Postgraduate Diploma

Radiophysics Applied to Nuclear Medicine

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Postgraduate Diploma
Radiophysics Applied to Nuclear Medicine

- Modality: **online**
- Duration: **6 months**
- Certificate: **TECH Technological University**
- Dedication: **16h/week**
- Schedule: **at your own pace**
- Exams: **online**

Website: www.techtitute.com/in/medicine/postgraduate-diploma/postgraduate-diploma-radiophysics-applied-nuclear-medicine

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Introduction

Radiophysics Applied to Nuclear Medicine plays a crucial role in improving medical care. This discipline employs principles of Physics, Technology and Mathematics to develop and apply techniques to diagnose and treat conditions through the use of radioactive substances. Its benefits are varied: from the early detection of pathologies by means of highly precise imaging procedures, to the possibility of carrying out targeted therapies with high specificity, minimizing damage to healthy tissues. As such, TECH offers this comprehensive academic program, due to the great need for specialized professionals in this field. This program will give physicians access to the latest techniques for diagnosis and treatment of diseases through radiopharmaceuticals.

With this 100% online qualification, you will use radioactive substances to obtain accurate and detailed images of the interior of the human body"

The benefits of Radiophysics Applied to Nuclear Medicine include visualization of internal biological processes, such as drug distribution or organ function, by detecting radiation emitted by nuclear tracers. This technique enables early and accurate diagnosis of diseases, facilitating a more specific and effective approach. In addition, Radiophysics ensures controlled and safe administration of radiation, optimizing treatments to minimize side effects.

For this reason, TECH has developed this Postgraduate Diploma, which will cover a broad spectrum of crucial knowledge, such as Radiobiology, where the interactions of ionizing radiation with biological tissues will be analyzed. In this way, the chain of cellular and biological effects generated by radiation will be unraveled, in addition to delve into the radiosensitivity of tissues, radioinduced damage and repair mechanisms.

Likewise, the physician will delve into radiopharmaceuticals in Nuclear Medicine, revealing their role in both diagnosis and therapy. It will also explore the key equipment used in hospitals, from activimeters to gamma cameras and PET, explaining their components, operation and image acquisition techniques.

Radiation protection will also be addressed from a historical perspective, including current legal complexities. The graduate will also delve into international regulations and their practical application in hospital environments, with emphasis on Nuclear Medicine, Radiation Oncology and Radiodiagnosis. Finally, the functions of a Radiological Protection Service in the hospital will be detailed, including the management of personal dosimetry and the design of medical facilities to minimize occupational exposure of workers.

This university program offers a complete education, based on an innovative methodology called Relearning This technique focuses on the repetition of key concepts to ensure a full understanding of the content. In addition, being completely online, the platform will be available 24 hours a day for the graduates, who will only need a device with Internet access.

This **Postgraduate Diploma in Radiophysics Applied to Nuclear Medicine** is the most complete and up-to-date scientific program on the market. Its most notable features are:

- The development of practical cases presented by experts in Radiophysics applied to Nuclear Medicine
- The graphic, schematic, and practical content with which they are created, provide scientific and practical information on the disciplines that are essential for professional practice
- Practical exercises where the self-assessment process can be carried out to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

This program will provide you with comprehensive knowledge, including the essential tools to apply specialized knowledge to the complex and crucial intersection of Radiation and Medicine"

You will address the utilization of radiotracers for the diagnosis and treatment of diseases in Nuclear Medicine. Enroll now!"

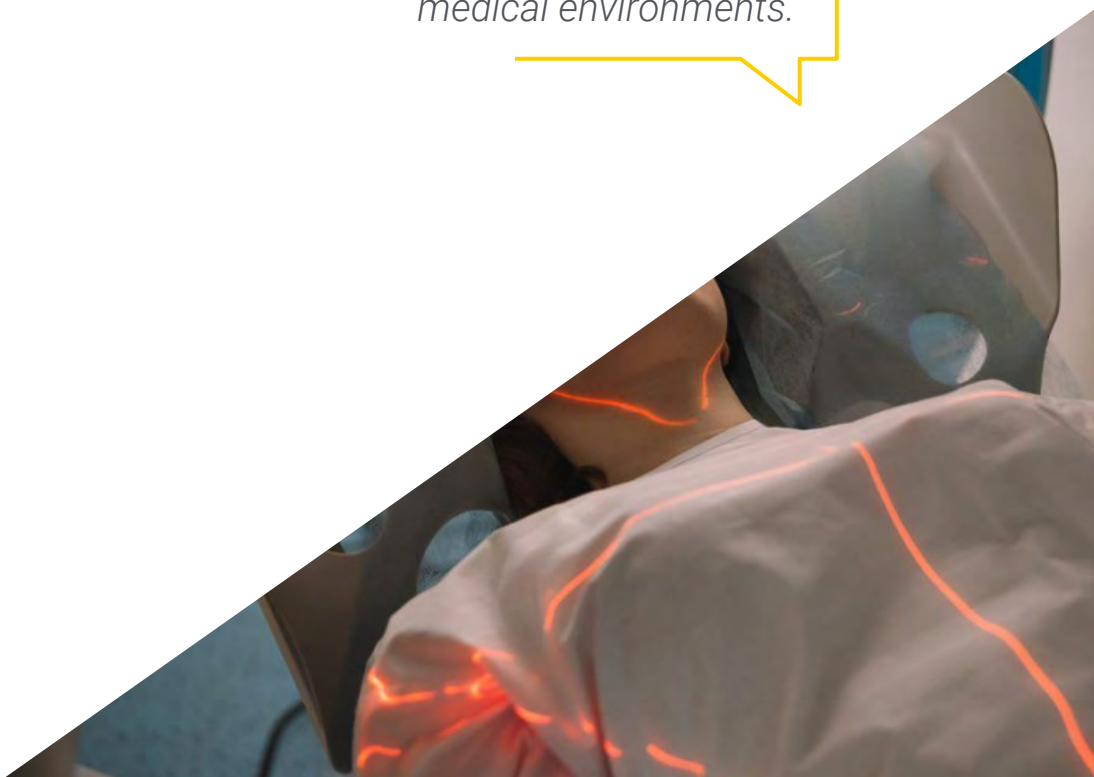
You will understand how radiation interacts with biological tissues and its health effects through this 100% online program.

Through a complete library of multimedia resources, you will analyze radiation protection measures, regulations and safe practices in medical environments.

The program's teaching staff includes professionals from the sector who contribute their work experience to this program, as well as renowned specialists from leading societies and prestigious universities.

The multimedia content, developed with the latest educational technology, will provide the professional with situated and contextual learning, i.e., a simulated environment that will provide immersive education programmed to learn in real situations.

This program is designed around Problem-Based Learning, whereby the professional must try to solve the different professional practice situations that arise during the academic year For this purpose, the students will be assisted by an innovative interactive video system created by renowned and experienced experts.



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Objectives

This program has been created with the aim of providing the physician with in-depth knowledge of Radiobiology, specialized instrumentation in Nuclear Medicine and radiological safety. Its essential mission will be to ensure accurate diagnoses and effective treatments, minimizing risks and maximizing safety, both for patients and for the medical team. In this way, you will train specialists in the clinical application of radiation, as well as in protection and safety in the field of Nuclear Medicine.

You will further your career in the field of Nuclear Medicine, continually contributing to advances that will transform medical practice and health care"

General Objectives

- Analyze the basic interactions of ionizing radiation with tissues
- Establish the effects and risks of ionizing radiation at the cellular level
- Develop the existing mathematical models and their differences
- Determine the cellular response to various medical exposures
- Compile the instrumentation of a Nuclear Medicine Service
- Acquire knowledge of gamma cameras and PET
- Investigate the operation of both tomographs based on quality control
- Establish more advanced concepts of dosimetry in patients
- Analyze the existing risks derived from the use of ionizing radiation in Hospital Radioactive Facilities
- Delve into the international regulations applicable to radiation protection
- Specify the main safety actions in the use of ionizing radiation
- Generate the right knowledge for the design and management of shielding

You will reach your goals thanks to the excellent tools that TECH puts at your disposal, at the forefront of technology and education"

Specific Objectives

Module 1. Radiobiology

- Assess the risks associated with the main medical exposures
- Analyze the interaction of ionizing radiation with tissues and organs
- Examine the different existing mathematical models in radiobiology
- Establish the parameters that affect the biological response to ionizing radiation

Module 2. Nuclear Medicine

- Distinguish between modes of image acquisition from a patient with radiopharmaceuticals
- Establish the physical basis of gamma camera and PET performance
- Determine the quality controls between gamma cameras and PET
- Develop expertise on MIRD methodology in patient dosimetry

Module 3. Radiation Protection in Hospital Radioactive Facilities

- Determine the radiological hazards present in hospital facilities
- Identify the main international laws governing radiological protection
- Develop the main actions carried out at the radiation protection level
- Establish the concepts applicable to the design of a radioactive facility

03

Course Management

The teaching team behind the Postgraduate Diploma in Radiophysics Applied to Nuclear Medicine are true architects of knowledge. These experts are committed to excellence, fusing clinical experience and expertise in Radiological Physics to guide graduates to a deep and practical mastery. Not only do they convey information, but they embody an unwavering commitment to the advancement of medicine through the understanding and responsible application of radiation for the benefit of mankind.

Take advantage of this unique opportunity offered to you by TECH! You will acquire the knowledge and skills you need to embark on the Nuclear Medicine Applied Radiophysics industry"

Management

Dr. De Luis Pérez, Francisco Javier

- Specialist in Hospital Radiophysics
- Head of the Radiophysics and Radiological Protection Service at Quirónsalud Hospitals in Alicante, Torrevieja and Murcia
- Research Group in Personalized Multidisciplinary Oncology, Universidad Católica San Antonio de Murcia
- Ph.D. in Applied Physics and Renewable Energies, University of Almeria
- Degree in Physical Sciences, specializing in Theoretical Physics, University of Granada
- Member of: Spanish Society of Medical Physics (SEFM), Royal Spanish Society of Physics (RSEF), Illustrious Official College of Physicists and Consulting and Contact Committee, Proton Therapy Center (Quirónsalud)

Professors

Dr. Irazola Rosales, Leticia

- Specialist in Hospital Radiophysics
- Physician in Hospital Radiophysics at the Biomedical Research Center of La Rioja
- Working group on Lu-177 treatments at the Spanish Society of Medical Physics (SEFM)
- Collaborator in the University of Valencia
- Reviewer of the journal Applied Radiation and Isotopes
- International Ph.D. in Medical Physics, University of Seville
- Master's Degree in Medical Physics from the University of Rennes I
- Degree in Physics from the Universidad de Zaragoza
- Member of: European Federation of Organisations in Medical Physics (EFOMP) and Spanish Society of Medical Physics (SEFM)

Dr. Rodríguez, Carlos Andrés

- Specialist in Hospital Radiophysics
- Physician in Hospital Radiophysics at the University Clinical Hospital of Valladolid, head of the Nuclear Medicine section
- Principal Tutor of residents of the Department of Radiophysics and Radiological Protection of the Hospital Clínico Universitario de Valladolid.
- Degree in Hospital Radiophysics
- Degree in Physics at the University of Salamanca

04

Structure and Content

The structure of this program will allow the physician to cover a wide range of knowledge, from Radiobiology to specialized instrumentation in Nuclear Medicine and radiation protection. This program offers a comprehensive approach that will allow graduates to investigate the intersection between radiation physics and its clinical application. In addition, they will be immersed in the use of radiopharmaceuticals, key instrumentation in hospitals and the management of radiological protection, offering a global perspective that will enhance technical skills and the ethical and responsible vision of the use of radiation in the medical field.

From Radiobiology to instrumentation specific to Nuclear Medicine, each module will be a gateway to broaden your knowledge"

Module 1. Radiobiology

1.1. Interaction of Radiation with Organic Tissues
- 1.1.1. Interaction of Radiation with Tissues
- 1.1.2. Interaction of Radiation with Cells
- 1.1.3. Physical-Chemical Response

1.2. Effects of Ionizing Radiation on DNA
- 1.2.1. Structure of DNA
- 1.2.2. Radiation-induced Damage
- 1.2.3. Damage Repair

1.3. Effects of Radiation on Organic Tissues
- 1.3.1. Effects on the Cell Cycle
- 1.3.2. Irradiation Syndromes
- 1.3.3. Aberrations and Mutations

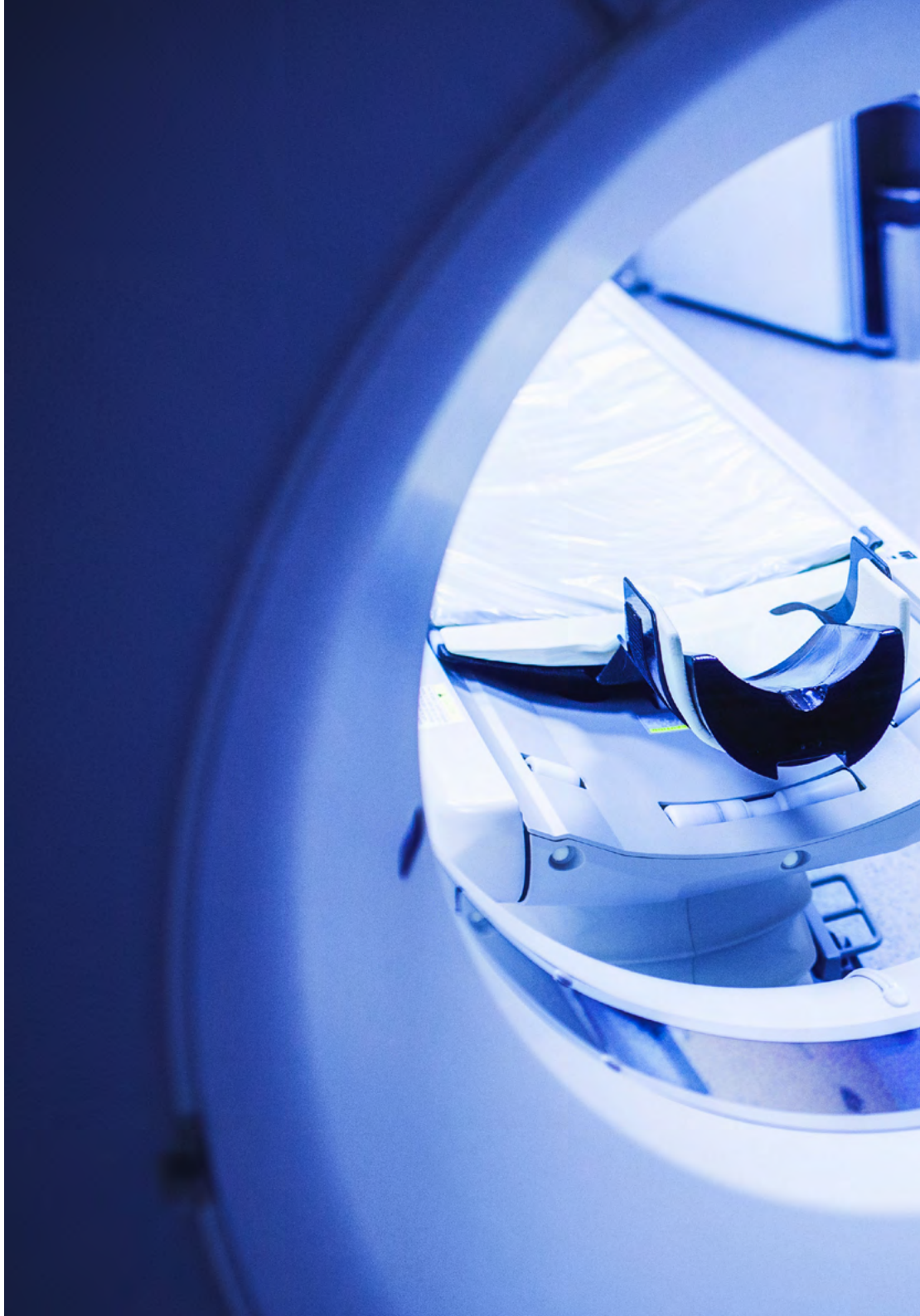
1.4. Mathematical Models of Cell Survival
- 1.4.1. Mathematical Models of Cell Survival
- 1.4.2. Alpha-Beta Model
- 1.4.3. Effect of Fractionation

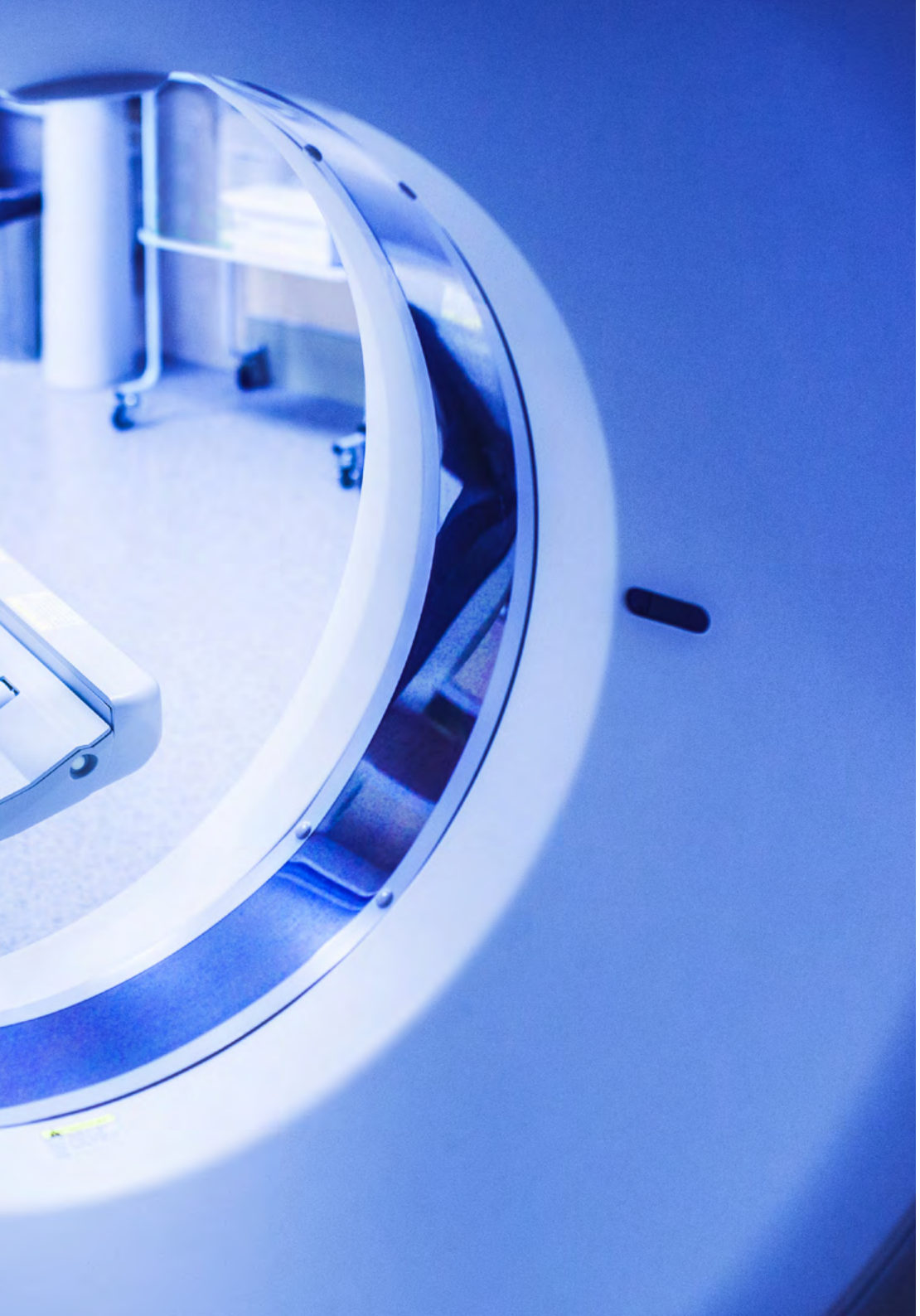
1.5. Efficacy of Ionizing Radiations on Organic Tissues
- 1.5.1. Relative Biological Efficacy
- 1.5.2. Factors Altering Radiosensitivity
- 1.5.3. LET and Oxygen Effect

1.6. Biological Aspects according to the Dose of Ionizing Radiations
- 1.6.1. Radiobiology at Low Doses
- 1.6.2. Radiobiology at High Doses
- 1.6.3. Systemic Response to Radiation

1.7. Estimation of the Risk of Ionizing Radiation Exposure
- 1.7.1. Stochastic and Random Effects
- 1.7.2. Risk Estimation
- 1.7.3. ICRP Dose Limits

1.8. Radiobiology in Medical Exposures in Radiotherapy
- 1.8.1. Isoeffect
- 1.8.2. Proliferation Effect
- 1.8.3. Dose-Response





1.9. Radiobiology in Medical Exposures in Other Medical Exposures
- 1.9.1. Brachytherapy
- 1.9.2. Radiodiagnostics
- 1.9.3. Nuclear Medicine

1.10. Statistical Models in Cell Survival
- 1.10.1. Statistical Models
- 1.10.2. Survival Analysis
- 1.10.3. Epidemiological Studies

Module 2. Nuclear Medicine

2.1. Radionuclides used in Nuclear Medicine
- 2.1.1. Radionuclides
- 2.1.2. Typical Diagnostic Radionuclides
- 2.1.3. Typical Therapy Radionuclides

2.2. Typical Radionuclides in Therapy
- 2.2.1. Obtaining Artificial Radionuclides
- 2.2.2. Cyclotron
- 2.2.3. Generators

2.3. Instrumentation in Nuclear Medicine
- 2.3.1. Activimeters. Calibration of Activimeters
- 2.3.2. Intraoperative Probes
- 2.3.3. Gamma Camera and SPECT
- 2.3.4. PET

2.4. Quality Assurance Program in Nuclear Medicine
- 2.4.1. Quality Assurance in Nuclear Medicine
- 2.4.2. Acceptance, Reference and Constancy Tests
- 2.4.3. Good Practice Routine

2.5. Nuclear Medicine Equipment: Gamma Cameras
- 2.5.1. Image Formation
- 2.5.2. Image Acquisition Modes
- 2.5.3. Standard Patient Protocol

2.6. Nuclear Medicine Equipment: SPECT
- 2.6.1. Tomographic Reconstruction
- 2.6.2. Synogram
- 2.6.3. Reconstruction Corrections

2.7. Nuclear Medicine Equipment: PET
- 2.7.1. Physical Basis
- 2.7.2. Detector Material
- 2.7.3. 2D and 3D Acquisition. Sensitivity
- 2.7.4. Time of Flight

2.8. Image Reconstruction Corrections in Nuclear Medicine
- 2.8.1. Attenuation Correction
- 2.8.2. Dead Time Correction
- 2.8.3. Random Event Correction
- 2.8.4. Scattered Photon Correction
- 2.8.5. Standardization
- 2.8.6. Image Reconstruction

2.9. Quality Control of Nuclear Medicine Equipment
- 2.9.1. International Guidelines and Protocols
- 2.9.2. Planar Gamma Cameras
- 2.9.3. Tomographic Gamma Cameras
- 2.9.4. PET

2.10. Dosimetry in Nuclear Medicine Patients
- 2.10.1. MIRD Formalism
- 2.10.2. Uncertainty Estimation
- 2.10.3. Erroneous Administration of Radiopharmaceuticals

Module 3. Radiation Protection in Hospital Radioactive Facilities

3.1. Radiation Protection in Hospitals
- 3.1.1. Radiation Protection in Hospitals
- 3.1.2. Radiological Protection Magnitudes and Specialized Radiation Protection Units
- 3.1.3. Risks in the Hospital Area

3.2. International Radiation Protection Standards
- 3.2.1. International Legal Framework and Authorizations
- 3.2.2. International Regulations on Health Protection against Ionizing Radiation
- 3.2.3. International Regulations on Radiological Protection of the Patient
- 3.2.4. International Regulations on the Specialty of Hospital Radiophysics
- 3.2.5. Other International Regulations

3.3. Radiation Protection in Hospital Radioactive Facilities
- 3.3.1. Nuclear Medicine
- 3.3.2. Radiodiagnostics
- 3.3.3. Radiotherapy Oncology

3.4. Dosimetric Control of Exposed Professionals
- 3.4.1. Dosimetric Control
- 3.4.2. Dose Limits
- 3.4.3. Personal Dosimetry Management

3.5. Calibration and Verification of Radiation Protection Instrumentation
- 3.5.1. Calibration and Verification of Radiation Protection Instrumentation
- 3.5.2. Verification of Environmental Radiation Detectors
- 3.5.3. Verification of Surface Contamination Detectors

3.6. Tightness Control of Encapsulated Radioactive Sources
- 3.6.1. Tightness Control of Encapsulated Radioactive Sources
- 3.6.2. Methodology
- 3.6.3. International Limits and Certificates

3.7. Design of Structural Shielding in Medical Radioactive Facilities
- 3.7.1. Design of Structural Shielding in Medical Radioactive Facilities
- 3.7.2. Important Parameters
- 3.7.3. Thickness Calculation

3.8. Structural Shielding Design in Nuclear Medicine
- 3.8.1. Structural Shielding Design in Nuclear Medicine
- 3.8.2. Nuclear Medicine Facilities
- 3.8.3. Calculation of the Workload

3.9. Structural Shielding Design in Radiotherapy
- 3.9.1. Structural Shielding Design in Radiotherapy
- 3.9.2. Radiotherapy Facilities
- 3.9.3. Calculation of the Workload

3.10. Structural Shielding Design in Radiodiagnostics
- 3.10.1. Structural Shielding Design in Radiodiagnostics
- 3.10.2. Radiodiagnostics Facilities
- 3.10.3. Calculation of the Workload

Take advantage of all the benefits of the Relearning methodology, which will allow you to organize your time and pace of study, adapting to your schedule"

05

Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning.**

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"

At TECH we use the Case Method

What should a professional do in a given situation? Throughout the program, students will face multiple simulated clinical cases, based on real patients, in which they will have to do research, establish hypotheses, and ultimately resolve the situation. There is an abundance of scientific evidence on the effectiveness of the method. Specialists learn better, faster, and more sustainably over time.

With TECH you will experience a way of learning that is shaking the foundations of traditional universities around the world.

According to Dr. Gérvas, the clinical case is the annotated presentation of a patient, or group of patients, which becomes a "case", an example or model that illustrates some peculiar clinical component, either because of its teaching power or because of its uniqueness or rarity. It is essential that the case is based on current professional life, trying to recreate the real conditions in the physician's professional practice.

Did you know that this method was developed in 1912, at Harvard, for law students? The case method consisted of presenting students with real-life, complex situations for them to make decisions and justify their decisions on how to solve them. In 1924, Harvard adopted it as a standard teaching method"

The effectiveness of the method is justified by four fundamental achievements:

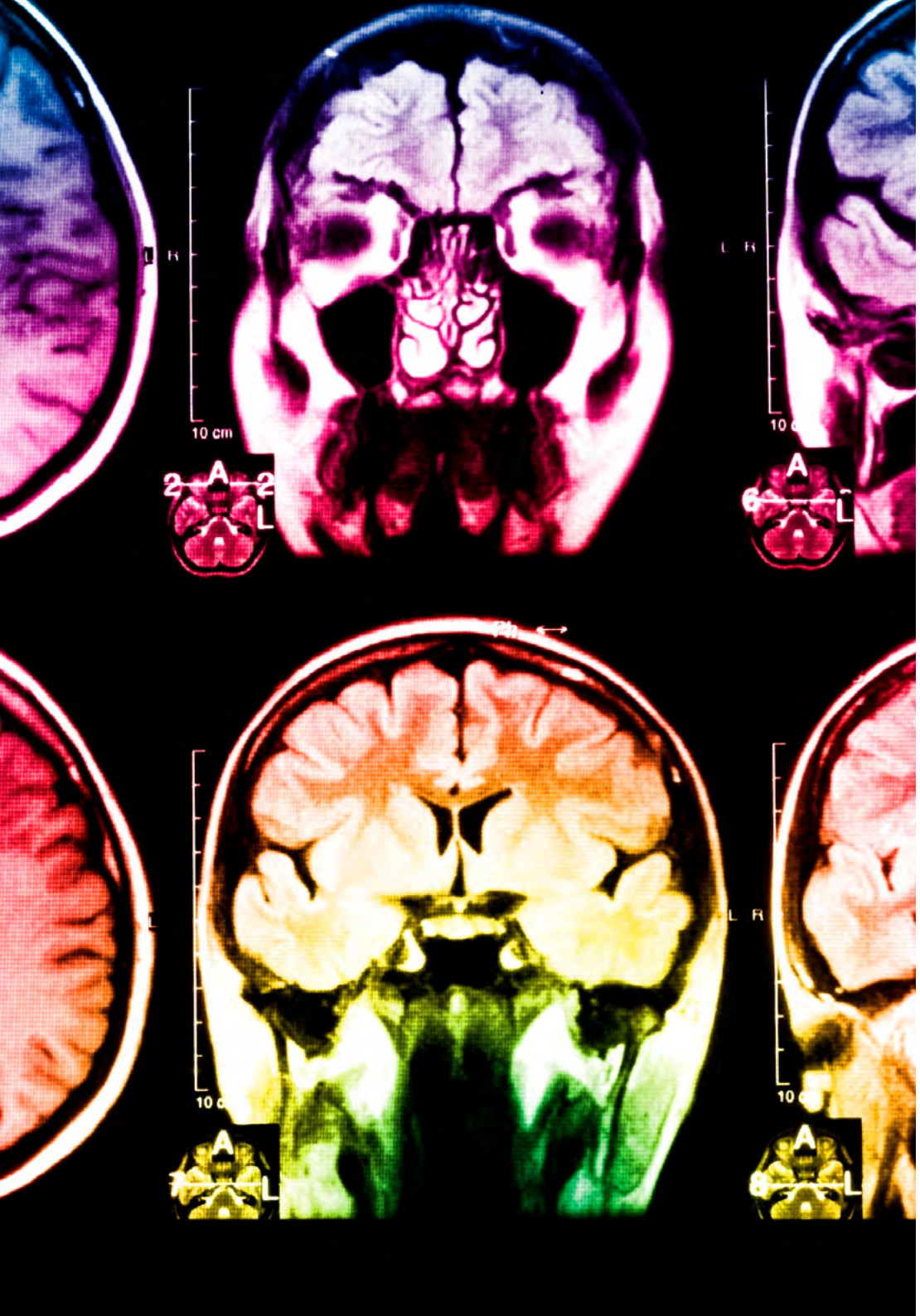
1. Students who follow this method not only achieve the assimilation of concepts, but also a development of their mental capacity, through exercises that evaluate real situations and the application of knowledge.
2. Learning is solidly translated into practical skills that allow the student to better integrate into the real world.
3. Ideas and concepts are understood more efficiently, given that the example situations are based on real-life.
4. Students like to feel that the effort they put into their studies is worthwhile. This then translates into a greater interest in learning and more time dedicated to working on the course.

Relearning Methodology

At TECH we enhance the case method with the best 100% online teaching methodology available: Relearning.

This university is the first in the world to combine the study of clinical cases with a 100% online learning system based on repetition, combining a minimum of 8 different elements in each lesson, a real revolution with respect to the mere study and analysis of cases.

Professionals will learn through real cases and by resolving complex situations in simulated learning environments. These simulations are developed using state-of-the-art software to facilitate immersive learning.



At the forefront of world teaching, the Relearning method has managed to improve the overall satisfaction levels of professionals who complete their studies, with respect to the quality indicators of the best online university (Columbia University).

With this methodology, more than 250,000 physicians have been trained with unprecedented success in all clinical specialties regardless of surgical load. Our pedagogical methodology is developed in a highly competitive environment, with a university student body with a strong socioeconomic profile and an average age of 43.5 years old.

Relearning will allow you to learn with less effort and better performance, involving you more in your specialization, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation to success.

In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically.

The overall score obtained by TECH's learning system is 8.01, according to the highest international standards.

This program offers the best educational material, prepared with professionals in mind:

Study Material

All teaching material is produced by the specialists who teach the course, specifically for the course, so that the teaching content is highly specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.

Surgical Techniques and Procedures on Video

TECH introduces students to the latest techniques, the latest educational advances and to the forefront of current medical techniques. All of this in direct contact with students and explained in detail so as to aid their assimilation and understanding. And best of all, you can watch the videos as many times as you like.

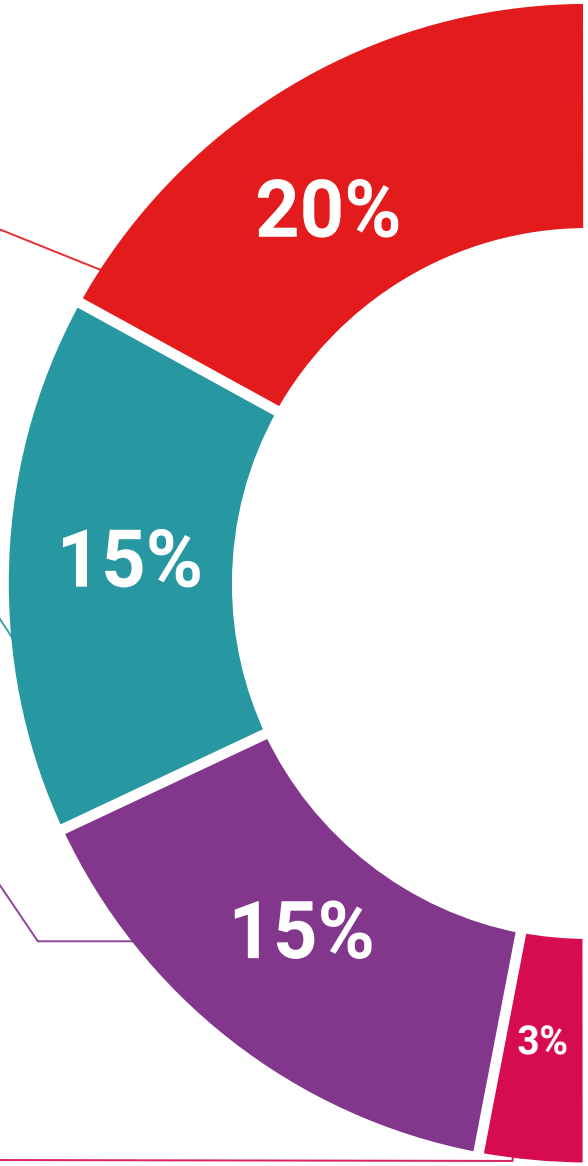
Interactive Summaries

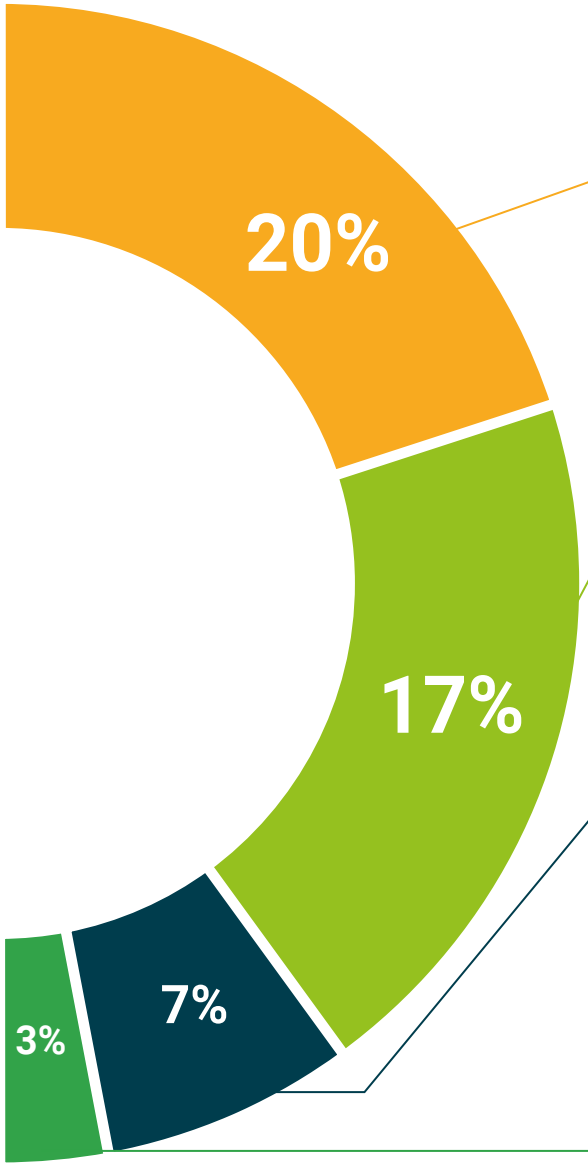
The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".

Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.





Expert-Led Case Studies and Case Analysis

Effective learning ought to be contextual. Therefore, TECH presents real cases in which the expert will guide students, focusing on and solving the different situations: a clear and direct way to achieve the highest degree of understanding.

Testing & Retesting

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises, so that they can see how they are achieving their goals.

Classes

There is scientific evidence on the usefulness of learning by observing experts. The system known as Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

Quick Action Guides

TECH offers the most relevant contents of the course in the form of worksheets or quick action guides. A synthetic, practical, and effective way to help students progress in their learning.

06

Certificate

The Postgraduate Diploma in Radiophysics Applied to Nuclear Medicine guarantees, in addition to the most rigorous and up to date knowledge, access to a Postgraduate Diploma issued by TECH Technological University.

Successfully complete this program and receive your university qualification without having to travel or fill out laborious paperwork"

This **Postgraduate Diploma in Radiophysics Applied to Nuclear Medicine** is the most complete and up-to-date scientific program on the market.

After the student has passed the assessments, they will receive their corresponding **Postgraduate Diploma** issued by **TECH Technological University** via tracked delivery*.

The certificate issued by **TECH Technological University** will reflect the qualification obtained in the Postgraduate Diploma, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Postgraduate Diploma Radiophysics Applied to Nuclear Medicine**

Official Nº of Hours: **450 h.**


tech technological university

Awards the following

CERTIFICATE

to

Mr./Ms. _____, with identification number _____.

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Radiophysics Applied to Nuclear Medicine

This is a qualification awarded by this University, equivalent to 450 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH is a Private Institution of Higher Education recognized by the Ministry of Public Education as of June 28, 2018.

June 17, 2020

Tere Guevara Navarro

Dean

This qualification must always be accompanied by the university degree issued by the competent authority to practice professionally in each country. Unique TECH Code: AFWORD23S techtitute.com/certificates

*Apostille Convention. In the event that the student wishes to have their paper certificate issued with an apostille, TECH EDUCATION will make the necessary arrangements to obtain it, at an additional cost.

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