Lecture 1
Introduction to medical imaging

We will discuss the following questions in this module

1. Why do we need medical imaging?
2. Why are there so many different imaging modalities?
3. What are the shortcomings of current imaging techniques?

Why do we need medical imaging?

Why do we need medical imaging?

- Diagnosing diseases

www.bbc.com

- Structural and functional information about healthy tissues

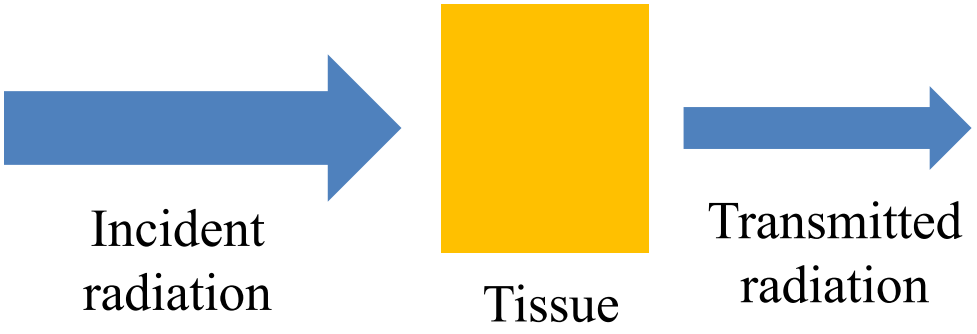
www.mayoclinic.org

- Usually non-invasive

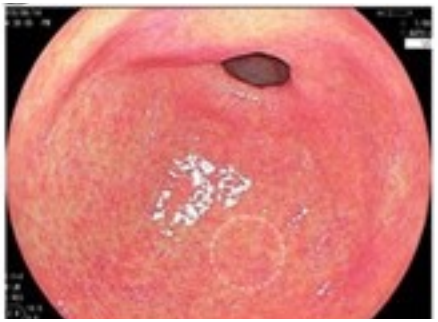
What is the principle of medical imaging?

- Interaction of some form of energy (e.g. electromagnetic wave for x-rays, sound waves for ultrasound imaging, etc.) with biological tissues.

- Tissue needs to be **semi-transparent** to the radiation. Neither completely transparent, nor completely opaque to the radiation.

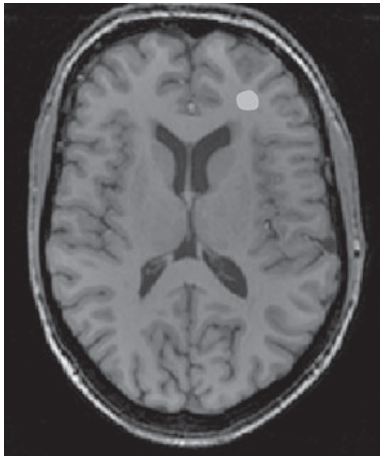


Can you identify these imaging techniques?



Endoscopy
(Sun, *et. al.*, Sci. Rep., 2017)

X-ray
(Smith and Webb)



MRI
(Smith and Webb)

Ultrasound
(www.wikipedia.org)

Why are there so many different medical imaging modalities?

Why are there so many different medical imaging modalities?

- Each technique involves a separate physical interaction of energy with the biological tissue.
- Each technique measures different physical properties of tissue.
- Two tissues may be very similar in one property, but differ in another.

Are there any problems with current imaging techniques?

Are there any problems with current imaging techniques?

- Spatial resolution ~ 1 mm. Early detection of cancer is difficult without molecular diagnostic tests!
- Hazards (ionizing x-rays, high magnetic fields)
- Bulky, expensive equipment. Needs trained people to operate.
- Slow