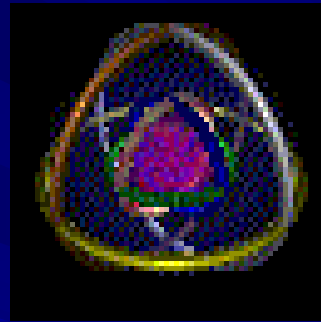


Medical Physics at KFUPM



Dr. Nabil Maalej

Physics Dept.

KFUPM

Outline

- Medical Physics
- The role of the Medical Physicist
- Medical Physics program at KFUPM
- How can you become a medical physicist?

Medical Physics

Medical physics is the application of physics in the practice of medicine

Areas of Medical Physics

- Diagnostic imaging
 - X-ray (Mammography, Fluoroscopy, Digital Subtraction Angiography, CT)
 - Ultrasound
 - Magnetic resonance imaging
- Nuclear medicine
- Radiation Therapy
- Health Physics
- Body Physics

X-ray Imaging



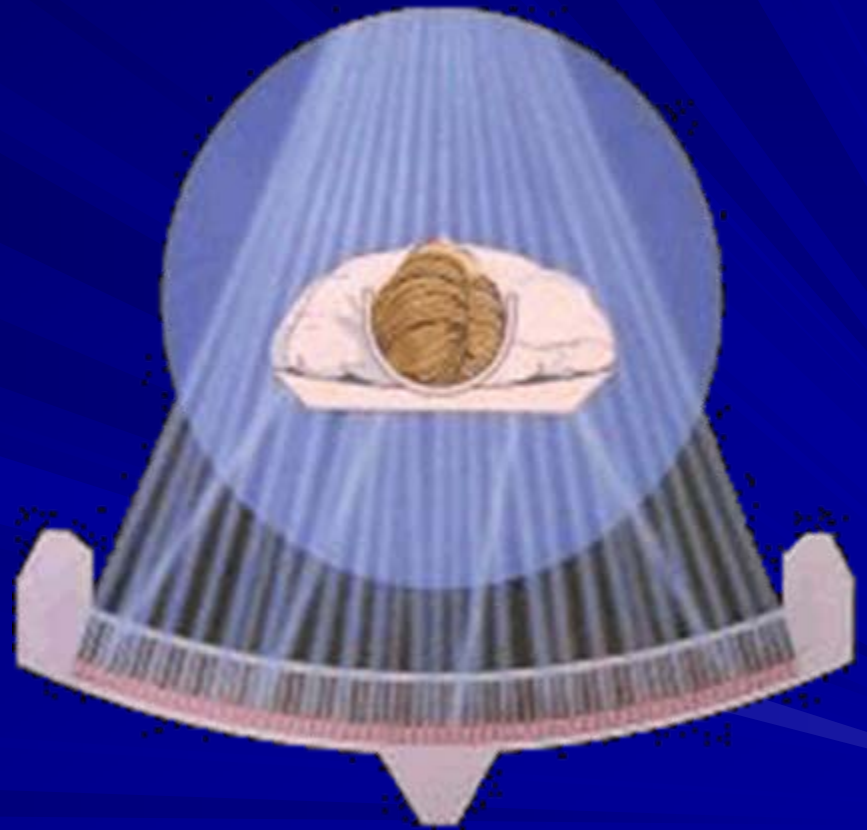
Chest X-ray



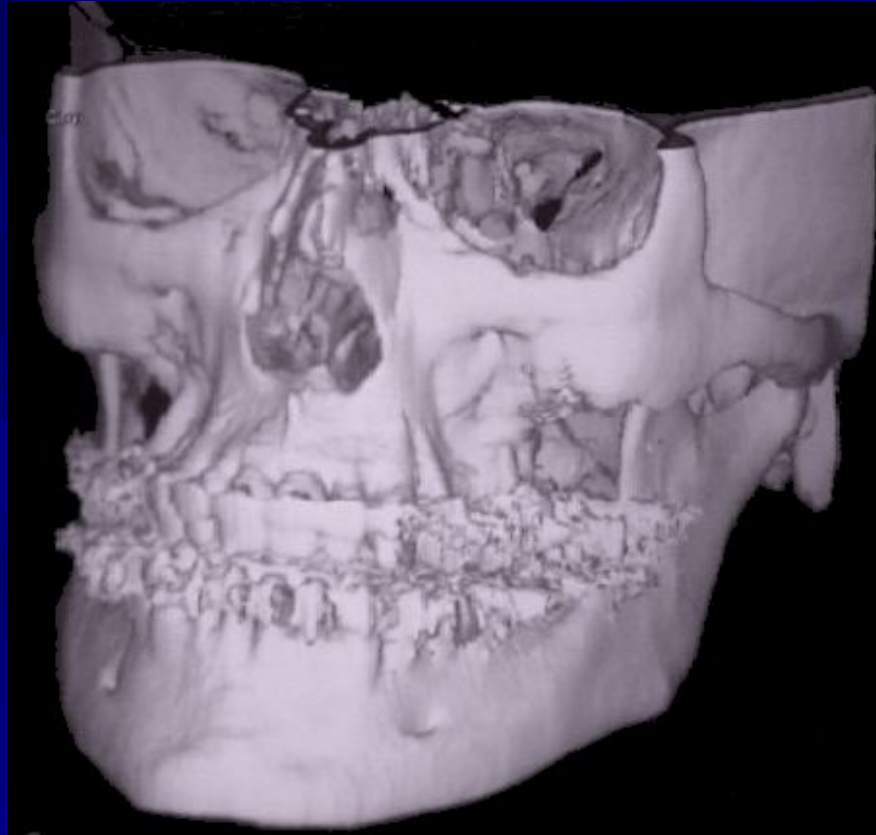
Head X-ray

Computerized Tomography (CT)

The technique of CT scanning was developed in 1973 by Hounsfield. A thin fan beam of X-rays generated by a conventional X-ray tube passes through a single 'slice' of a patient through to a bank of X-ray detectors.



CT 3-D Images



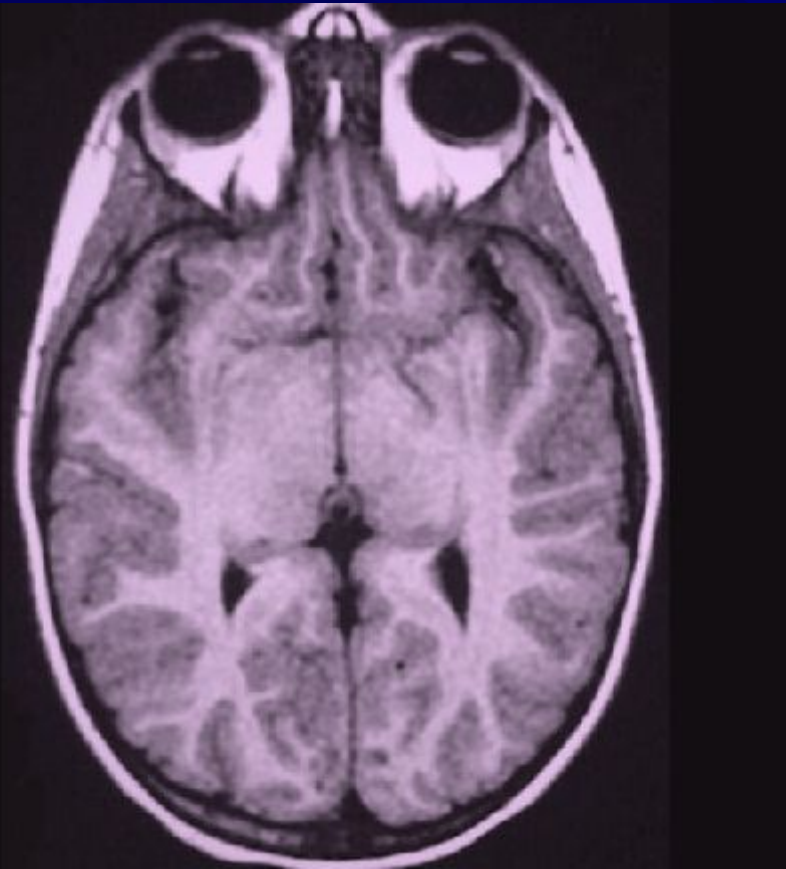
3-D CT Image of the Head

Magnetic Resonance Imaging

The technique involves placing the patient in a strong magnetic field. The magnetic field aligns the nuclear spin of atoms in the patient. When the spins relax to the original orientation, they emit radio-waves which are picked up by receiver coils.



Magnetic Resonance Imaging

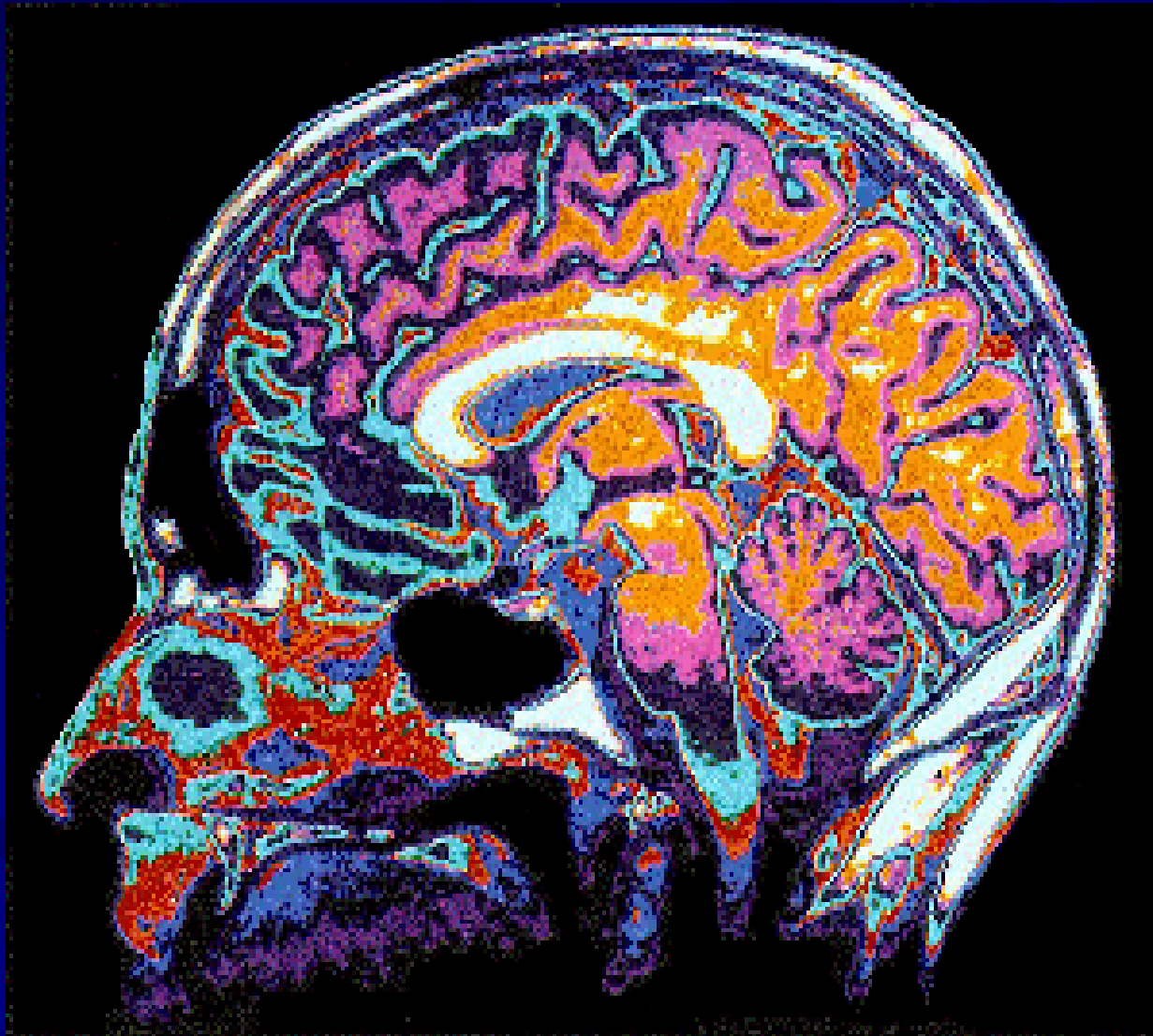


2-D MRI scan of the brain



MRI Angiogram of the brain Artery

Functional MRI



Nuclear Medicine

It is the clinical use of radioactivity for the diagnosis of disease. Examinations involve the injection of a small quantity of a radioactive material which is designed to specifically target a region of interest in the body.

Gamma Camera

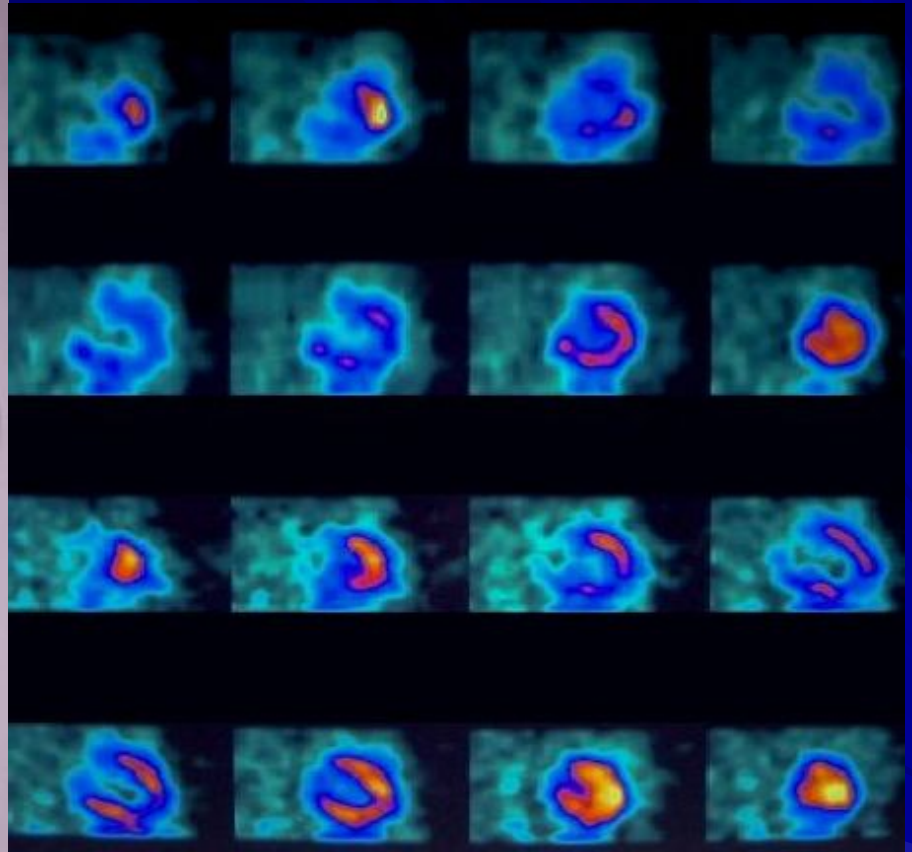
Gamma Ray emitters are commonly used to diagnose disease. For example, Technetium is used to detect adrenal gland and bone tumors.



Nuclear Medicine Images



Bone Scan To Detect Bone Inflammations and Tumors



Thallium Scan To Detect Heart Disease

Radiation Therapy

Radiation therapy involves the use of ionizing radiation in the treatment of patients with cancer and occasionally non-malignant conditions.

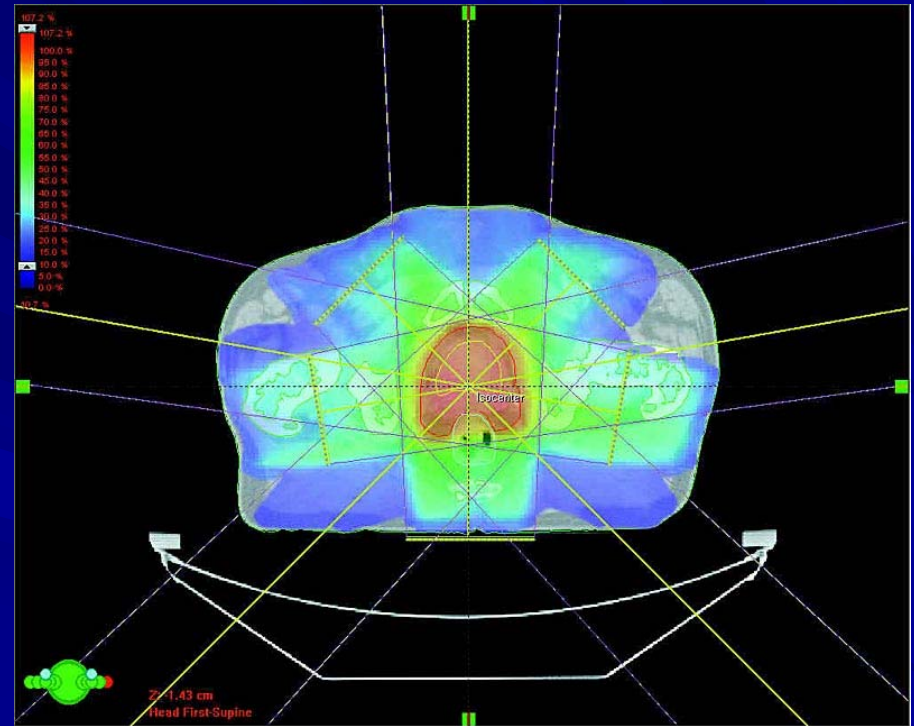
Radiation Therapy Machine



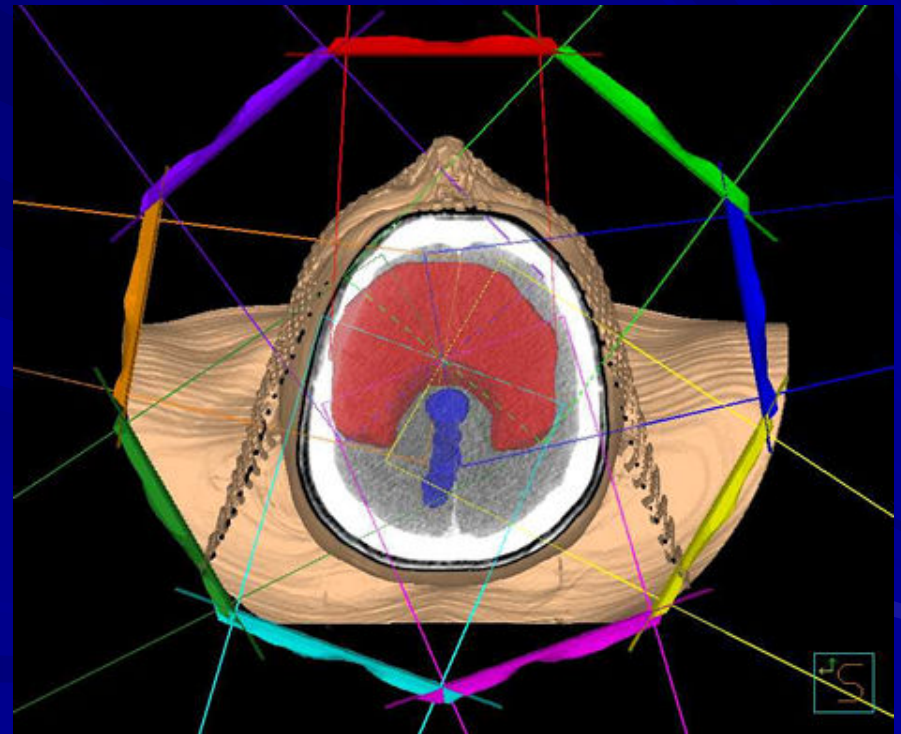
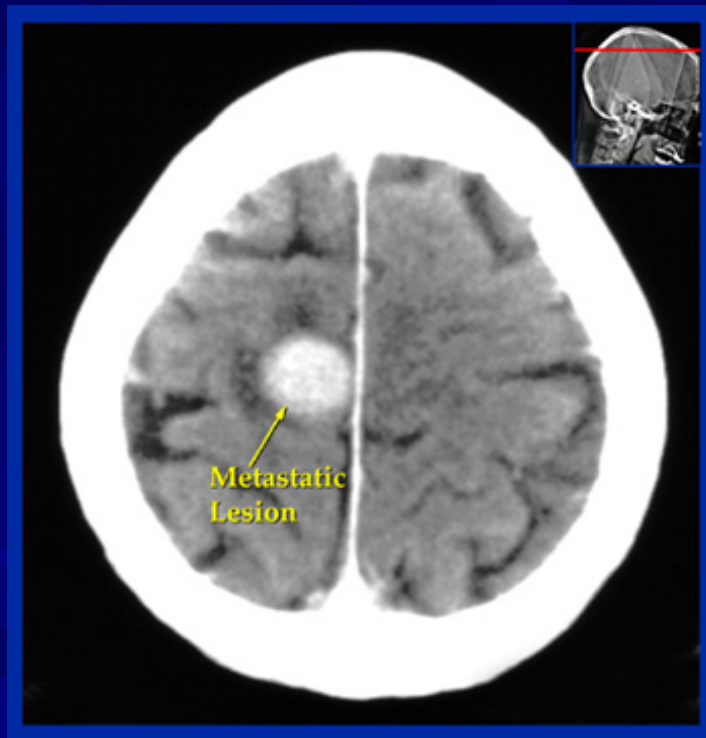
Linear Accelerator

Treatment Planning

The most critical role of the radiation therapy physicist is to plan the treatment of the tumor in order to kill the cancerous cells and minimize the damage to the normal cells



Accurate Diagnosis And Precise Treatment of Disease



Role of The Medical Physicist

- Clinical Engineering :Design and development of clinical test devices and procedures.
- Diagnostic Investigations: Develop and apply a variety of imaging modalities used in the diagnosis and management of numerous medical conditions.
- Innovations: Develop innovative technology that can offer improvements throughout the entire healthcare system
- Quality Assurance Services: Acceptance inspections for new equipment (e.g. X-ray sets, CT scanners) followed by on-going regular checks on performance factors such as radiation dose and image quality.

Role of The Medical Physicist

- Radiation Protection: Ensuring that patients and staff are protected against unnecessary exposure to radiation.
- Research & Development
- Education & Training
- Scientific & Technical Support in Diagnosis
Treatment of disease

Medical Physics at KFUPM

Goal:

Providing education and clinical training for motivated graduate students in areas of diagnostic imaging, nuclear medicine, radiation therapy, and health physics

Academic Program

Program Requirements	Number of Credits
Completion of Core Courses	22
Completion of Elective Courses	11
Completion of Clinical Training	6
Completion of Med. Physics Project	3
Passing the Comprehensive Exam	--
TOTAL	42

Core Courses

Course #	Course Title	Credits
MEPH 500	Human Anatomy and Physiology	3
MEPH 510	Radiobiology	2
MEPH 561	Radiological Physics and Dosimetry	3
MEPH 563	Radioisotopes in Medicine	3
MEPH 566	Radiotherapy Physics	3
MEPH 567	Diagnostic radiology Physics	4
MEPH 569	Health Physics	4
		18

Elective Courses

Course #	Course Title	Credits
MEPH 501	Physics of Medicine and Biology	3
MEPH 511	Instrumentation for Medical Physics	3
MEPH 568	Magnetic Resonance Imaging (MRI)	2
MEPH 570	Advanced Brachytherapy Physics	2
MEPH 571	Advanced External Radiation Oncology	3
MEPH 573	Imaging in Medicine	3
MEPH 574	Application of Digital Imaging: DSA, CT, MRI	2
MEPH 575	Diagnostic Ultrasound Physics	3
MEPH 591	Selected Topics in Medical Physics	3
MEPH 592	Independent Reading	3
EE 614	Digital Signal Processing	3
EE 617	Image Processing and Holography	3
MATH 513	Mathematical Methods for Engineers	3

Medical Physics Labs

A minimum of 3 credit hours to be selected from the following list of Radiological Physics labs (Rad Lab)

Course #	Course Title	Credits
MEPH 581	Rad Lab : Radiotherapy	1
MEPH 582	Rad Lab : Diagnostic Radiology	1
MEPH 583	Rad Lab : Nuclear Medicine	1
MEPH 584	Rad Lab : Health Physics	1
MEPH 585	Rad Lab: CT, MRI, and DSA	1
MEPH 586	Rad Lab: Medical Ultrasound	1

Clinical Training

- The student will spend 4 months of hospital training to complete a clinical rotation in: radiation therapy, diagnostic imaging, nuclear medicine, and health physics
- The student will observe and practice clinical procedures under the direct supervision of a senior clinical medical physicist
- The student will write monthly progress reports, a final report and present a seminar

Required B.S. Courses

■ Physics:

- Modern Physics PHYS 212
- Experimental Physics PHYS 303 (not required for EE)

■ Mathematics:

- Methods of applied mathematics MATH 301 Or
Engineering Mathematics MATH 302

■ Physiology:

- Cell Biology BIOL 101
- Physiology BIOL 202

Incentive

- Working in an essential field of health care
- Working with state of the art medical technology
- Rewarding Career
 - According to the Am. Ass. Of Physicist in Medicine, the MS in Medical Physics Average annual salary in 2001, is \$87,100 (no certification) \$109,800 (with certification)

Conclusions

- Medical Physicists play an essential role in delivering modern and effective health care .
- Medical Physicists are needed to work in hospitals, medical industry, academic institutions, research laboratories, and in governmental organizations.
- Engineers and science graduates are very good candidates for the rewarding Medical Physics profession.

Thank You

The image features the text "Thank You" written in a blue, elegant cursive script. The text is centered within a light blue horizontal band that spans the width of the image. On either side of the text, there are decorative scrollwork elements in a darker blue color, consisting of spirals and leaf-like shapes. The background is a deep blue with subtle diagonal lines.