

Office Hours

Having Your Questions Answered is a Huge Part of Learning Organic Chemistry

I am sort of stating the obvious there I know. Unfortunately, in the past, attendance at my office hours usually only reached about 20% of the class (or less) most of the time. We now offer a variety of formats. We assume all of you will watch the on-line simulcast office hours on Mondays from 3:30 - 5 PM, but we also assume you will attend at least one of the other formats at least once per week. [See recordings by clicking here.](#)

Monday 3:30-5 PM Studio is BUR 124 Iverson Live Virtual Simulcast Office Hours (recorded) - I will provide prepared explanations of the most difficult material, answer questions you submit from your computers, and I will work through difficult examples with you. You can also attend in person in the very cool broadcast studio! No Hawaiian shirts required if you attend in person, although they are recommended. We assume that all of you will be coming to this office hour or at least watching the recording. [Click here to attend by live streaming.](#) [Click here to attend by live Zoom.](#)

Tuesday 3:30-4:30 PM MEZ 1.306 Active Problem Solving (recorded) - Historically, students say these are THE BEST WAY TO SUCCEED IN THE COURSE. New and challenging problems will be presented, and you will work in groups to solve them. These optional sessions will provide the perfect opportunity to ask any questions you have about any of the course material as well.

Wednesday 5-6 PM MEZ 1.306 Iverson In-person Office Hours (recorded) - I will be answering questions in a standard format office hour each week. Attend this if you have specific questions about the material being currently discussed in lecture.

Thursday 5-7 PM BUR 108 "Missed the Wave" Office Hours (recorded) - Falling behind a little, no worries. We got you. It happens to everyone, especially in OChem II. This office hour is specifically for people who feel they need help catching up or want to discuss older material. TA Qifan or one of the other TAs will lead this. If you ever feel you are missing the wave during the semester, THIS IS THE OFFICE HOUR FOR YOU!

Friday 10-11 AM PHR 2.110 Active Problem Solving (recorded) -- Historically, students say these are THE BEST WAY TO SUCCEED IN THE COURSE. This will be a repeat of the Tuesday session, no need to attend both!

SI Leader Introduction - Madison Ruggiero

Hi everyone I'm a junior biochemistry major and I'm super excited to work with you all! I took Ochem II last spring and I was an SI Leader for this course this past fall. This course can seem intimidating, but I know anyone can succeed if you consistently set aside time to review and put in the effort. I am here to help you in any way I can, please come see me in weekly discussion sessions!



What to expect from SI Sessions?

- The purpose of SI sessions is to facilitate active learning, put effective study strategies into practice, help students become more self-sufficient learners, and to build community by collaborating with your peers.*
- The role of an SI Leader is to help you think for yourselves as you solve problems, so I may not answer your questions directly and instead redirect you to your peers, resources, or ask you another question.*

Why should you attend SI Sessions?

- You will collaborate with your peers in a peer-led discussion group which is proven to be very effective for learning. Additionally, you may find people to create study groups with outside of class which can be very helpful (and was my favorite part of Ochem II).*

When will SI Sessions be held?

- SI Sessions are held twice a week for an hour each. Each weekly session will be identical, so there is no need to attend more than one session a week (but you are still welcome to attend both if you'd like).*
- SI Sessions begin next week (1/22) and we will cover material from the previous week's lectures.*
- Specific times and rooms will be announced before next week.*

In the classic ^1H -Nuclear Magnetic Resonance (^1H -NMR) experiment:

1. A sample of the molecule of interest is placed in solvent (the solvent has deuterium atoms in place of H atoms so the solvent molecules will not show up in the spectra).
2. The solution is put in a spinning tube in a very strong magnetic field.
3. The sample is exposed to radiofrequency irradiation and if it is of exactly the right frequency, energy is absorbed and spins flip from $+1/2$ to $-1/2$ spin states (the energy absorption/spin flipping process is called resonance).
4. The absorbed energy is plotted on the spectra as a function of wavelength, normalized by using the parts per million (ppm) scale.
5. ^1H nuclei in different functional groups come into resonance at different and characteristic values of ppm and adjacent ^1H nuclei split signals in predictable ways, allowing for chemical structures to be determined based on ^1H NMR spectra.

The old way to carry out an NMR experiment:

1. Scan wavelengths (ex. High to low wavelengths) of radiofrequency electromagnetic radiation.
2. Measure absorbance during the scan and plot the amount of energy absorbed versus wavelength using the normalized ppm scale.
3. This is NOT used any more.

What we did not tell you: After a nuclear spin is flipped back from $+1/2$ to $-1/2$, it will relax back to the $+1/2$ spin state and EMIT a photon of the same wavelength it absorbed in the first place.

How modern NMR works:

1. The sample is irradiated with all wavelengths simultaneously with a short blast. All of the ^1H spins are flipped at once.
2. The sample is monitored for emitted photons as the ^1H nuclear spins “relax” back to the $+1/2$ spin state.
3. The emitted photons are analyzed using a technique called Fourier Transform (FT) to extract frequency and intensity information.
4. The frequency and intensity information is plotted on the ppm scale.
5. This process is repeated hundreds or thousands of times with the same sample to dramatically improve signal-to-noise.

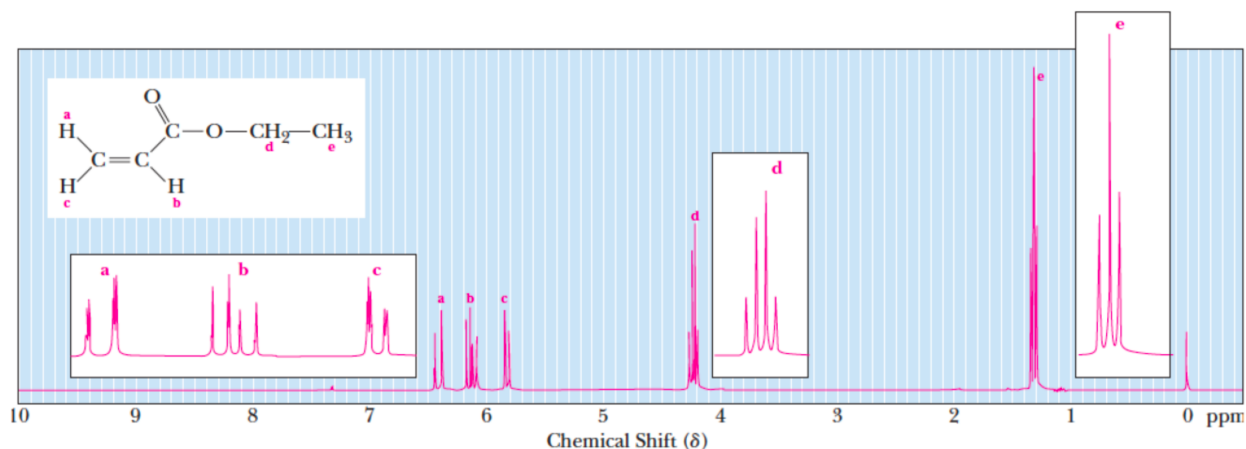


Figure 13.21
300 MHz ^1H -NMR spectrum of ethyl propenoate.

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

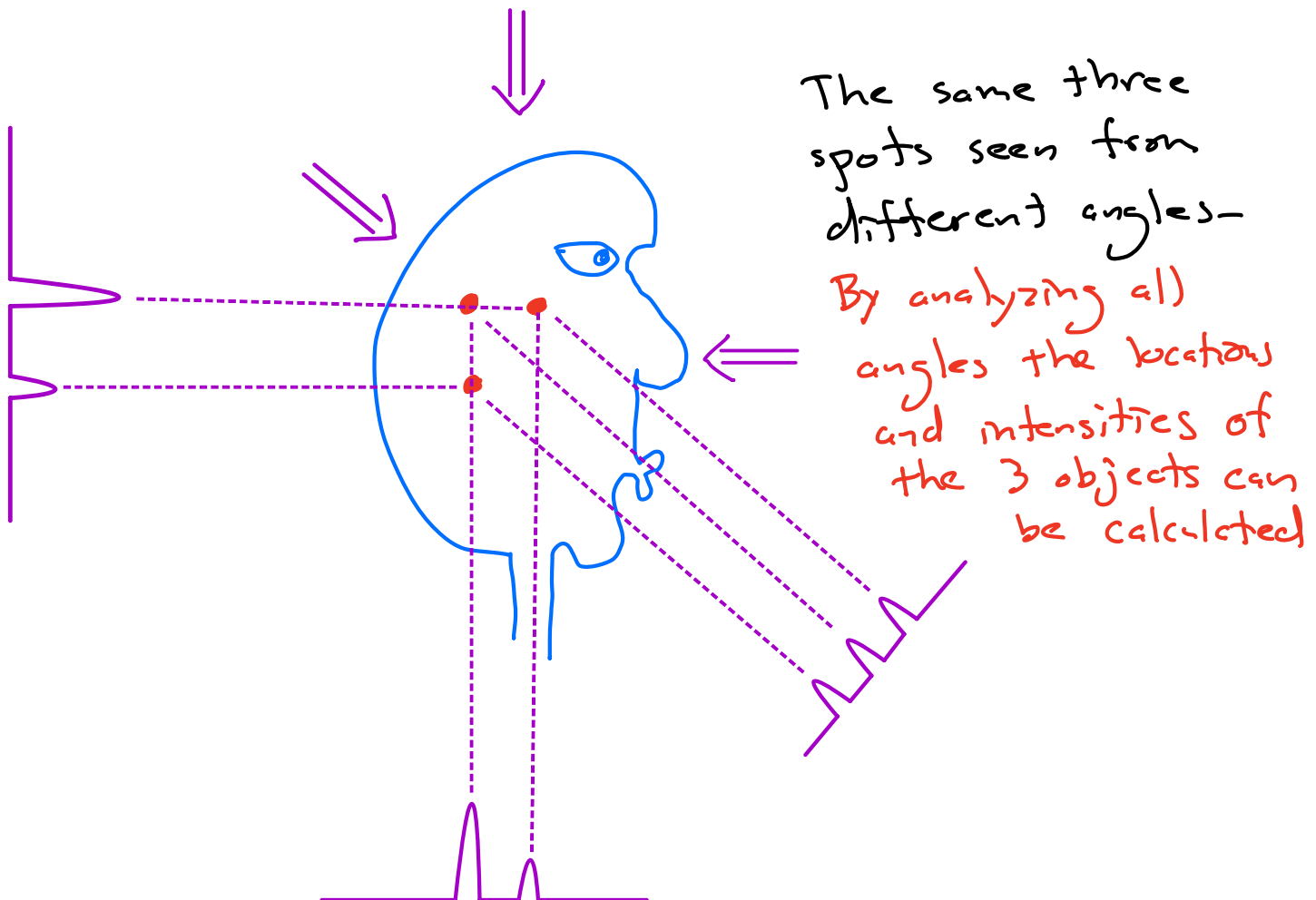
MRI is similar in approach, but complementary to, a CAT scan, which uses X-rays for imaging.

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 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.

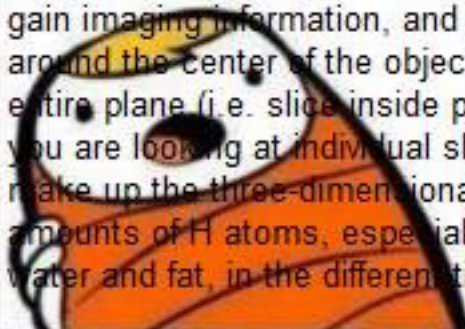
Water and fat have the highest density of ^1H atoms, so these are primarily being monitored in an **MRI** image.

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 next midterm. No I am not kidding, I just gave you 14 points right there.]





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.



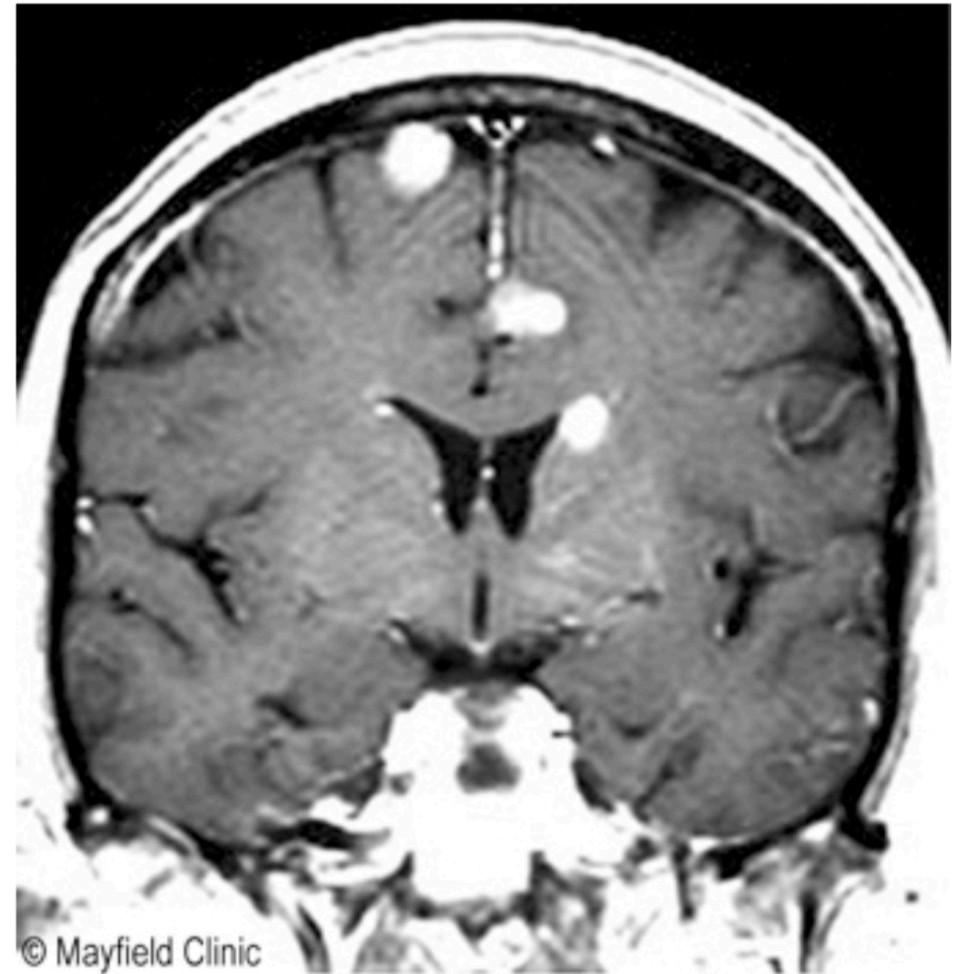
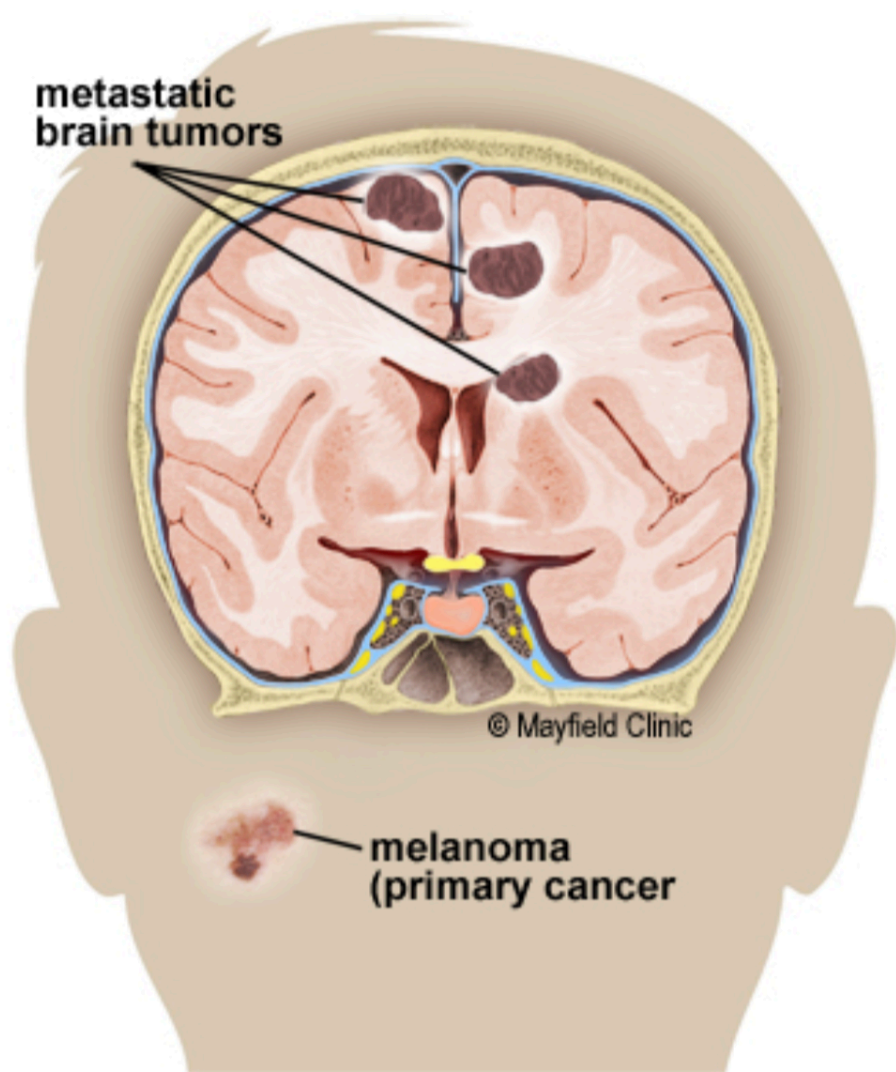
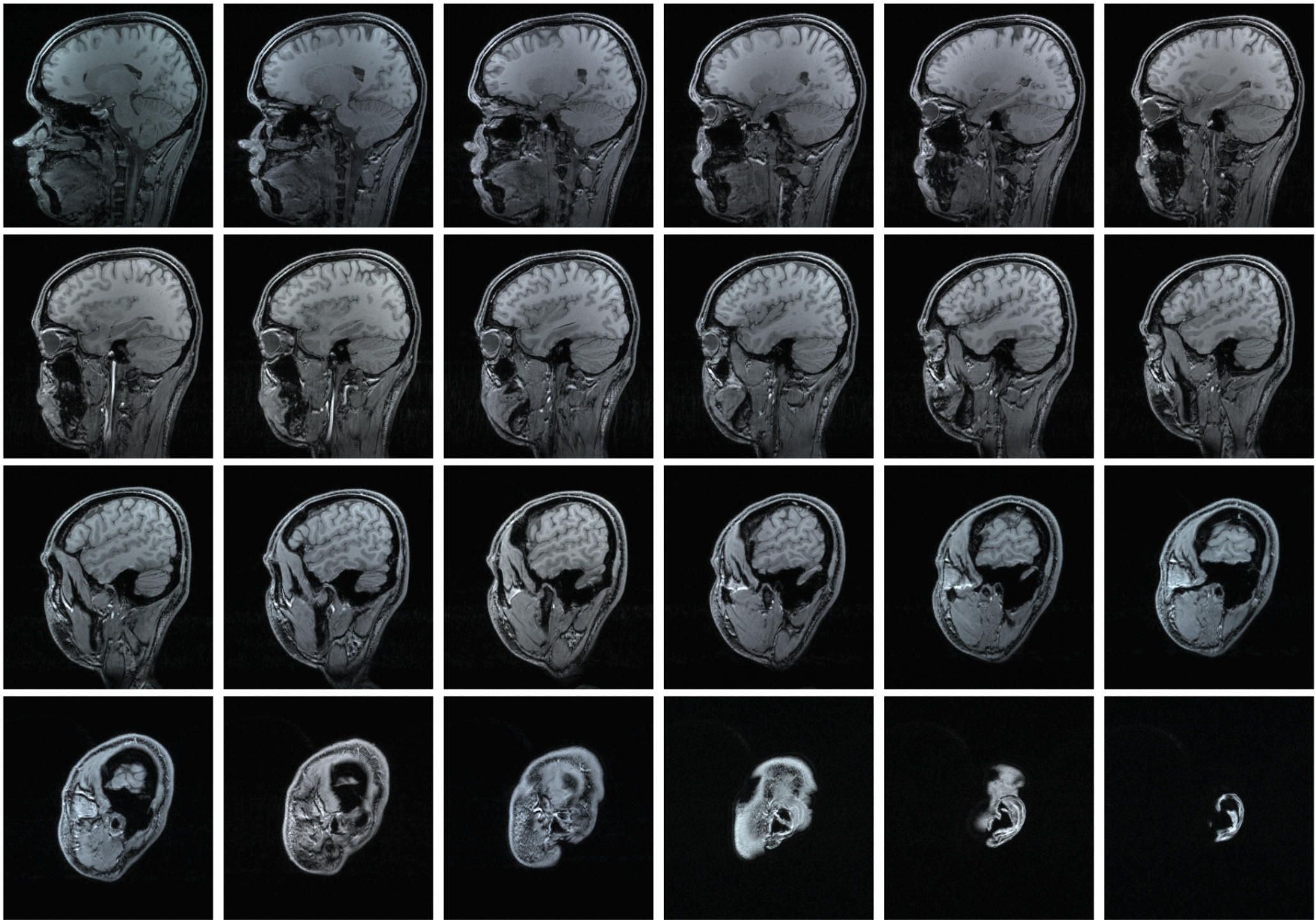


Figure 1. Illustration and MRI of multiple metastatic brain tumors that have spread from the melanoma skin cancer on the face.



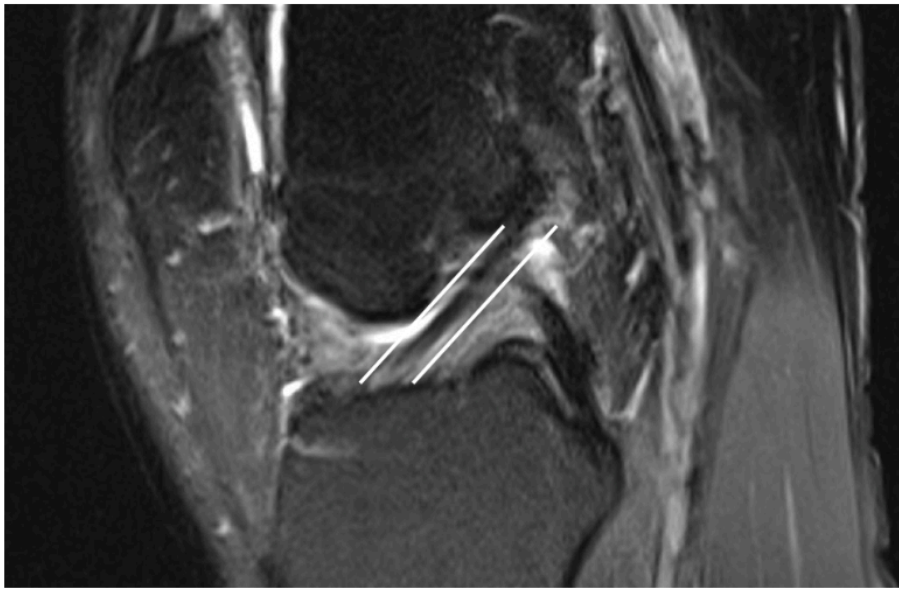
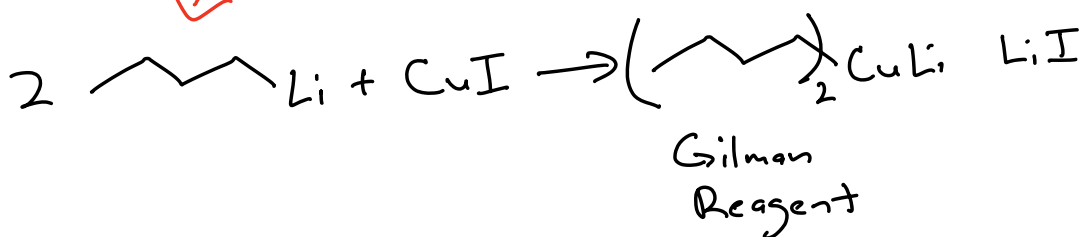
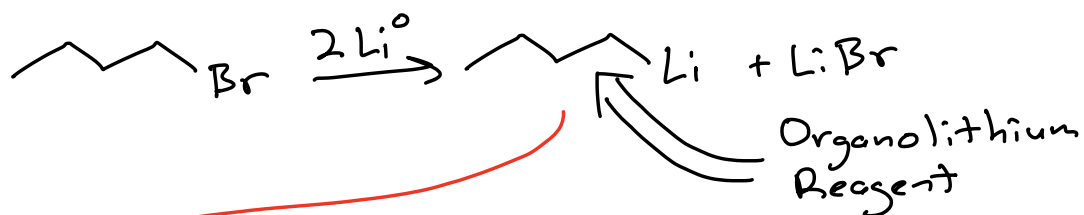
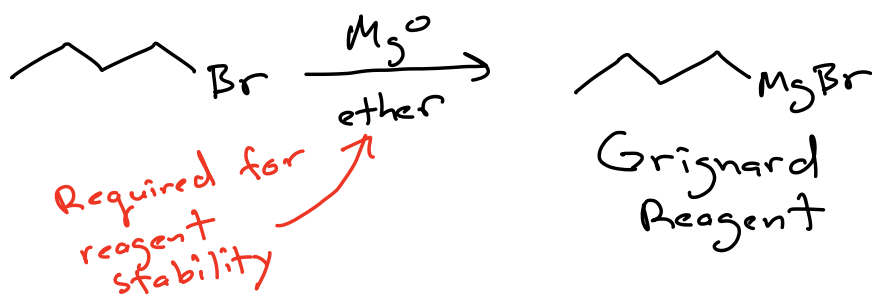


Image 13-16: MRI images of a normal ACL (between white lines), ruptured ACL (ligament not clearly visible), bone marrow oedema (white arrows) and anterior tibial translation.

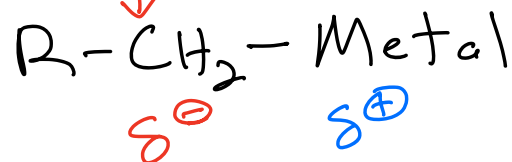
Preparation of Organometallic Reagents

→ C-Metal bonds
→ Prepared from haloalkanes



Not responsible for the mechanisms here!

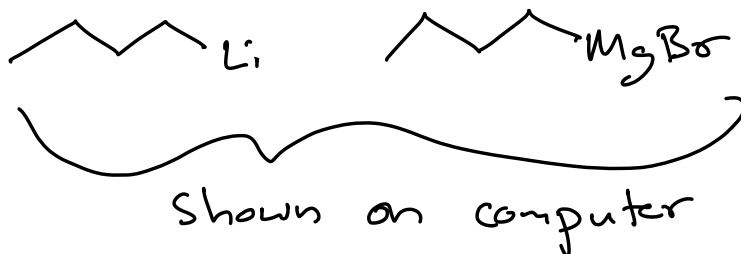
More electronegative



The C-metal bond is polarized so the majority of electron density is on C.

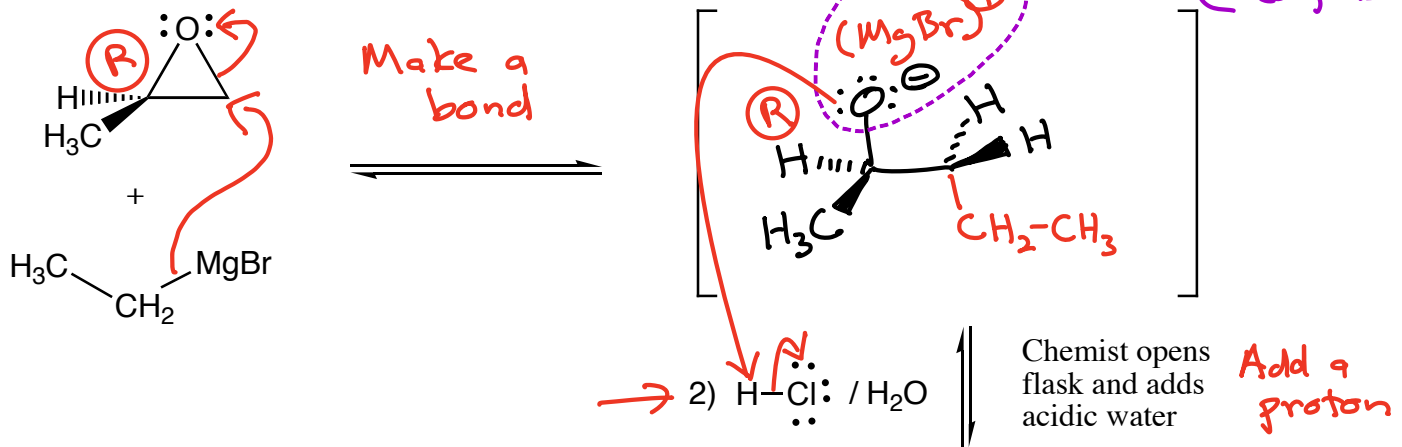
OII The carbon atom of organometallic

The electron density of the C-metal bond acts as a source for an arrow!



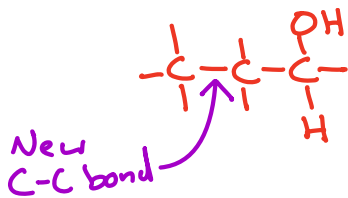
Organolithium and Gilman reagents react the same way as Grignard reagents in this reaction.

Grignard Reagent Reacting with an Epoxide



Key Recognition Element (KRE):

There is a new C-C bond that is two carbon atoms away from an OH group



New C-C bond!

