MEDICAL PHYSICS

A Broad Spectrum of Careers

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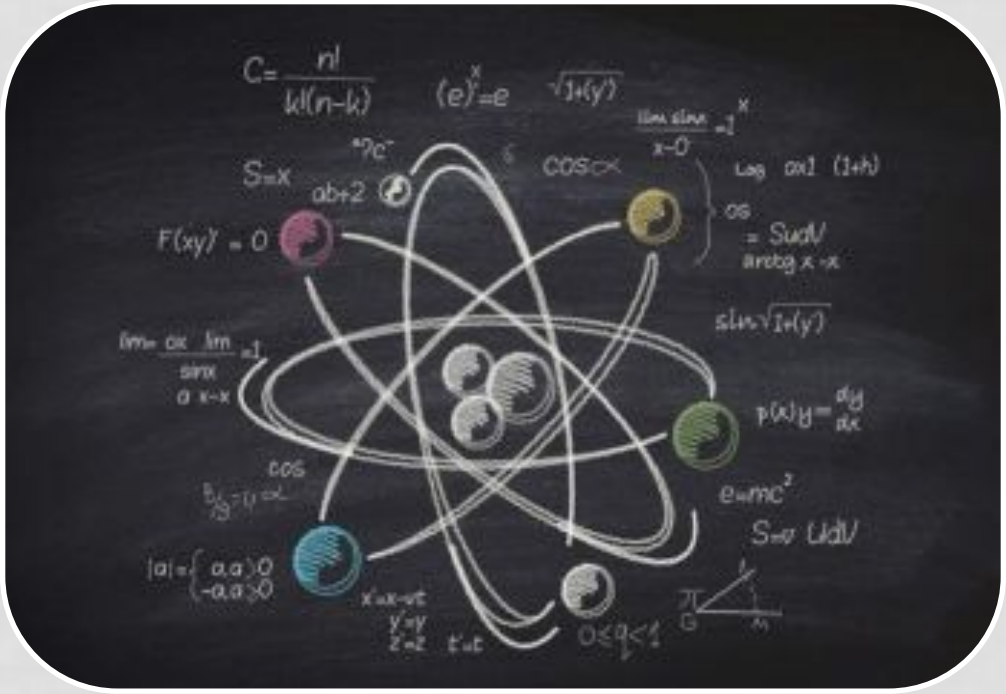
OVERVIEW

- What is Physics?
- Career Path Guidance for Physics Major
- Introduction to Medical Physics
- Job Description
- Scope of Practice
- Specializations
- Qualification Required

WHAT IS PHYSICS?



Physics is the natural science that studies matter, its fundamental constituents, its motion and behavior through space and time, and the related entities of energy and force.

CAREER PATH GUIDANCE FOR PHYSICS MAJOR

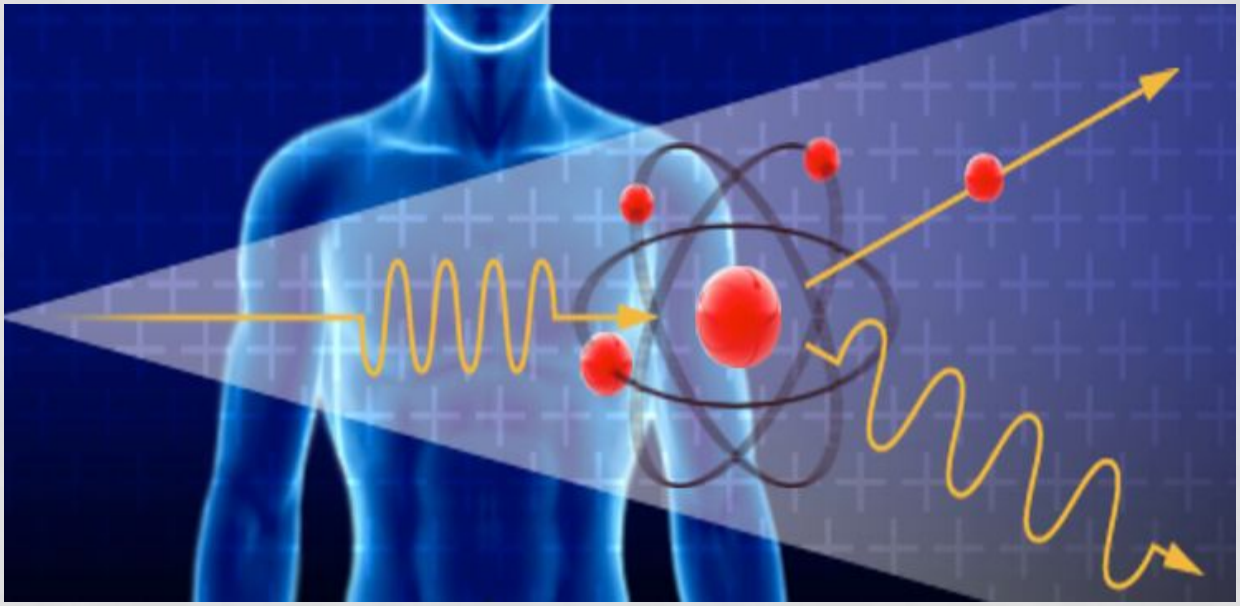
It's a common misconception that earning a role as a high school teacher or a college professor is the most likely or realistic career path for physics majors.

In reality,

"A physics degree is a passport into a broad range of science, engineering and technology careers."

INTRODUCTION TO MEDICAL PHYSICS

Medical physics deals with the application of the concepts and methods of physics to the prevention, diagnosis and treatment of human diseases with a specific goal of improving human health and well-being.



WHAT DOES A MEDICAL PHYSICIST DO?

- Medical physicists work in health care and apply their knowledge of physics to the development and use of medical radiation treatments, devices, and technologies.
- They make sure the equipment is operating correctly and are often involved directly with a patient's diagnosis and treatment, as well as with radiation safety and product development.

SCOPE OF PRACTICE

- Plan radiation treatments for cancer patients
- Ensure equipment is safe, effective, and working properly
- Develop new safety procedures
- Research new treatment options
- Teach and train future medical physicists, residents, and medical students

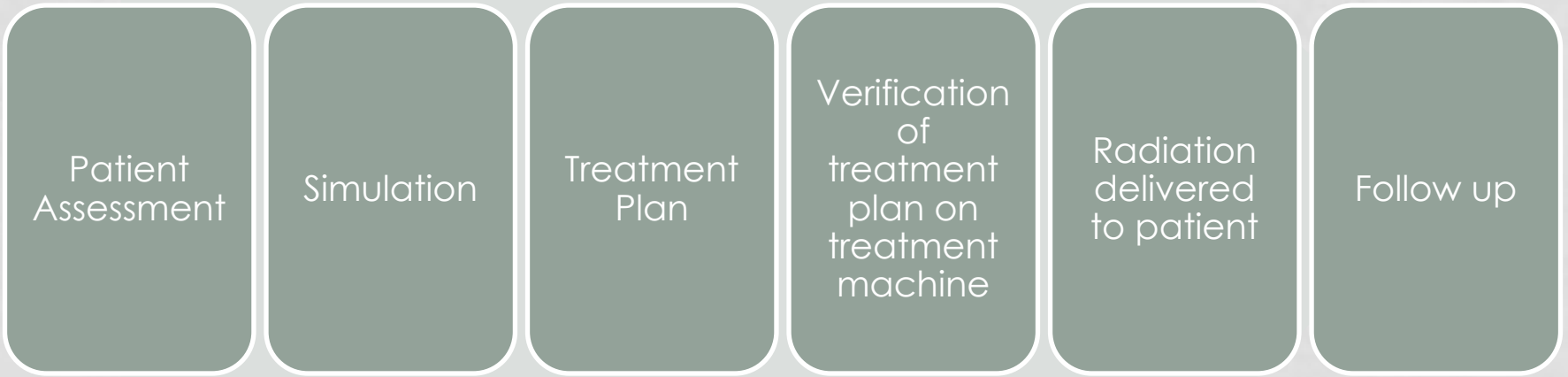
SPECIALIZATIONS

Medical physicists commonly practice in one of these areas:

- Therapeutic medical physics
- Diagnostic medical physics
- Nuclear medical physics

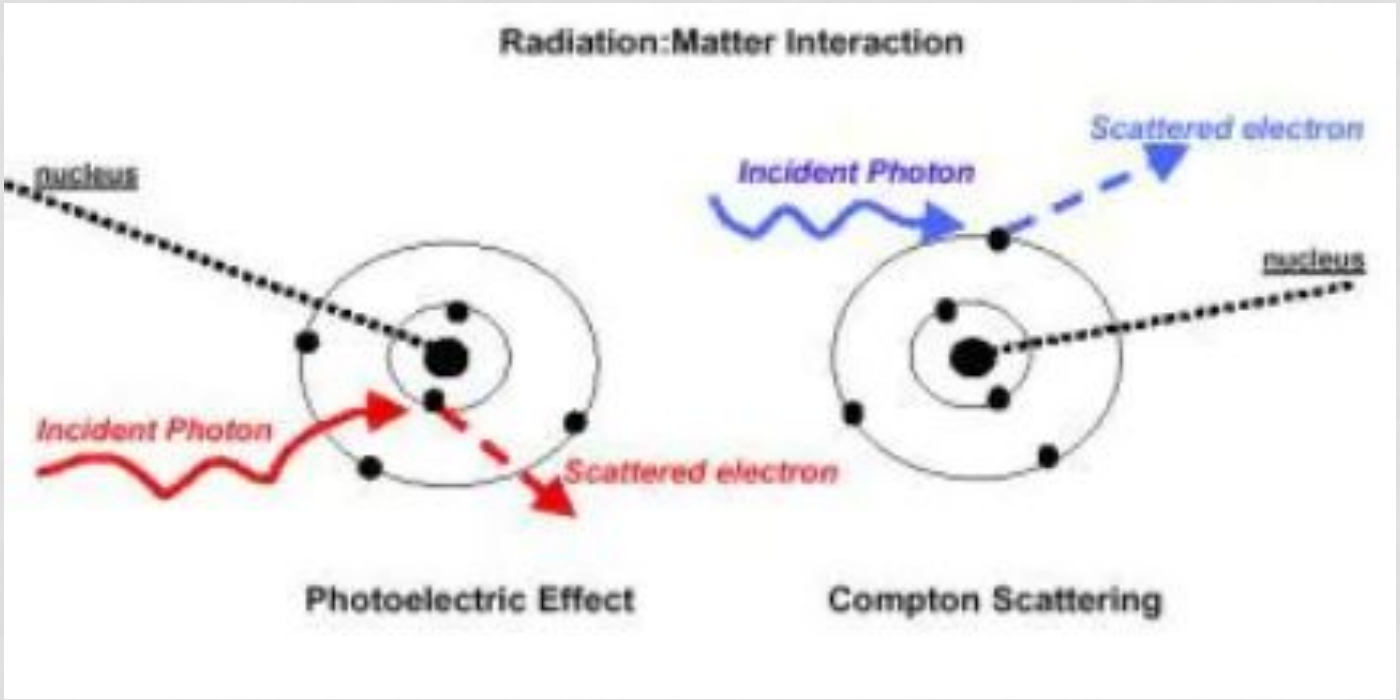
Therapeutic Medical Physics

WORKFLOW IN RADIATION ONCOLOGY DEPARTMENT



PHYSICS BEHIND RADIOTHERAPY

Radiation used for cancer treatment is called ionizing radiation because it forms ions in the cells of the tissues it passes through. It creates ions by removing electrons from atoms and molecules. This can kill cells so the cells stop growing.



RESPONSIBILITIES

- Treatment Planning

Facilitates the appropriate use of X-rays, gamma rays, electrons and other charged particle beams in the treatment of disease

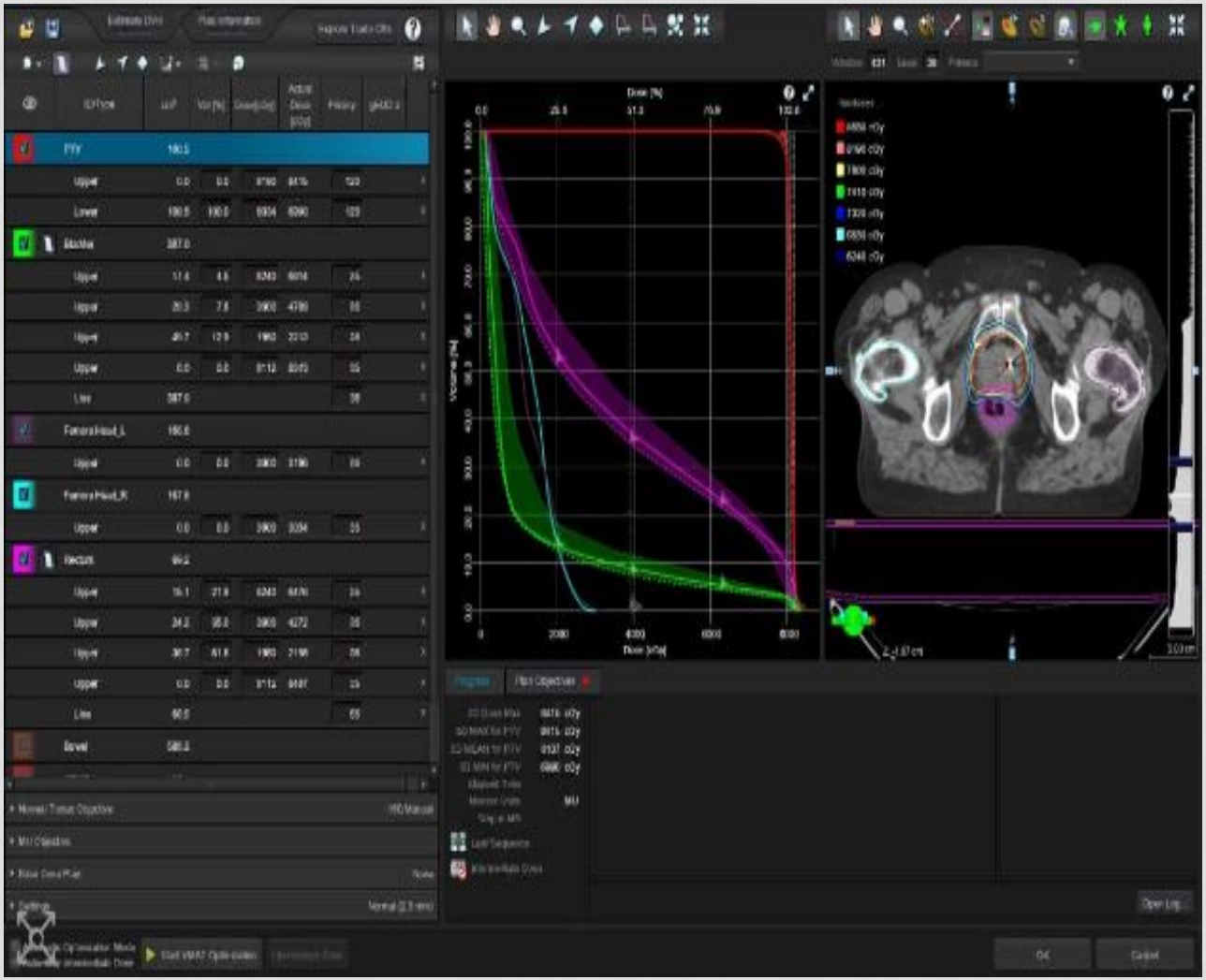
- Quality Assurance

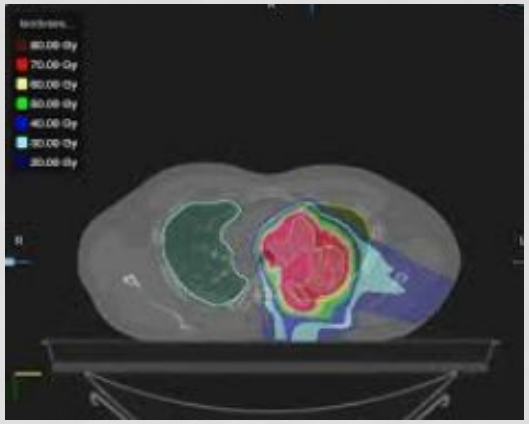
Monitors the performance of the equipment associated with therapeutic procedures

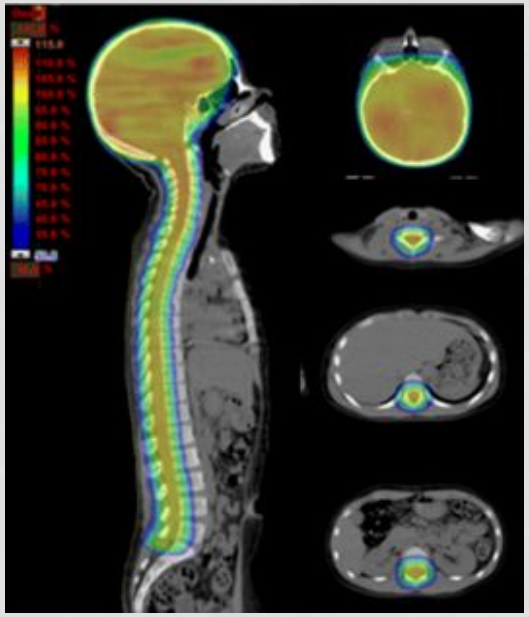
- Radiation Protection

applies the standards for the safe use of radiation

TREATMENT PLANNING

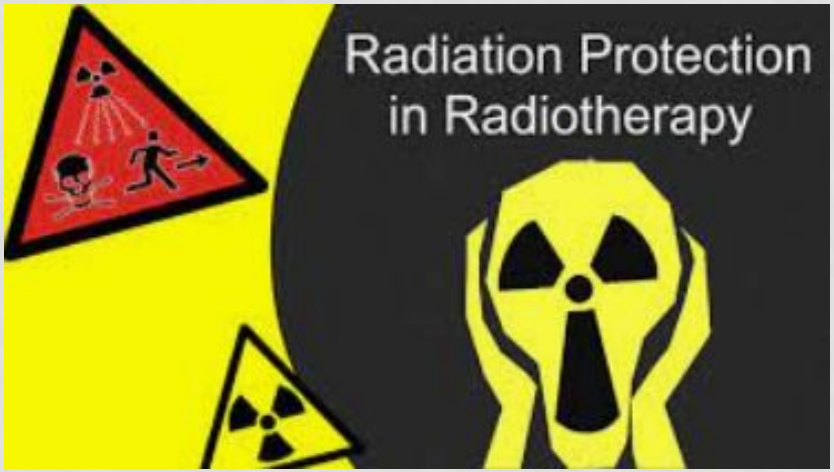


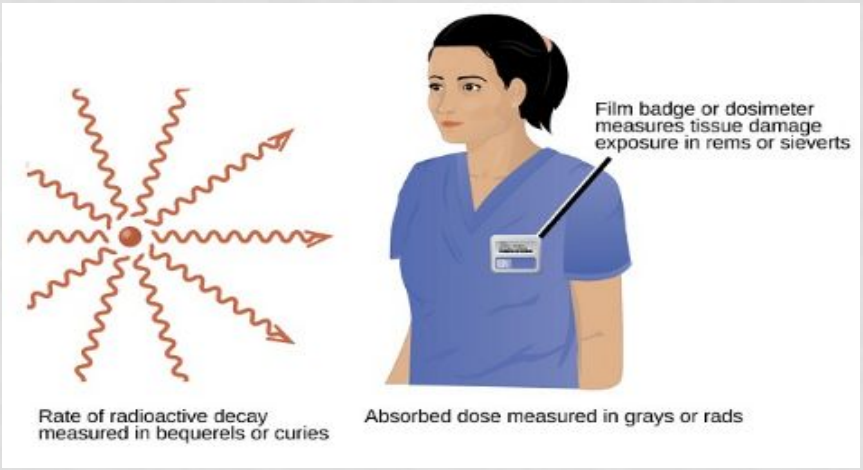


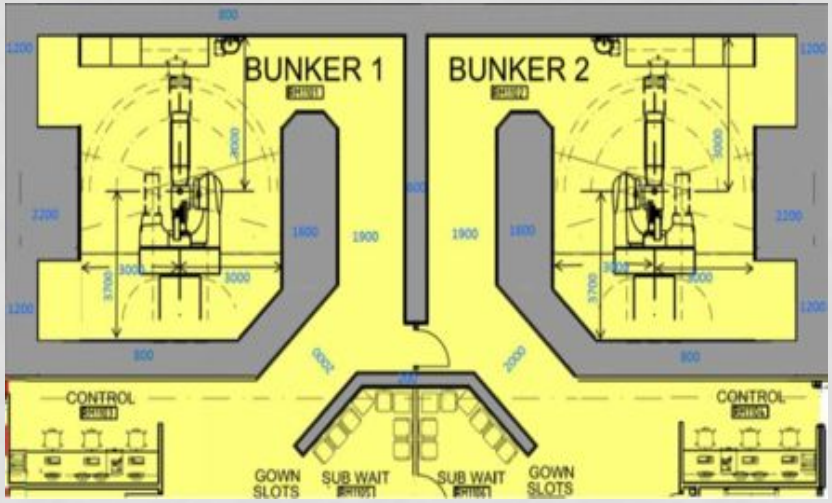


QUALITY ASSURANCE

RADIATION PROTECTION



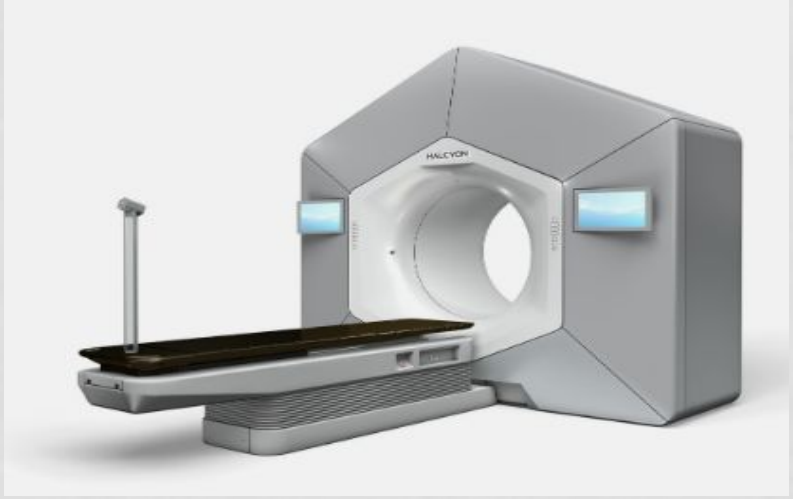




Linear Accelerator

Gamma Knife

Cyber Knife



Halcyon

Cobalt 60 Teletherapy

Brachytherapy Remote Afterloader

Diagnostic Medical Physics

WHAT IS DIAGNOSTIC IMAGING?

- Diagnostic Imaging is a range of techniques and equipment used to look inside the body.
- The purpose of this is to help physicians identify injuries and illnesses, and to help make an accurate diagnosis and treatment plan.
- This can include a variety of procedures, from simple X-rays for broken bones to more complex procedures involving the brain, heart, or lungs.

RESPONSIBILITIES

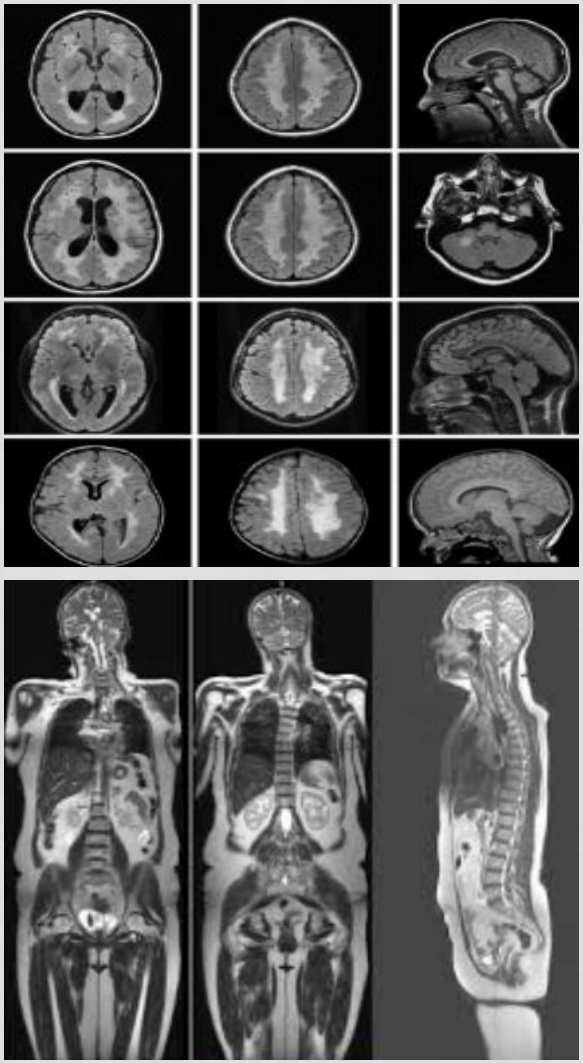
Diagnostic medical physicists are responsible for ensuring the safe and effective application of radiation used in medical treatments. Specifically, radiology procedures.

EQUIPMENT EVALUATION AND COMPLIANCE

- One of the main roles of a diagnostic medical physicist is to ensure the safe operation of radiation-producing machines and diagnostic radiation detectors.
- This also includes assessing all the software, algorithms, data, and computer systems associated with the radiation-producing equipment for accuracy and performance.
- Any unit that is used in a diagnostic setting must be periodically reviewed to ensure not only that the image quality is maintained, but that the unit is operating in compliance with the manufacturer's specifications.

Radiographic X-Ray

Computed Tomography (CT Scan)

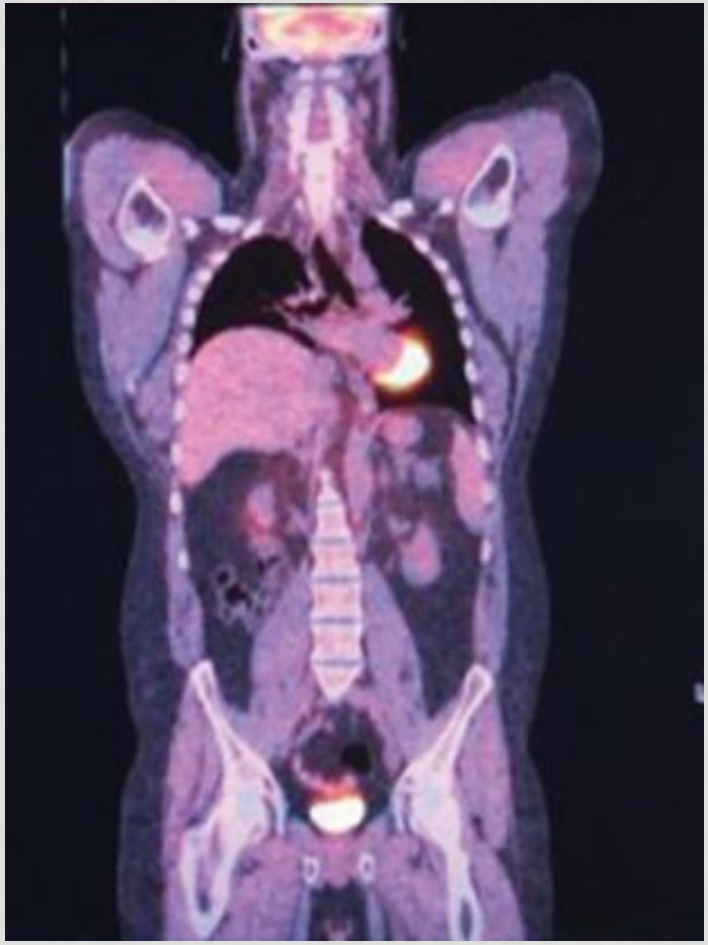


Magnetic Resonance Imaging (MRI)

Nuclear Medical Physics

BASIC PRINCIPLE OF NUCLEAR MEDICINE

- Nuclear medicine uses radioactive materials and their emitted radiation from the body to diagnose and treat disease.
- Radionuclides are typically administered orally or intravenously to the patient.
- These radionuclides are often tagged with other molecules forming a radiopharmaceutical and allowing the combination to localize the organs of interest.
- Specialized cameras are used to record the radiation emission from these unstable atoms to localize pathology and guide treatment.

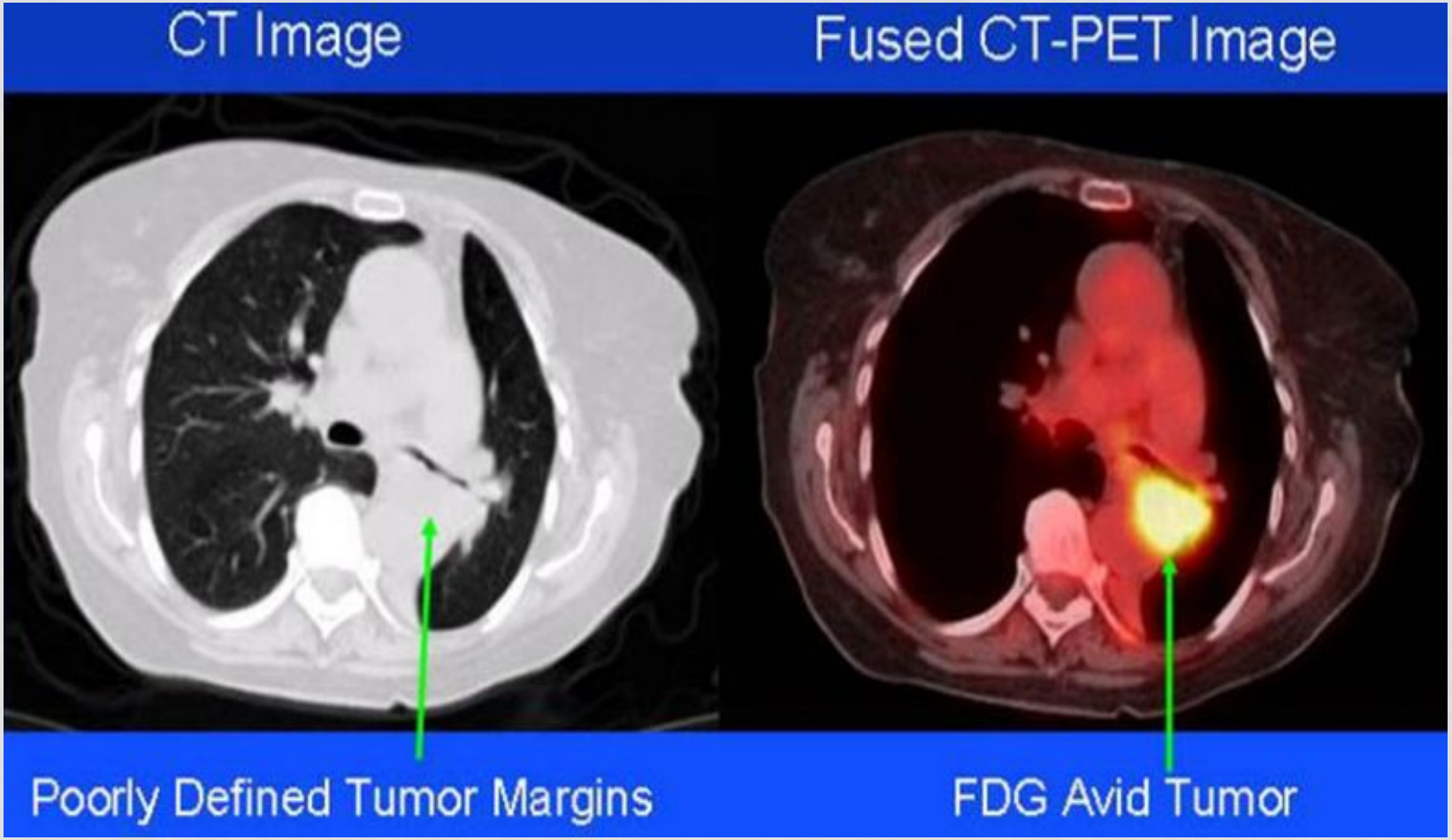


ROLE OF NUCLEAR PHYSICS IN MEDICINE

- Which atoms and their tagged molecules can be used in diagnostics.
- Which radioactive atoms can be used in therapeutics
- Precautions necessary to protect the general public from radiation
- Precautions necessary to minimize the patient radiation
- The type of shielding and other protective measures necessary in the handling of certain radioactive products
- The proper disposal of radioactive substances in the nuclear medicine department

RADIONUCLIDES USED IN CLINICAL IMAGING AND TREATMENT

- Technetium-99m
- Iodine-123
- Iodine-131
- Indium-111
- Xenon-133
- Fluorine-18
- Nitrogen-13
- Rubidium-82
- Radium-223
- Strontium-89



Fused CT-PET scans more clearly show tumors and are therefore often used to diagnose and monitor the growth of cancerous tumors.

Gamma Camera

PET Scan

QUALIFICATION REQUIRED

- Major in physics for your undergraduate work (Mandatory)
- Complete your MS degree in medical physics
- Pursue a PhD if you want to enter university work
- Complete a residency to qualify for full board certification
- Get board-certified by passing certification test


thank you