MDEXPO
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Foundation for a Successful Career in Diagnostic Imaging

Navigating Education, Skills, and Networking

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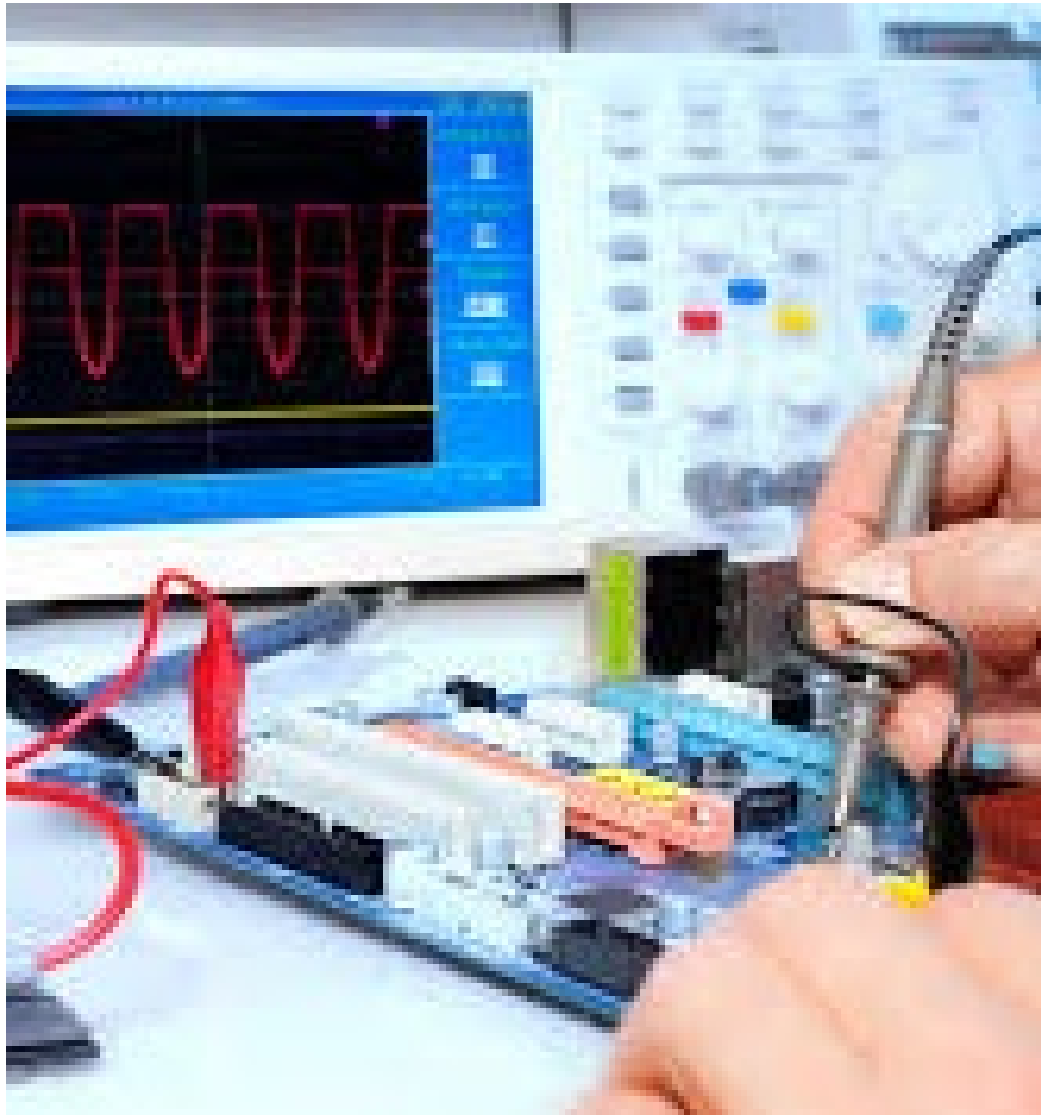
Welcome

Foundation for a Successful Career in Diagnostic Imaging

Introduction

- Brief Overview of Biomedical and Imaging Engineer Roles
- Transferable Skills from Biomedical Engineering to Imaging Engineer
- Modalities
- Education and Certification
- Technical and Soft Skills
- Regulatory Compliance/Safety
- Industry Growth
- Conclusion



Roles

- **Biomedical engineers** play a crucial role in hospitals, contributing to the development, maintenance, and improvement of medical equipment and technologies.

- Description of the biomedical engineering role in a hospital:
  - Medical Equipment Management
  - Maintenance and Repair
  - Calibration and Testing
  - Technology Assessment

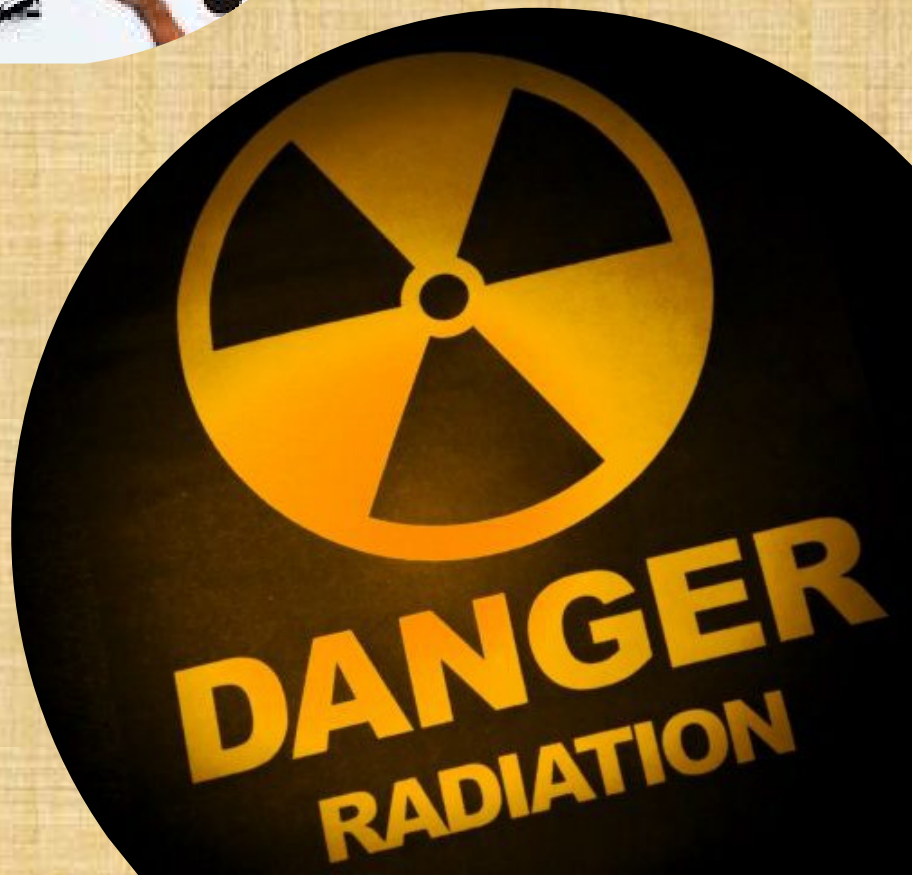
Roles

Imaging Engineer is a professional who specializes in maintenance, repair, troubleshooting, and optimizing imaging systems and technologies.

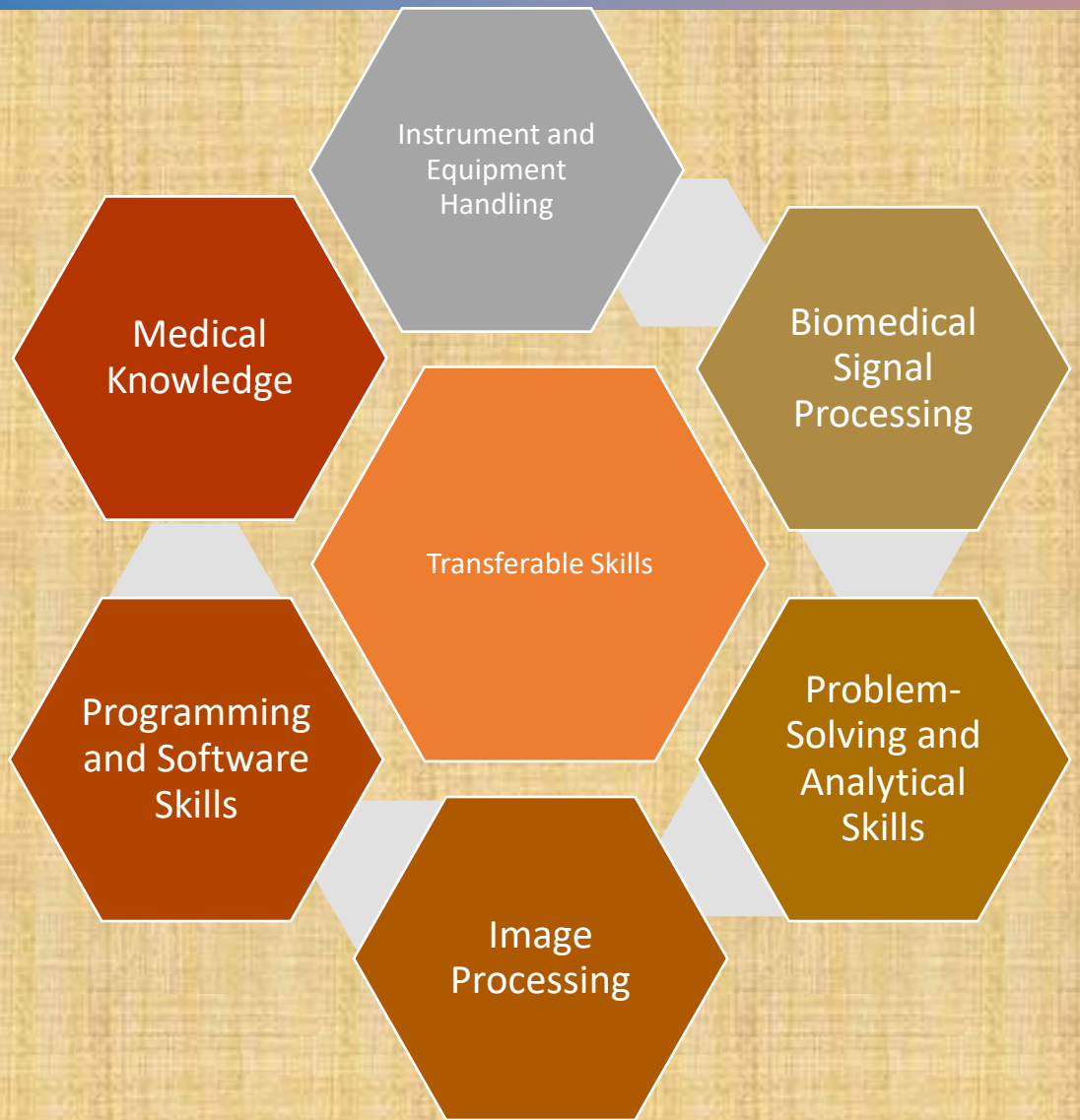
- **Equipment Calibration and Inspections**
- **Preventative Maintenance**
- **Replacement and Repairs**

Roles

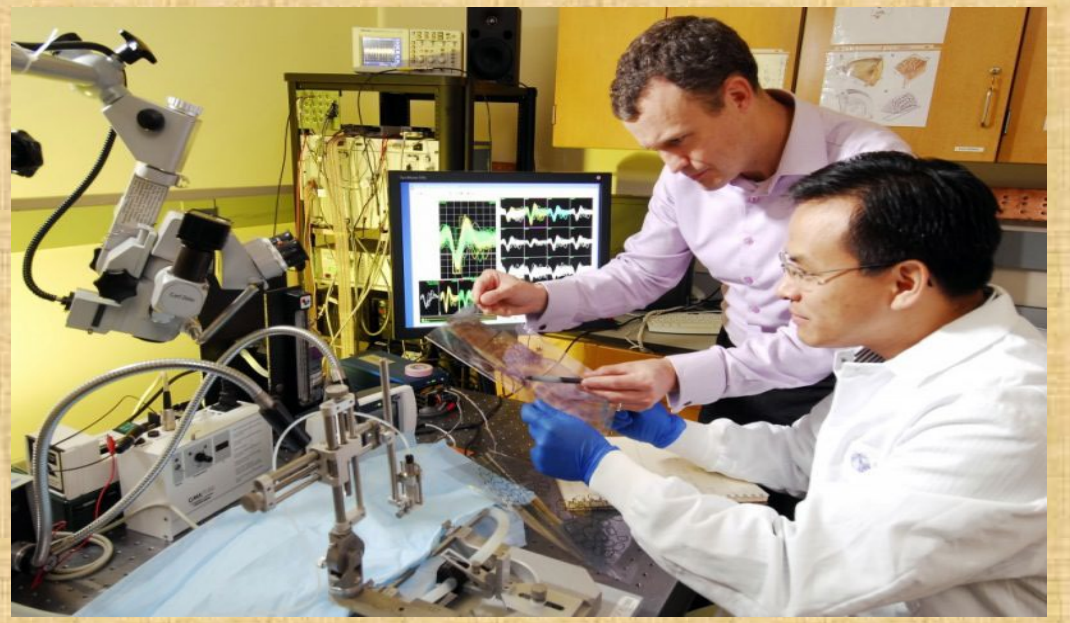
- **Regulatory Compliance**
- **New Technology Implementation**
- **Contiguous Learning**
- **Customer Service**



Transferable Skills



Both roles share a considerable overlap in skills, principles to healthcare and medical technology, including medical imaging.



Modalities in Imaging

- Modalities is the term used in radiology to refer to one form of imaging.

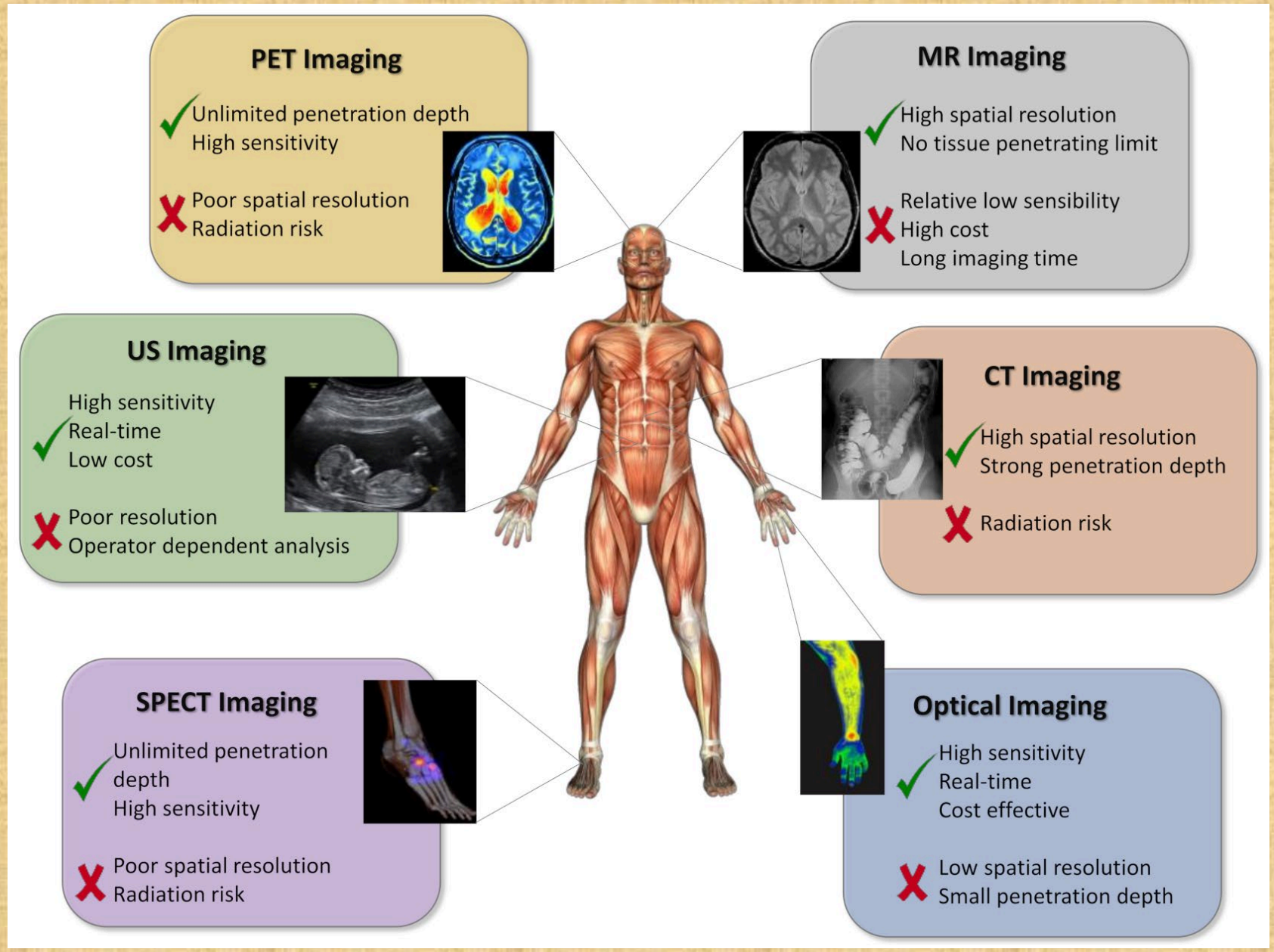
- Diagnostic Modalities: Different imaging methods used to diagnose a medical condition, including imaging techniques (X-rays, MRI, CT scans).

- Medical imaging techniques are used to visualize the interior of the body.

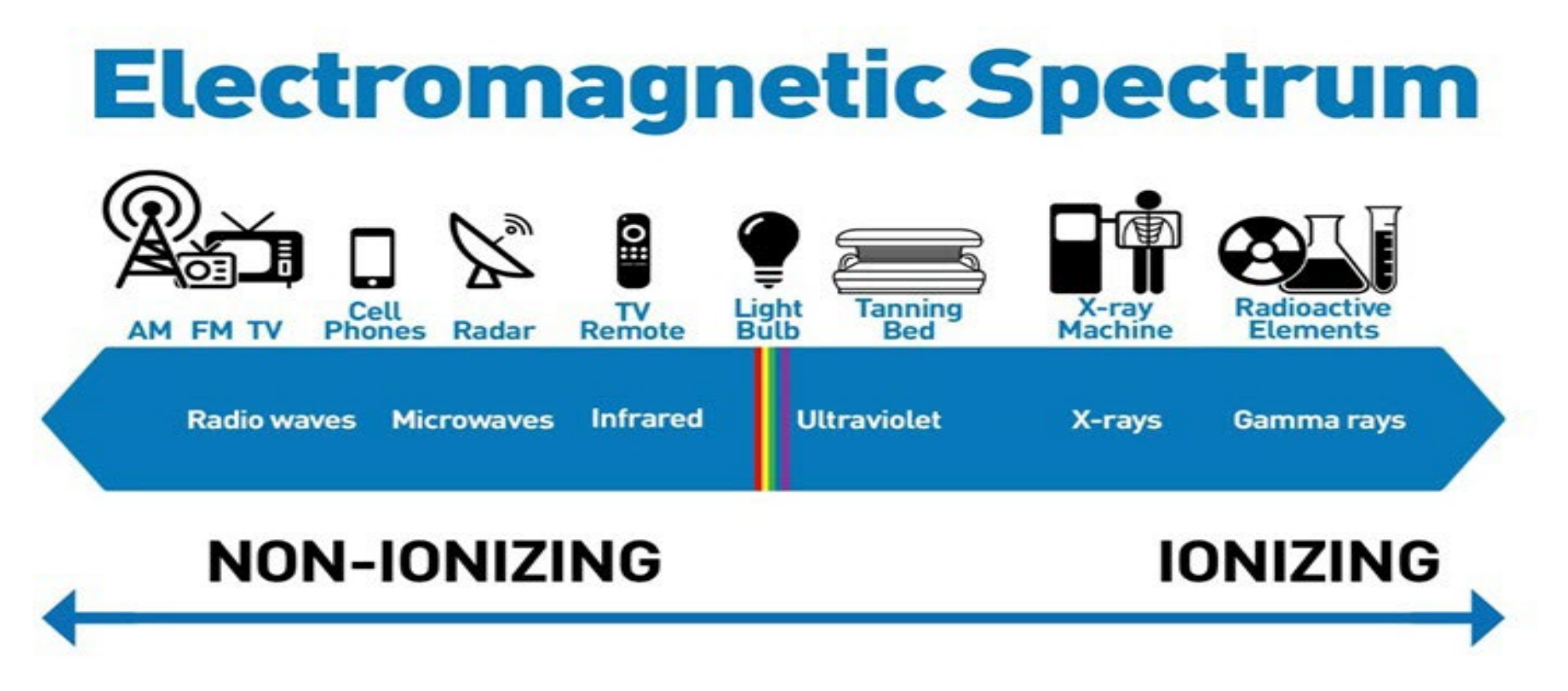
Modalities – Pros and Cons

Imaging Modality	Pros	Cons	Cost[25, 26]
X-Ray	Cheap	Low sensitivity, delayed findings	~$50-100
US	Cheap, useful in children and sickle cell patients	Low sensitivity, difficult interpretation	~$100-200
Bone Scintigraphy	High sensitivity	Poor specificity	~$150-600
CT	Useful for bony architecture, necrotic bone in chronic osteomyelitis, can guide biopsy	Increased cost and radiation exposure	~400-700
MRI	Highly specific for both acute and chronic osteomyelitis	High cost	~$700-1200
PET	Highly specific	High cost, limited availability	~$1000-2000

Types of Modalities



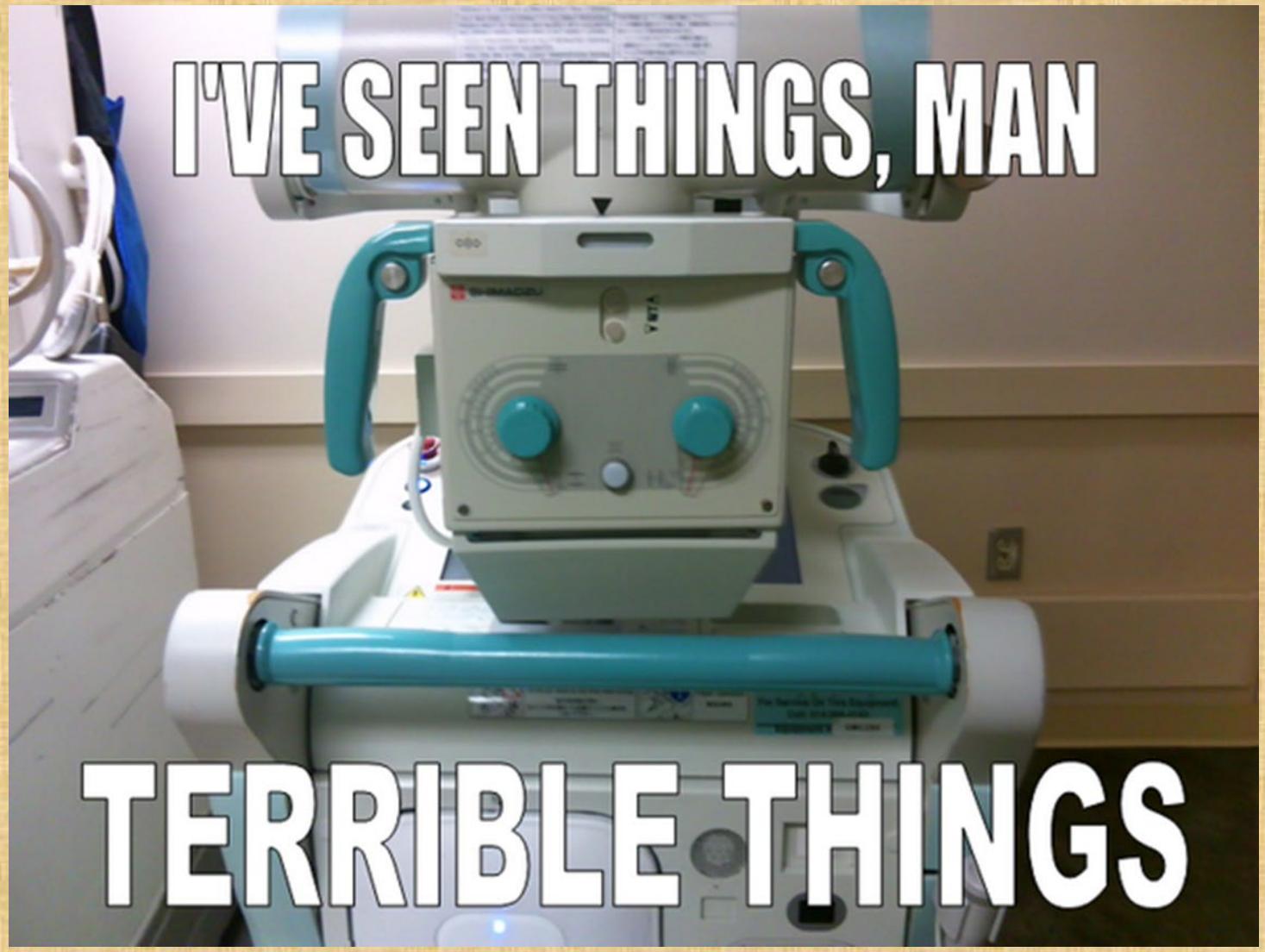
Where do we Operate?



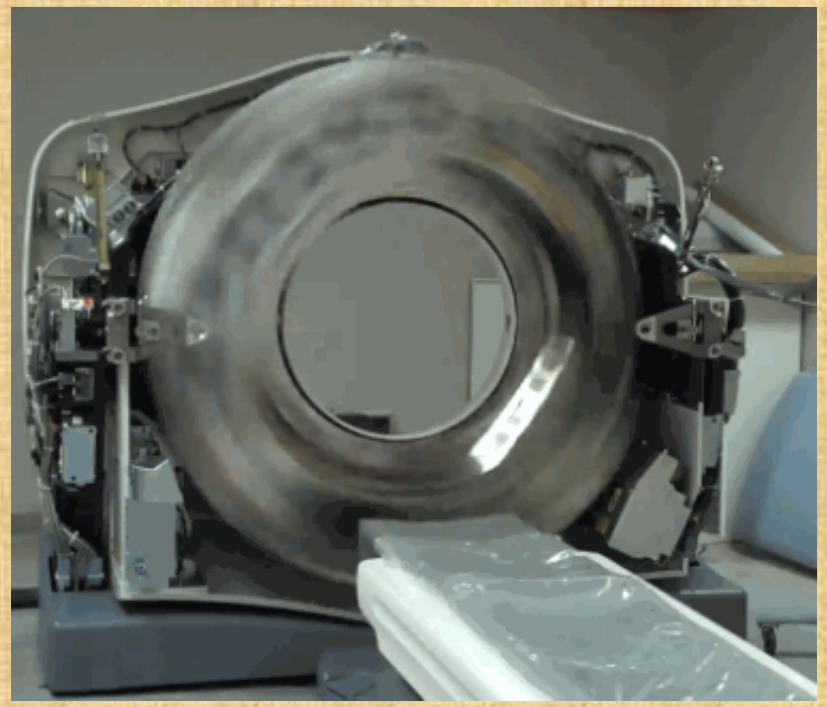
Radiographic (Rad) Room

Mobile / Portable X-ray

- Portable X-ray machines are used to take x-rays when the patient is unable to be brought to radiology
- Units may use CR cassettes or digital detector



Computed Tomography (CT)



- CT spinning with the covers off
- CT scanners are capable of multiple rotations per second

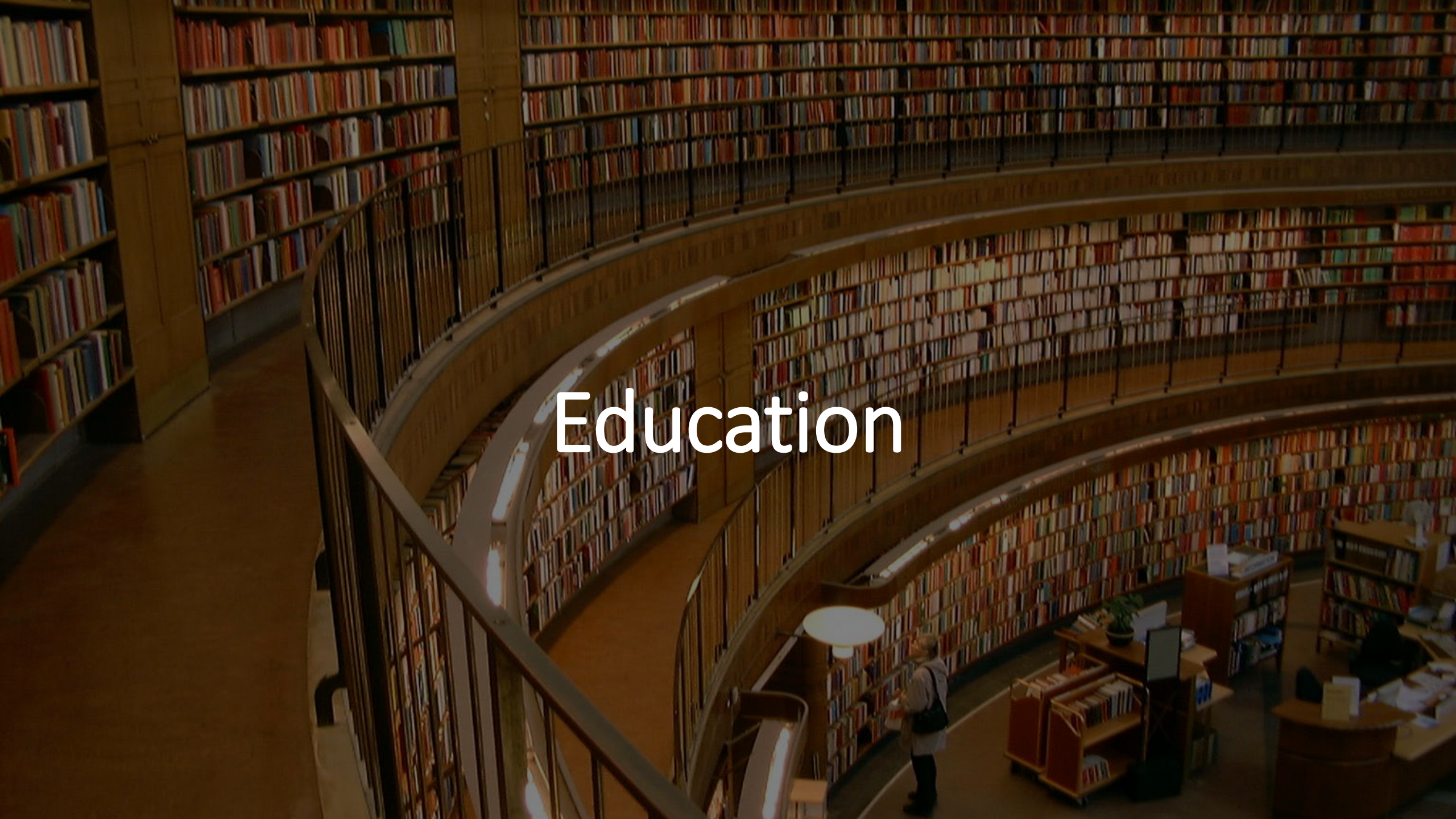
Click here to view an interesting video of a CT for veterinary use!

Magnetic Resonance Imaging

What is the cheapest imaging modality?

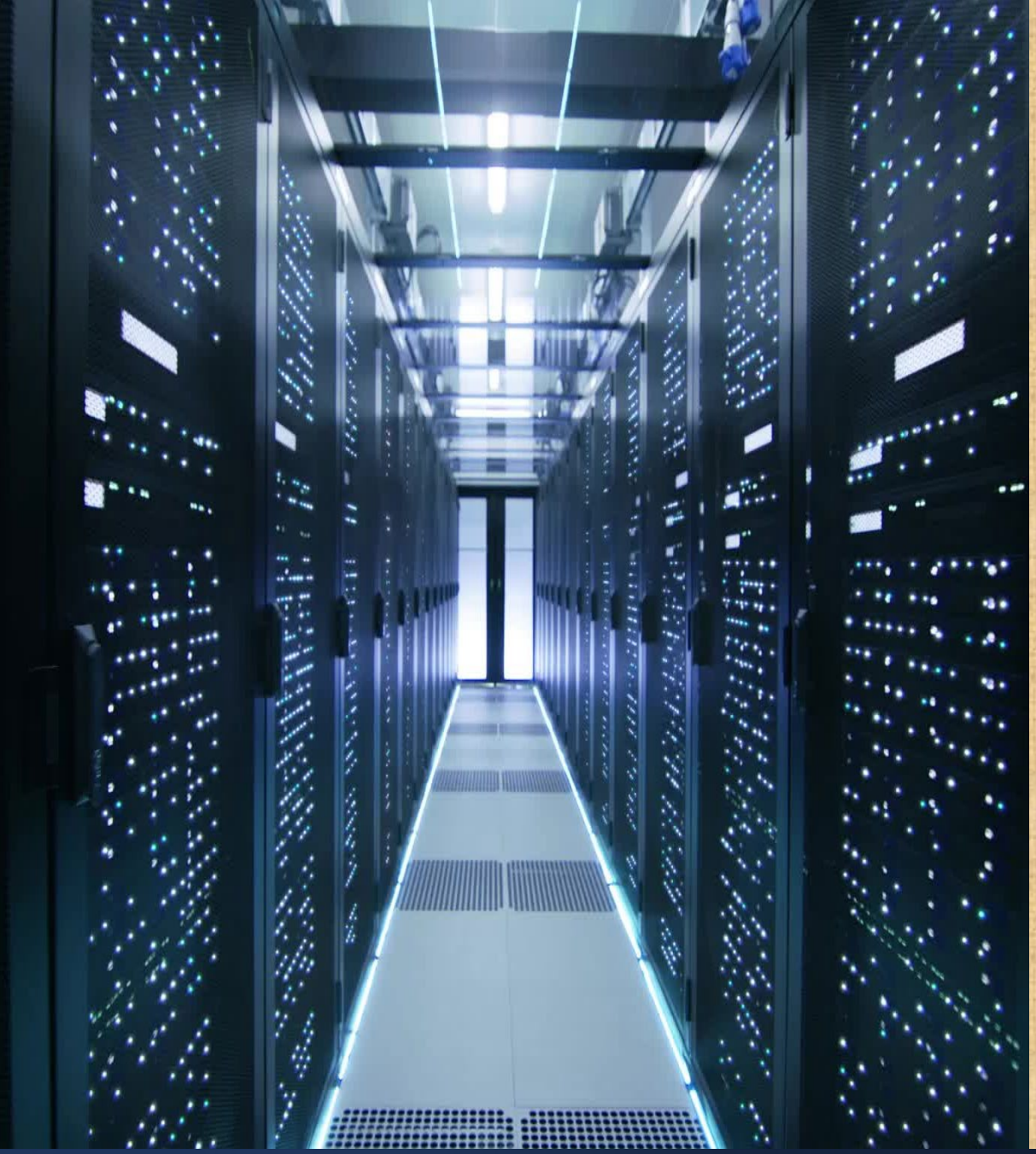
Ultrasound is the cheapest

- **No Ionizing Radiation:**
  - Unlike X-rays or CT scans, ultrasound uses sound waves instead of ionizing radiation for imaging. This eliminates the need for expensive radiation shielding and reduces safety concerns
- **Lower Maintenance Costs:**
  - They have fewer components that can wear out or require regular servicing
- **Lower Operational Costs:**
  - Operating an ultrasound machine is generally less expensive process is less complex, real-time which allows for quicker procedures and interpretation.
- **Versatility:**
  - Can be used for a wide range of applications, from obstetrics to musculoskeletal imaging.


Education

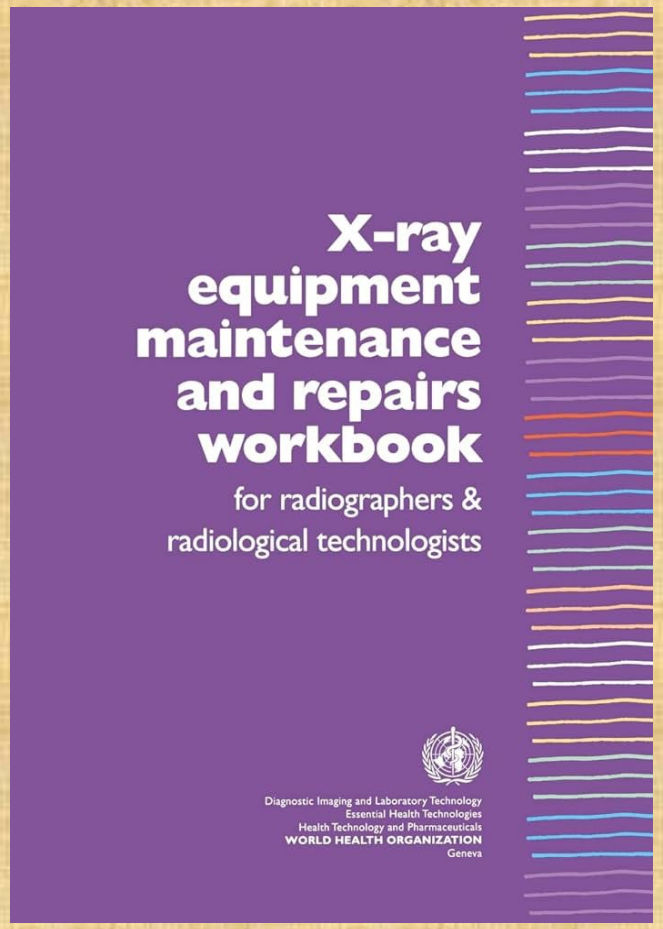
Education: Background

- **Bachelor's Degree**
  - Common majors include Biomedical Engineering, Medical Imaging Technology, Radiologic Technology, Electrical Engineering with a focus on medical devices
- **Coursework:**
  - Courses should cover fundamental concepts in medical imaging, anatomy, physiology, electronics, and medical device technology.
- **Clinical Training:**
  - Many programs incorporate hands-on clinical training where students gain practical experience in operating imaging equipment under supervision.
- **Certification and Licensure**
  - Certifications are not always mandatory; however, it enhances your career prospects
    - Examples: Certified Biomedical Equipment Technician (CBET), Biomedical Electronics Technician (BMD), and Master Certified Electronics Technician (CETma)
  - Licensing requirements vary by region
- **Ongoing Professional Development**
  - Continuous Learning
  - Membership in Professional Organization



Education: *Pathway*

- **Gain relevant experience**: Look for opportunities to gain experience in engineering, such as internships or co-op positions. This will give you a chance to see if you enjoy the field and to develop the skills you need to be successful.
- **Take engineering classes**: Consider taking classes in engineering, either through your university or through online classes. This will help you to gain the knowledge and skills you need to be successful in an engineering career.
- **Network**: Network with engineers in your desired field. They can provide you with valuable insights, advice, and connections that can help you to find a job in your desired field.
- **Consider graduate school**: Consider getting a masters or PhD in engineering. This will give you the opportunity to gain a deeper understanding of the field and to develop specialized skills that will make you more marketable.
- **Be patient and persistent**: Transitions can be challenging, but with patience and persistence, you can achieve your goal.



READING IS FUNDAMENTAL

Technical and Soft Skills

Technical Skills

- **Proficiency with Imaging Modalities**
- **Troubleshooting and Repairs**
- **Software Proficiency**
- **Electronic and Electrical Skills**
- **IT and Networking**
- **Data Managements (PACS)**
- **Radiation Safety**
- **Understand Biomedical Instruments**
- **Understand Regulations**

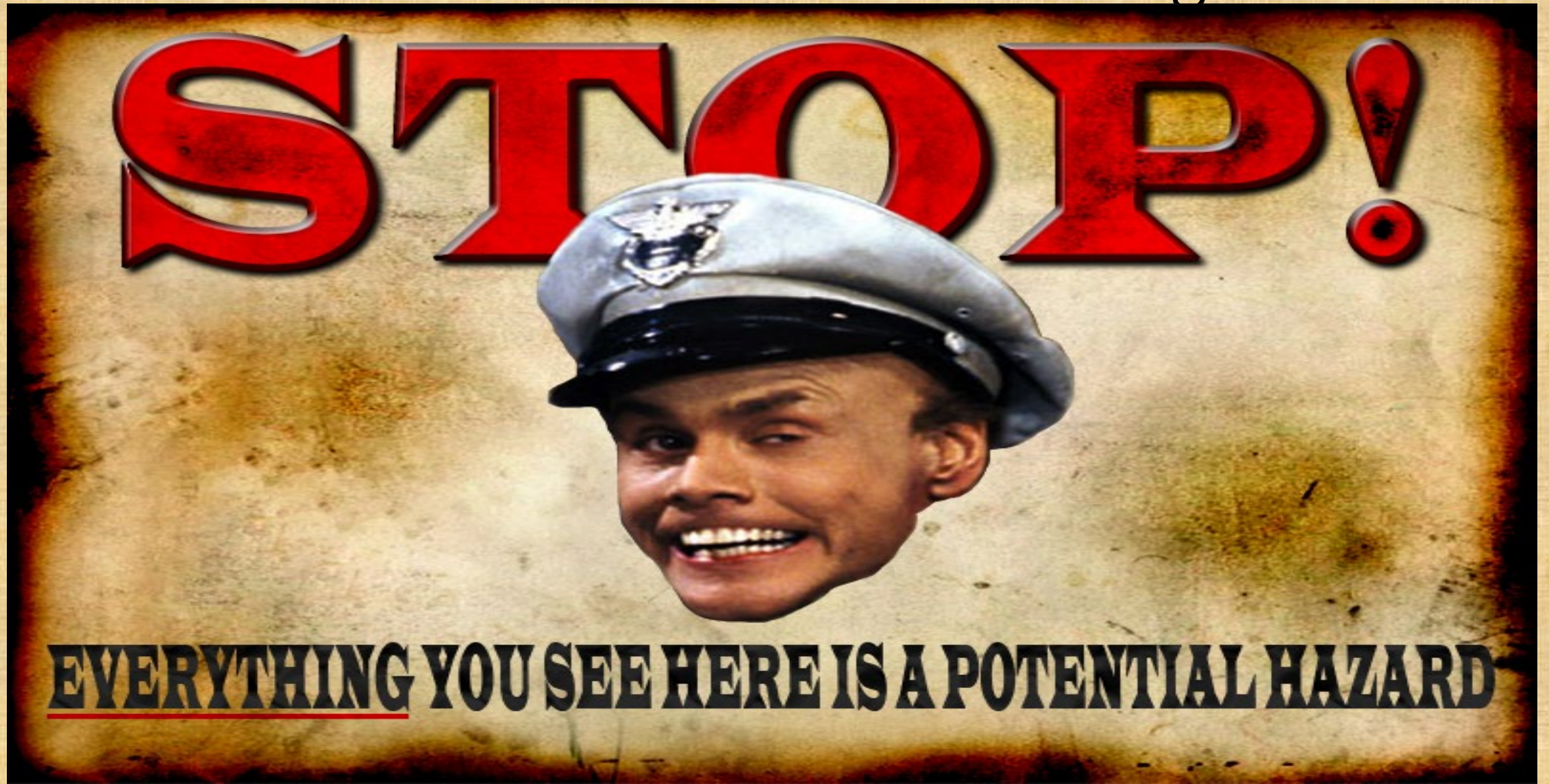

Soft
Skills

Soft Skills

- **Communication Skills**
  - Clear communication
  - Active listening
- **Interpersonal Skills**
  - Collaboration
  - Teamwork
  - Customer Service
- **Time Management**
  - Prioritization
  - Efficiency to avoid loss of equipment downtime
- **Flexibility**
  - Adapt to changing work environments
  - Long work schedules

Safety

"Let Me Tell You Something"

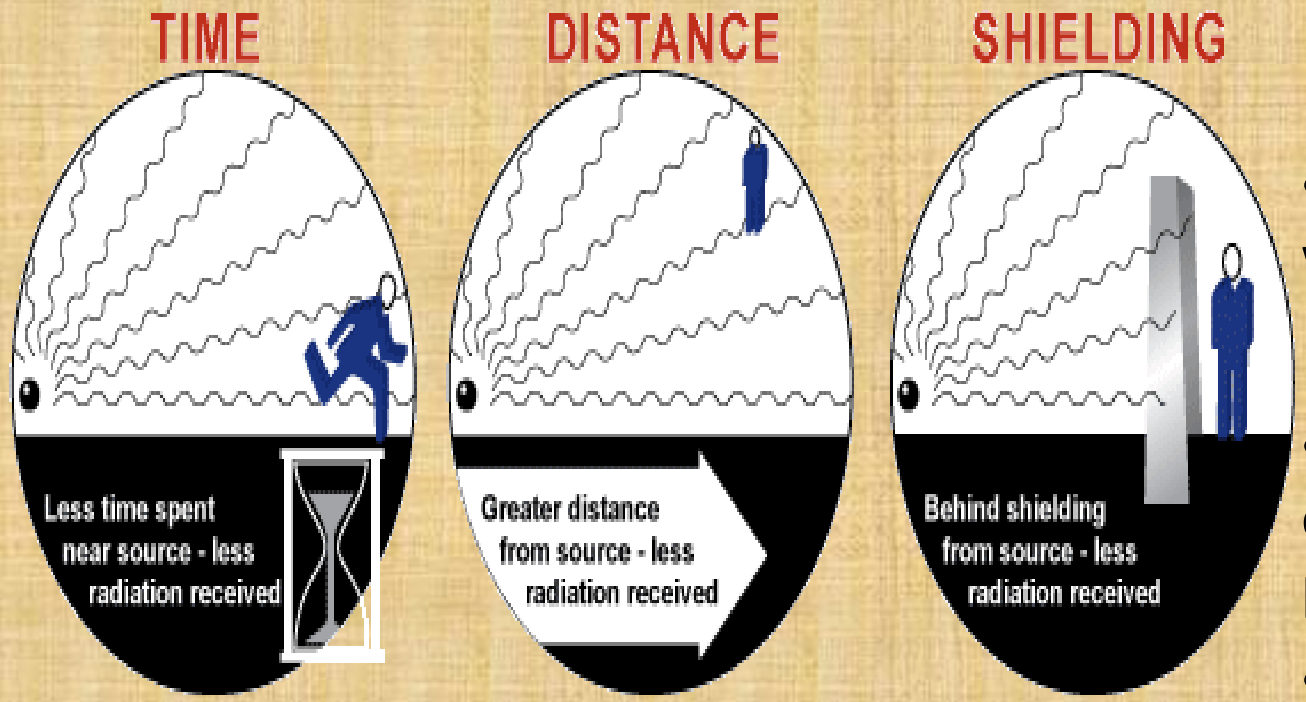


Safety

What does it mean and why is it important?

- **ALARA** is the guiding principle of radiation safety.
- **ALARA** regulatory guidelines reduce workers' exposure to radiation exposure by using three main principles of:
  - Time
  - Distance
  - Shielding

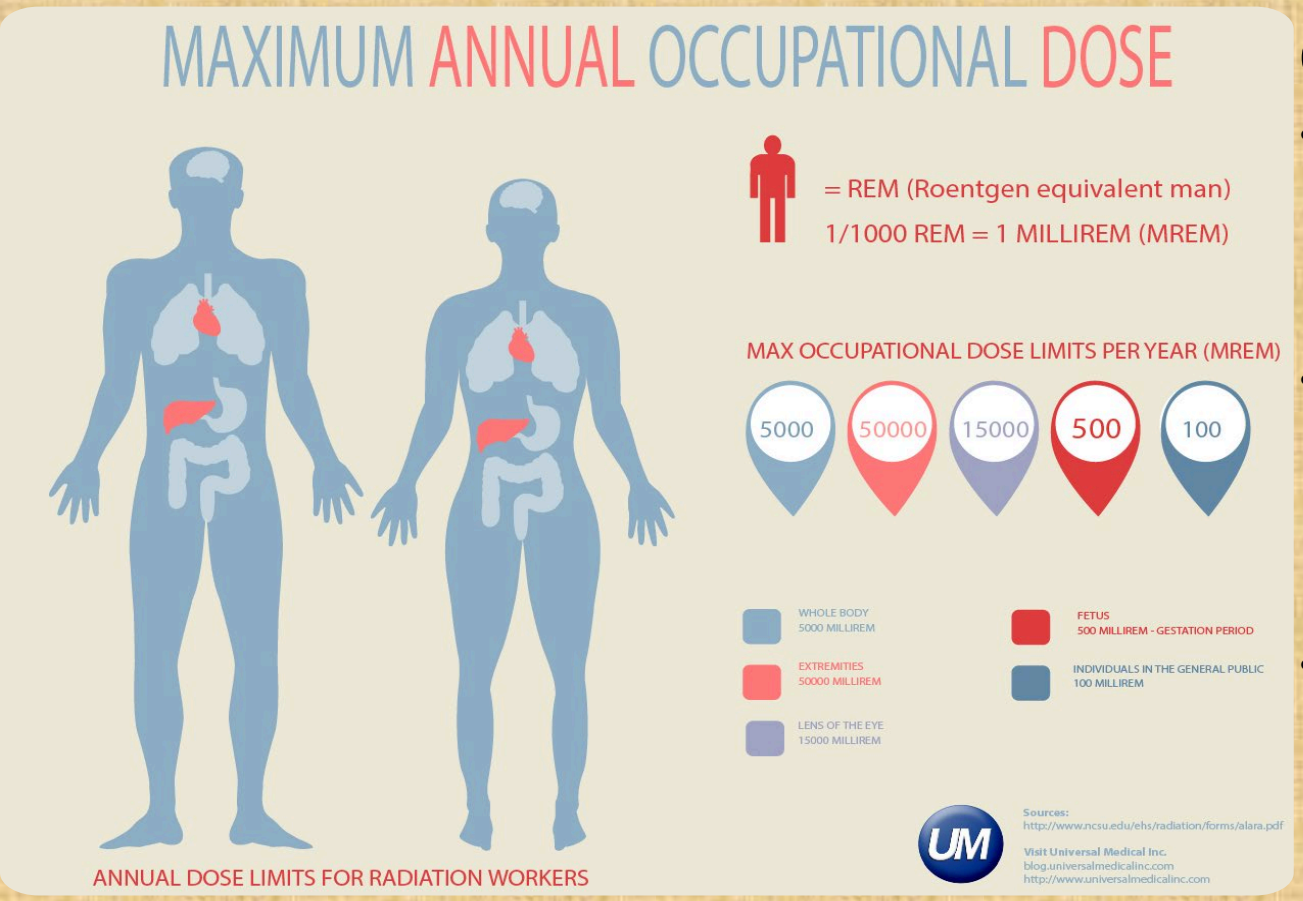
Radiation Protection



- Make these three principles part of your work routine:

- **Time:** Care should be taken to keep exposure times as short as reasonably possible
- **Distance:** According to the inverse square law, doubling the distance will reduce the dose rate to a quarter.
- **Shielding:** Wearing radiation protection garments is an effective way to reduce radiation exposure

Safety



Occupational Safety Dosage for Radiation

- **Annual Dose Limits:**
  - The annual dose limits are typically set to minimize the risk of radiation-related health effects. Common units for measuring radiation dose include Sieverts (Sv) or millisieverts (mSv).
- **Effective Dose Limit for Occupational Exposure:**
  - In many countries, the annual effective dose limit for radiation workers is typically around 50 millisieverts (mSv) per year averaged over five consecutive years, with no single year exceeding 100 mSv.
- **Equivalent Dose Limit for Specific Organs or Tissues:**
  - There are also specific limits for equivalent dose to individual organs or tissues to prevent localized damage. For example, the annual equivalent dose limit for the lens of the eye is often lower than the overall effective dose limit.
- **Cumulative Lifetime Dose:**
  - In addition to annual limits, there may be cumulative lifetime dose limits to ensure that the total radiation exposure over a worker's career remains within safe levels.

New Search

CFR Title 21 - Food and Drugs: Parts 1000 to 1050

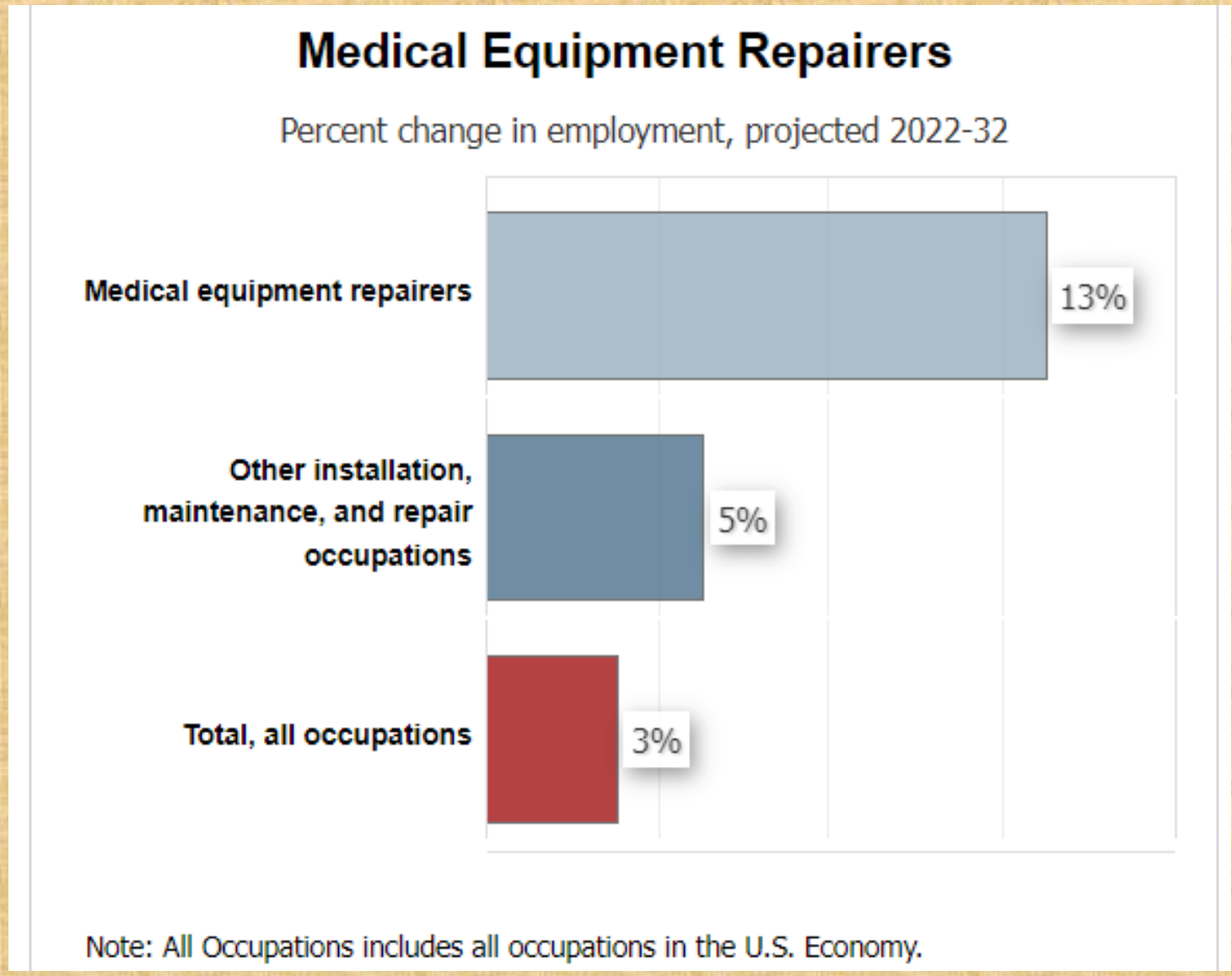
1000	General
1002	Records and reports
1003	Notification of defects or failure to comply
1004	Repurchase, repairs, or replacement of electronic products
1005	Importation of electronic products
1010	Performance standards for electronic products: general
1020	Performance standards for ionizing radiation emitting products
1030	Performance standards for microwave and radio frequency emitting pr
1040	Performance standards for light-emitting products

Safety – Title 21 FDA

Contains radiation safety regulations for manufacturers of radiation-emitting electronic products.

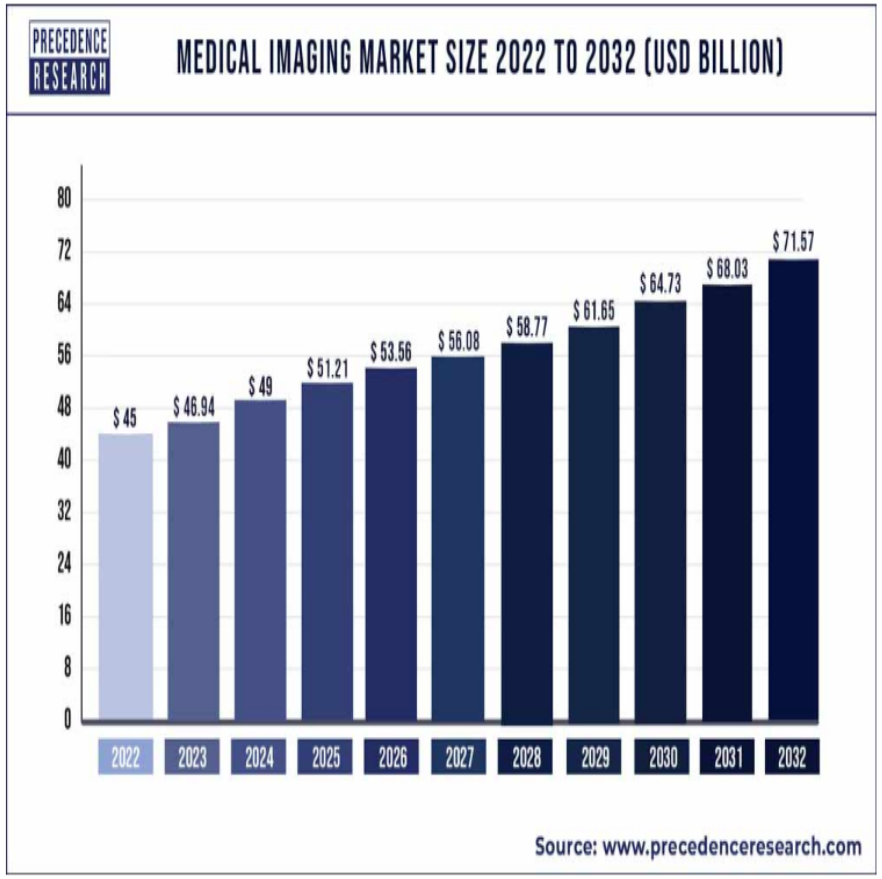
Job Outlook

- Per U.S. Bureau of Labor Statistics, employment of medical equipment repairers are projected to grow 13 percent from 2022 to 2032.
- About 7,300 openings for medical equipment repairers are projected each year.



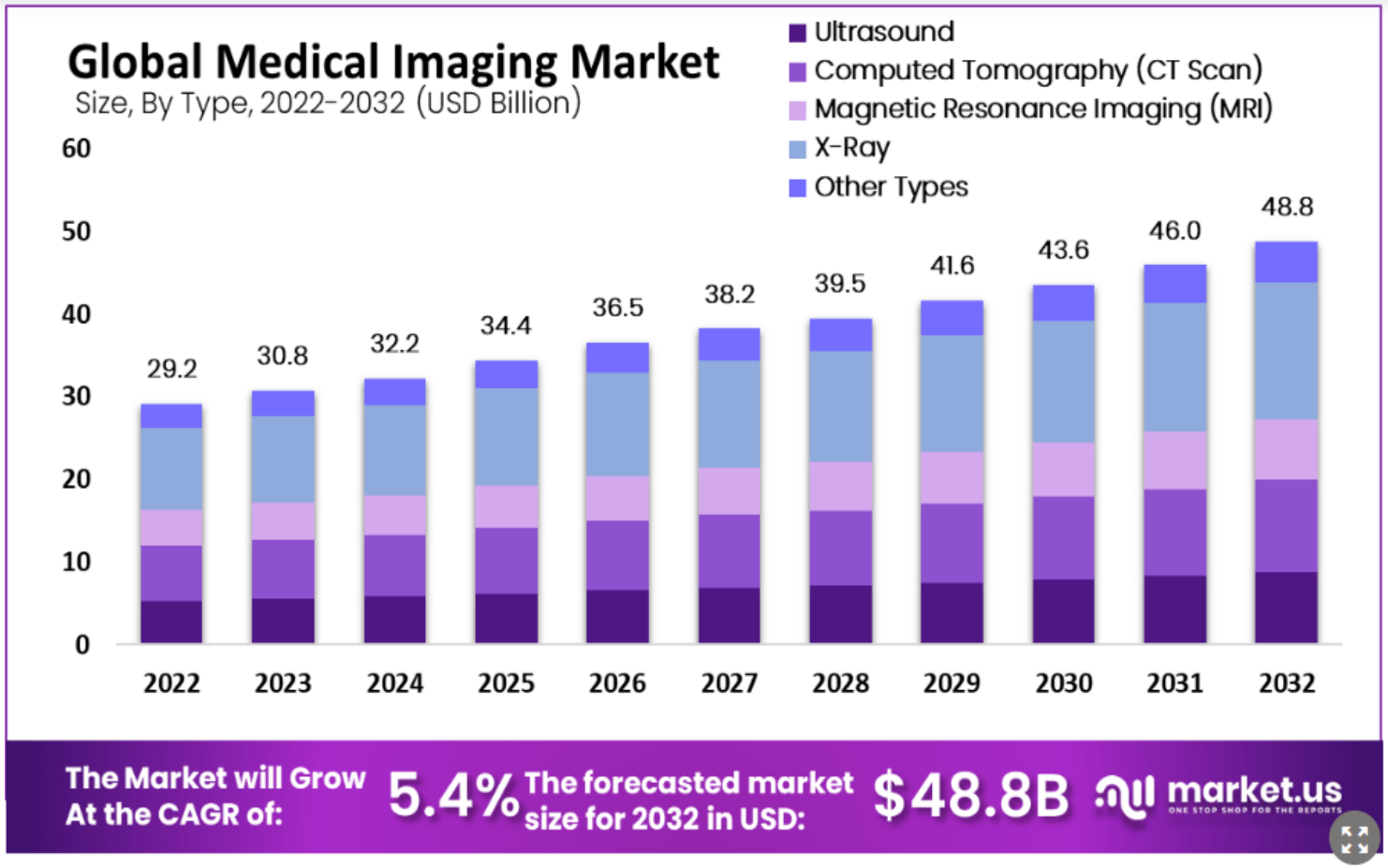
Global Medical Imaging Market

The global medical imaging market size was estimated at USD 45 billion in 2022 and is projected to hit around USD 71.57 billion by 2032 and is poised to grow at a compound annual growth rate (CAGR) of 4.80% during the forecast period 2023 to 2032.



- The increasing number of patients suffering with chronic ailments and pathological disorders has boosted the demand for advanced medical imaging techniques.
- By product, the ultrasound segment accounted highest revenue share of 30% in 2022.
- North America medical imaging market was accounted at USD 13 billion in 2022.
- By product, U.K. medical imaging market was valued at USD 3 billion in 2022.
- The CT product segment is expected to witness the fastest CAGR during the forecast period.
- By end user, the hospital segment has garnered 49% market share in 2022.
- North America region has contributed 36% revenue share in 2022.

Global Medical Imaging Market



- By type, the **X-ray segment** dominated the market with the largest revenue share in 2022.
- By applications, the **orthopedic segment** held the largest market share globally.
- By end-user, the **hospital's segment** accounted for a significant revenue share of the total market in 2022.
- In 2022, **North America** dominated the market with the highest revenue share of **36.0%.**
- Asia-Pacific is expected to be the fastest-growing market from 2023-2032.

Industry Growth

The increasing demand for diagnostic imaging services is driven by several factors:

- Advancements in medical technology
  - Growing Number of Imaging Device
  - Complexity of Equipment
- Rising prevalence of chronic diseases.
- As the demand for diagnostic imaging services grows, so does the need for skilled professionals to maintain and repair the sophisticated imaging equipment used in healthcare settings.

Engineer Shortage

- **Specialized Training**
  - Lack of educational programs
  - Lack of training opportunities
  - Limit training facilities
- **Technological Advancements:**
  - Gap in training programs
  - Adjusting to changes in technology
- **Aging Workforce:**
  - Baby boomers are retiring
  - Lack of interest from the younger generation
  - Unaware of the profession
- **Skilled Personnel Shortages**
  - Not enough professionals to meet the increasing demand
  - Lack of skills
  - Training can be time consuming

Growth Opportunities

- Imaging programs are being created for qualified BMET’s
- Some companies provide in-house training platforms to help current biomedical technicians (BMETs) become imaging engineers.
- Increase in the number of BMET’s seeking opportunities to learn new skills
- Higher income for top level BMET’s
- Better opportunities for those willing to relocate

Conclusion

- Unique and rewarding career path
- Transferable skills
- Educational requirements
- Growing demand for diagnostic imaging services
- Essential part of the healthcare environment
- Biomedical background correlates well with imaging
- Gain technical expertise with a sense of purpose


"That's all Folks!"


Q & A

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We value your feedback!

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Thank You!