Outline

• I. What is Cancer
• II. Typical Cancer treatment
• III. How is particle radiation different
• IV. Particle-Tissue interactions
• VI. Conclusion
• V. What’s Next for Proton Therapy
What is Cancer?

- Abnormal cells uncontrollably grow and divide destroying surrounding cells and tissues.
Typical Cancer Treatment

**Chemotherapy**
- Use of drugs to treat cancer
  - Ex. doxorubicin, asparaginase,
- Works in all parts of the body
- Slows/stops growth of cancer cells

**Surgery**
- Goal is to cut out all cancerous cells from the body.
- Only works if the cancer is isolated in one (or a few) regions.
- In a certain area

**Radiation Therapy:**
- The use of X-rays to shrink/kill cancerous cells by damaging their DNA and creating free radicals.
- In a certain area
Particle Radiation:

**Electron:**
- Uses linear accelerator to generate a beam of electrons.
- Energy is released near the surface of the body, which is great for superficial tumors as it does not harm normal tissues that reside deeper.

**Neutron:**
- Originally used but were not as successful as protons.
- Currently 3 places in the US that practice this. Requires 1/3 the effective dose compared to protons.
- Better treat certain brain tumors, also has a shorter treatment cycle.

**Carbon Ion: (Heavy Ion Therapy)**
- An increased efficiency of the dose because they have a higher density of ionization at the end of their path.
- There are only 8 places that allow for Heavy ion therapy.

**Proton:**
- As of 2012, is the most common.
- Currently 49 facilities worldwide practice proton therapy.
Making the Comparison

http://www.quantumdiaries.org/2012/page/31/
How does proton therapy work?

- Uses an accelerator.

- Most people think of an accelerator like the LHC...think smaller...well a little smaller.

- Use of magnetic fields to speed up and energize the particles.
- The particles are then focused to the specific area of treatment.
As protons travel through the body, they deposit some of their energy. Then at a specific distance they release a surge of energy. After which no energy is released.

Sophi Farid  PHYS 3305 Southern Methodist University Spring 2016
The Bragg Peak
Conclusion

• While all methods have been shown to be somewhat successful in the fight against cancer, particle radiation techniques have been less harmful.

• Bragg Peak

• Extremely accurate

• Better suited for difficult-to-reach tumors
What’s Next for Proton Therapy?

- Unethical NOT to use particle radiation
- Presently, team at the Oxford Particle Therapy Cancer Research Institute was created to bring together a variety of medical professionals and scientists to study the effects of proton radiation therapy.
- Accessibility is increasing...there’s a center in Irving.
Pencil Beam Scanning

ScrippsHealth

Sophi Farid  PHYS 3305 Southern Methodist University Spring 2016
Works Cited


