaction with just me
And trust me I'll give it a chance now
Let's react, stop, put your charge over here
And then we start to react, and now I'm singing like
You know I want to make a bond
Your charge was handmade for a reagent like me
Come on now, follow my lead
I'm an electrophile, don't mind me
Say now let's not talk too much
Get through solvent and put your electrons on me
Come on now, follow my lead,
Come, come on now, follow my lead

I'm attracted to the charge of you
We push and pull like charges do
Although my orbitals are reacting too
Come on let's get bonding
Transition state is coming true
Time to finish the S_N2
Creating a bond brand new
Come on let's get bonding
Oh-I-oh-I-oh-I-oh-I
Come on let's get bonding
Oh-I-oh-I-oh-I-oh-I
Come on let's get bonding
Oh-I-oh-I-oh-I-oh-I
Come on let's get bonding
We need to make a bond brand new
Come on now let's S_N2 .

" Don't Stop, Believin'

Just a Houston girl,
Living in a Longhorn world.
She took the premed train
Straight to OChem 1

Just a Plano boy,
Born and raised in full burnt orange,
He took the premed train
Straight to OChem 1

They study in a smoky room,
Smell of vapes and Mountain Dew
For an A they study all night
It goes on and on and on and on

Alkanes to alkynes
Up and down the I-35
Two students studying in the night
Roadmaps, reactions
Living just to pass the final
Will they ever get it right

Working hard to get my grade
Everybody wants an "A"
Trying anything to ace this class
Just one more exam
Some will win, some will lose
I don't want to sing the blues
OChem never seems to end
It goes on and on and on and on

Alkanes to alkynes
Up and down the I-35
Two students studying in the night
Roadmaps, reactions
Living just to pass the final
Will they ever get it right

Don't stop believin'
Hold on to that "A" feelin'
Roadmaps, reactions
Ohohohohohoh

Don't stop believin'
Hold on
Roadmaps, reactions
Ohohohohohoh

Don't stop believin'
Hold on to that "A" feelin'
Roadmaps, reactions
Ohohohohohoh

We All Love Organic Chemistry

**In the town where I was born,
Lived a man of chemistry.
And he told us of his life
In the organic laboratory.**

**Making molecules to fight disease
Coming up with their syntheses.
So we sit in 320M
Learning organic chemistry.**

Refrain:

*We all love organic chemistry
Synthetic chemistry
Molecules with "C"
We all love organic chemistry
Synthetic chemistry
Molecules with "C"*

**All our friends think we're a bore
Our grade point averages begin with
4.**

**But we await graduation day
To work in lab for meager pay.**

**But its OK, who else can say
They're curing cancer or fighting
AIDS.**

**We hope that you in 320M
Respect organic chemistry**

Refrain:

*We all love organic chemistry
Synthetic chemistry
Molecules with "C"
We all love organic chemistry
Synthetic chemistry
Molecules with "C"*