Postgraduate Diploma

Bioinformatics and Big Data in Medicine

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Postgraduate Diploma
Bioinformatics and Big Data in Medicine

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

Website: www.techtitute.com/us/medicine/postgraduate-diploma/postgraduate-diploma-bioinformatics-big-data-medicine

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01

Introduction

Advances in bioinformatics have made it possible to develop vaccines against Ebola or COVID-19 in a much shorter time, thanks to the processing of large amounts of biological data. This has shone a spotlight on this discipline, which has perfected the techniques and methods used in recent years. In addition, its direct application in medicine has made professionals in this area increasingly interested in updating their knowledge in a field that advances in computing and biomedicine. Given this scenario, TECH offers a 100% online and intensive program, where you can delve into new omics technologies, Big Data or the main genetic databases. All this, through quality content, developed by an excellent team of professional experts in this field.

With TECH Technological University, you will get up to date on advances in Bioinformatics and Big Data applied to Medicine"

In recent years, the development of bioinformatics has made it possible to achieve great scientific advances in various sectors such as agriculture, food and medicine. It is in this field where the incorporation of new techniques and computer processing have allowed the collection of a large amount of biological data, working with them and even creating a 3D model of the viral protein of the COVID-19 spike. All this not only leads to a better understanding of viral processes, but also to obtaining vaccines or specific drugs in less time.

Likewise, given the speed of mutation and transmission of diseases, the massive collection and analysis of clinical data will lead to more effective action, from prevention to cure. A reality of great interest for medical professionals who want to keep abreast of developments in this field. For this reason, TECH has created this program in Bioinformatics and Big Data in Medicine, developed by a team of professionals with extensive experience in this field.

A 100% online program, where the specialist will be able to delve dynamically into future trends in Bioinformatics computing, analysis techniques used in biomedical datasets or the different tools used from engineering in bioprocesses. All this, through a content with a theoretical-practical approach, complemented with multimedia teaching resources of excellent quality.

In addition, thanks to the *Relearning* method, the graduate will be able to progressively advance through the syllabus and reduce the long hours of study with the reiteration of key concepts during the course of this program.

In this way, this educational institution offers the specialist the most relevant and current information on Bioinformatics and Big Data in Medicine through a flexible program, which can be accessed whenever and wherever they want. All you need is an electronic device (computer, tablet or cell phone) with an Internet connection to access, at any time, the syllabus hosted in the Virtual Campus. An ideal option for those who seek to balance the most demanding responsibilities with a quality university program.

This **Postgraduate Diploma in Bioinformatics and Big Data in Medicine** contains 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 bioinformatics and databases
- The graphic, schematic, and practical contents with which they are created, provide practical information on the disciplines that are essential for professional practice
- Practical exercises where self-assessment can be used 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

With this program, you will learn about the use of Machine Learning algorithms in public health and the existing problems with data privacy"

The Relearning system, used by TECH Technological University, will help you to reduce the long hours of study and to easily learn key concepts"

This Postgraduate Diploma provides you with the most relevant biomedical, DNA and protein databases in the field of medical research.

This program provides you with the most relevant biomedical, DNA and protein databases in the field of medical research.

The program's teaching staff includes professionals from the sector who contribute their work experience to this educational 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 course. For this purpose, the student will be assisted by an innovative interactive video system created by renowned and experienced experts.

02

Objectives

In this educational program, the medical professional will learn the most recent techniques and methods used in Bioinformatics and Big Data. In this way, in just 6 months they will be able to update their knowledge on clinical applications, the methodology used for the massive collection of health data and the current trends in biomedical research and public health. For this, TECH will provide the most advanced teaching tools, which will provide greater dynamism, achieving the maximum performance of this Postgraduate Diploma.

A program that will allow you to keep abreast of progress in bioinformatics and its contribution to the development of new drugs"

General Objectives

- Develop key concepts of medicine that serve as a vehicle to understand clinical medicine
- Determine the major diseases affecting the human body classified by apparatus or systems, structuring each module into a clear outline of pathophysiology, diagnosis, and treatment
- Determine how to obtain metrics and tools for healthcare management
- Understand the basics of basic and translational scientific methodology
- Examine the ethical and best practice principles governing the different types of research in health sciences
- Identify and generate the means of funding, assessing and disseminating scientific research
- Identify the real clinical applications of the various techniques
- Develop the key concepts of computational science and theory
- Determine the applications of computation and its implication in bioinformatics
- Provide the necessary resources to practically apply all the concepts in the modules
- Develop the fundamental concepts of databases
- Determine the importance of medical databases
- Delve into the most important techniques in research
- Identify the opportunities offered by the IoT in the field of *e-Health*
- Provide specialized knowledge of the technologies and methodologies used in the design, development and assessment of telemedicine systems
- Determine the different types and applications of telemedicine
- Delve into the most common ethical aspects and regulatory frameworks of telemedicine
- Analyze the use of medical devices
- Develop the key concepts of entrepreneurship and innovation in *e-Health*
- Determine what a business model is and the types that exist
- Collect *e-Health* success stories and mistakes to avoid
- Apply the knowledge acquired to an original business idea

This program will give you a practical and direct view of Big Data in Medicine thanks to case study simulations"

Specific Objectives

Module 1. Computation in Bioinformatics

- Understand the concept of computation
- Break down a computer system into its various parts
- Distinguish between the concepts of computational biology and bioinformatics computing
- Master the most commonly used tools in the field
- Determine future trends in computing
- Analyze biomedical *datasets* using Big Data techniques

Module 2. Biomedical Databases

- Understand the concept of biomedical information databases
- Examine the different types of biomedical information databases
- Study data analysis methods in depth
- Compile models that are useful in predicting outcomes
- Analyze patient data and organize it logically
- Report on large amounts of information
- Determine the main lines of research and testing
- Utilize tools for bioprocess engineering

Module 3. *Big Data* in Medicine: Massive Medical Data Processing

- Gain specialized knowledge of massive data acquisition techniques in biomedicine
- Analyze the importance of data preprocessing in *Big Data*
- Determine the differences between the data derived from different massive data collection techniques, as well as their special characteristics in terms of pre-processing and handling
- Provide ways of interpreting results from massive data analysis
- Examine the applications and future trends in the field of *Big Data* in biomedical research and public health

03

Course Management

Undoubtedly, in order to keep abreast of computer processes applied in Biomedicine, it is essential to have excellent specialists in this field. That is why TECH has brought together a management and teaching team specialized in Bioinformatics, Biotechnology and *E-Health*. Their extensive knowledge in this field and their professional background is reflected in an advanced and intensive syllabus. In addition, you will be able to solve any doubt about it, given its proximity and human quality.

You will be able to solve any doubt about the syllabus with an excellent team of professionals specialized in Bioinformatics and Big Data"

Management

Ms. Sirera Pérez, Ángela

- Nuclear Researcher and Radiophysicist, University Clinic of Navarra, Pamplona, Spain
- Prototyped Parts Designer at Technaid, using 3D printing and CAD Inventor design software
- Biomechanics Professor, Master's Degree in Information and Communication Technologies (ICT) for Biomedical Engineering, TECH
- Degree in Biomedical Engineering from the University of Navarra

Professors

Mr. Piró Cristobal, Miguel

- e-Health Support Manager at ERN TRANSPLANTCHILD
- Biomedical Engineer at MEDIC LAB (UAM)
- Director of External Affairs CEEIBIS
- Degree in Biomedical Engineering, Carlos III University of Madrid
- Master's Degree in Clinical Engineering, Carlos III University, Madrid, 2019; Master's Degree in Financial Technologies: Fintech Carlos III University of Madrid

Ms. Ruiz de la Bastida, Fátima

- Specialist in the Bioinformatics Unit of the Institute for Health Research Jiménez Díaz Foundation
- Oncology Researcher at Idipaz
- Graduate in Biotechnology, University of Cadiz
- Master's Degree in Bioinformatics and Computational Biology, Autonomous University of Madrid

04

Structure and Content

The syllabus of this program has been developed by specialists in Biomedicine and Bioinformatics, with extensive knowledge of this field. Thanks to their contribution, the professional will be able to update on Bioinformatics computing, databases in Biomedicine and massive processing of health data. All this, with an innovative multimedia teaching material, which forms a library of resources that can be accessed at any time of the day, from an electronic device with an Internet connection.

A syllabus that will introduce you to Bioinformatics computing through multimedia pills and dynamic teaching resources"

Module 1. Computation in Bioinformatics

1.1. Central Tenet in Bioinformatics and Computing. Current State
- 1.1.1. The Ideal Application in Bioinformatics
- 1.1.2. Parallel Developments in Molecular Biology and Computing
- 1.1.3. Dogma in Biology and Information Theory
- 1.1.4. Information Flows

1.2. Databases for Bioinformatics Computing
- 1.2.1. Database
- 1.2.2. Data management
- 1.2.3. Data Life Cycle in Bioinformatics
  - 1.2.3.1. Use
  - 1.2.3.2. Modifications
  - 1.2.3.3. Archive
  - 1.2.3.4. Reuse
  - 1.2.3.5. Discarded
- 1.2.4. Database Technology in Bioinformatics
  - 1.2.4.1. Architecture
  - 1.2.4.2. Database Management
- 1.2.5. Interfaces for Bioinformatics Databases

1.3. Networks for Bioinformatics Computing
- 1.3.1. Communication Models. LAN, WAN, MAN and PAN Networks
- 1.3.2. Protocols and Data Transmission
- 1.3.3. Network Topologies
- 1.3.4. Datacenter Hardware for Computing
- 1.3.5. Security, Management and Implementation

1.4. Search Engines in Bioinformatics
- 1.4.1. Search Engines in Bioinformatics
- 1.4.2. Search Engine Processes and Technologies in Bioinformatics
- 1.4.3. Computational Models: Search and Approximation Algorithms

1.5. Data Display in Bioinformatics
- 1.5.1. Displaying Biological Sequences
- 1.5.2. Displaying Biological Structures
  - 1.5.2.1. Visualization Tools
  - 1.5.2.2. Rendering Tools
- 1.5.3. User Interface in Bioinformatics Applications
- 1.5.4. Information Architectures for Displays in Bioinformatics

1.6. Statistics for Computing
- 1.6.1. Statistical Concepts for Computing in Bioinformatics
- 1.6.2. Use Case: MARN Microarrays
- 1.6.3. Imperfect Data. Statistical Errors: Randomness, Approximation, Noise and Assumptions
- 1.6.4. Error Quantification: Precision and Sensitivity
- 1.6.5. Clustering and Classification

1.7. Data Mining
- 1.7.1. Mining and Data Computing Methods
- 1.7.2. Infrastructure for Data Mining and Computing
- 1.7.3. Pattern Discovery and Recognition
- 1.7.4. Machine Learning and New Tools

1.8. Genetic Pattern Matching
- 1.8.1. Genetic Pattern Matching
- 1.8.2. Computational Methods for Sequence Alignments
- 1.8.3. Pattern Matching Tools

1.9. Modelling and Simulation
- 1.9.1. Use in the Pharmaceutical Field: Drug Discovery
- 1.9.2. Protein Structure and Systems Biology
- 1.9.3. Available Tools and Future

1.10. Collaboration and Online Computing Projects
- 1.10.1. Grid Computing
- 1.10.2. Standards and Rules Uniformity, Consistency and Interoperability
- 1.10.3. Collaborative Computing Projects

Module 2. Biomedical Databases

2.1. Biomedical Databases
- 2.1.1. Biomedical Databases
- 2.1.2. Primary and Secondary Databases
- 2.1.3. Major Databases

2.2. DNA Databases
- 2.2.1. Genome Databases
- 2.2.2. Gene Databases
- 2.2.3. Mutations and Polymorphisms Databases

2.3. Protein Databases
- 2.3.1. Primary Sequence Databases
- 2.3.2. Secondary Sequence and Domain Databases
- 2.3.3. Macromolecular Structure Databases

2.4. Omics Projects Databases
- 2.4.1. Genomics Studies Databases
- 2.4.2. Transcriptomics Studies Databases
- 2.4.3. Proteomics Studies Databases

2.5. Genetic Diseases Databases. Personalized and Precision Medicine
- 2.5.1. Genetic Diseases Databases
- 2.5.2. Precision Medicine. The Need to Integrate Genetic Data
- 2.5.3. Extracting Data from OMIM

2.6. Self-Reported Patient Repositories
- 2.6.1. Secondary Data Use
- 2.6.2. Patients' Role in Deposited Data Management
- 2.6.3. Repositories of Self-Reported Questionnaires. Examples

2.7. Elixir Open Databases
- 2.7.1. Elixir Open Databases
- 2.7.2. Databases Collected on the Elixir Platform
- 2.7.3. Criteria for Choosing between Databases

2.8. Adverse Drug Reactions (ADRs) Databases
- 2.8.1. Pharmacological Development Processes
- 2.8.2. Adverse Drug Reaction Reporting
- 2.8.3. Adverse Reaction Repositories at European and International Levels

2.9. Research Data Management Plans. Data to be Deposited in Public Databases
- 2.9.1. Data Management Plans
- 2.9.2. Data Custody in Research
- 2.9.3. Data Entry in Public Databases

2.10. Clinical Databases. Problems with Secondary Use of Health Data
- 2.10.1. Medical Record Repositories
- 2.10.2. Data Encryption

Module 3. *Big Data* in Medicine: Massive Medical Data Processing

3.1. *Big Data* in Biomedical Research
- 3.1.1. Data Generation in Biomedicine
- 3.1.2. High-Throughput Technology
- 3.1.3. Uses of High-Throughput Data. Hypotheses in the Age of *Big Data*

3.2. Data Pre-Processing in *Big Data*
- 3.2.1. Data Pre-Processing
- 3.2.2. Methods and Approaches
- 3.2.3. Problems with Data Pre-Processing in *Big Data*

3.3. Structural Genomics
- 3.3.1. Sequencing the Human Genome
- 3.3.2. Sequencing vs. Chips
- 3.3.3. Variant Discovery

3.4. Functional Genomics
- 3.4.1. Functional Notation
- 3.4.2. Mutation Risk Predictors
- 3.4.3. Association Studies in Genomics

3.5. Transcriptomics
- 3.5.1. Techniques to Obtain Massive Data in Transcriptomics: RNA-seq
- 3.5.2. Data Normalization in Transcriptomics
- 3.5.3. Differential Expression Studies

3.6. Interactomics and Epigenomics
- 3.6.1. The Role of Cromatine in Gene Expression
- 3.6.2. High-Throughput Studies in Interactomics
- 3.6.3. High-Throughput Studies in Epigenetics

3.7. Proteomics
- 3.7.1. Analysis of Mass Spectrometry Data
- 3.7.2. Post-Translational Modifications Study
- 3.7.3. Quantitative Proteomics

3.8. Enrichment and *Clustering* Techniques
- 3.8.1. Contextualizing Results
- 3.8.2. *Clustering* Algorithms in Omics Techniques
- 3.8.3. Repositories for Enrichment: *Gene Ontology* and KEGG

3.9. Applying *Big Data* to Public Health
- 3.9.1. Discovery of New Biomarkers and Therapeutic Targets
- 3.9.2. Risk Predictors
- 3.9.3. Personalized Medicine

3.10. *Big Data* Applied to Medicine
- 3.10.1. Potential for Diagnostic and Preventive Assistance
- 3.10.2. Use of *Machine Learning* Algorithms in Public Health
- 3.10.3. The Problem of Privacy

A program that will show you the current trends in Big Data applied to medicine and its usefulness in disease prevention"

05

Methodology

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

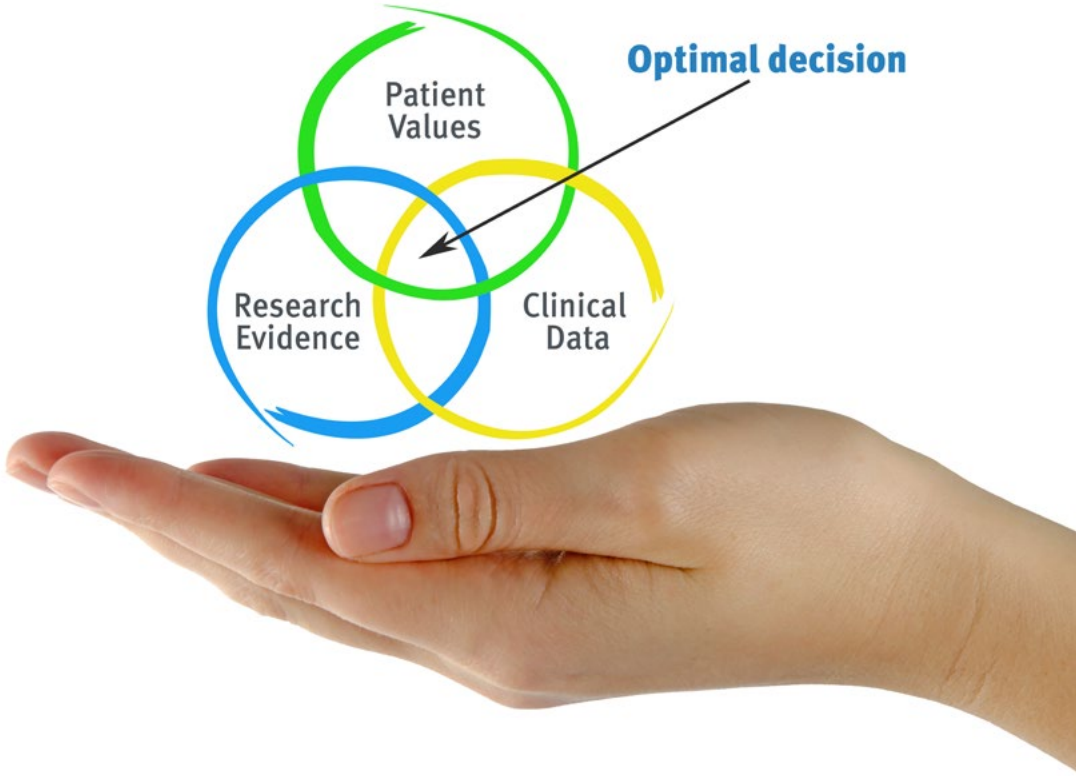
This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

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:

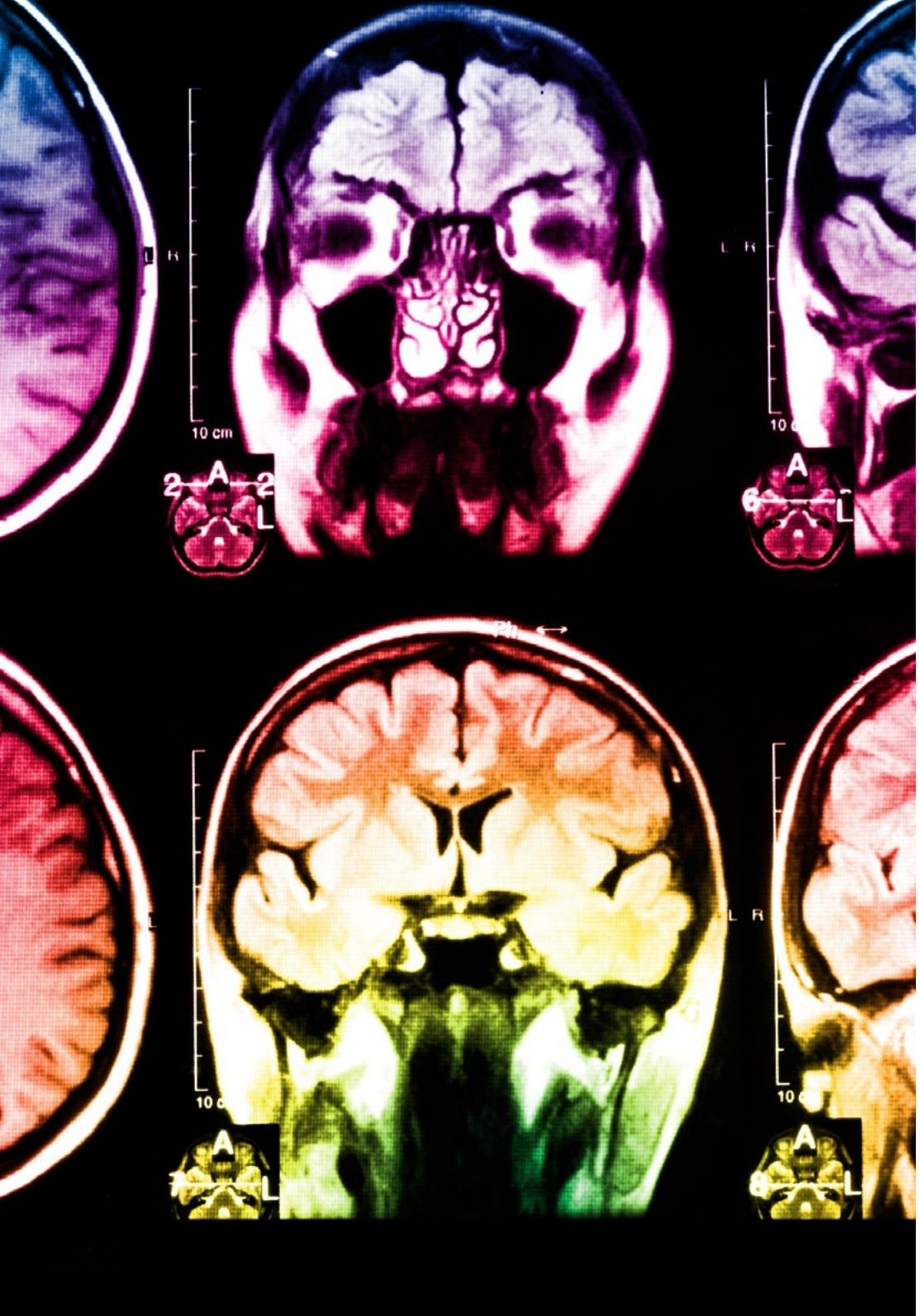
1. Students who follow this method not only achieve the assimilation of concepts, but also a development of their mental capacity, through exercises that evaluate real situations and the application of knowledge.
2. Learning is solidly translated into practical skills that allow the student to better 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 softw are 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.

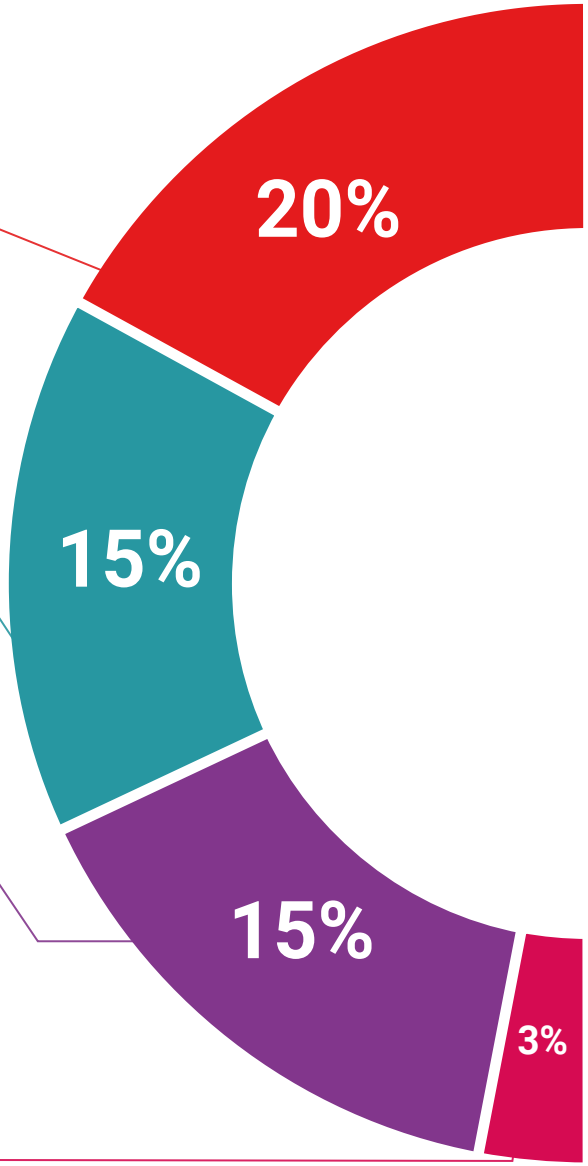
Interactive Summaries

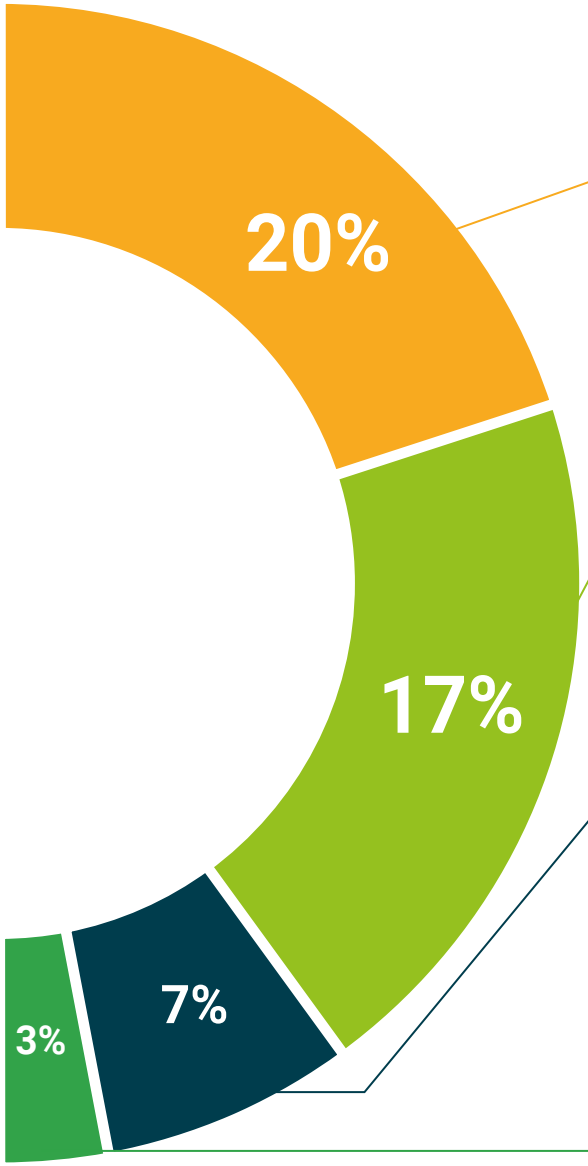
The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

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 Bioinformatics and Big Data in Medicine guarantees students, in addition to the most rigorous and up-to-date education, 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"

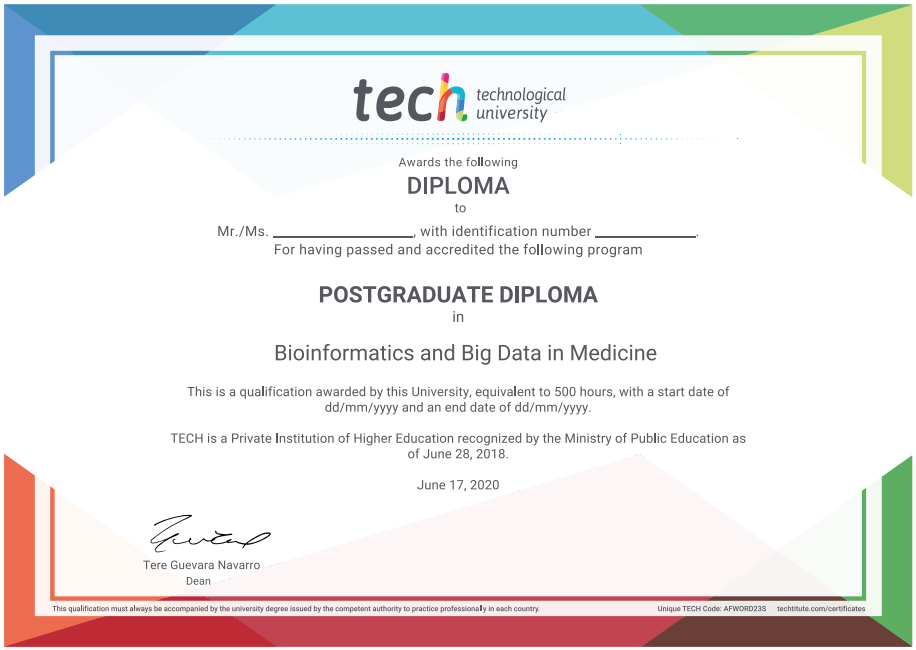
This **Postgraduate Diploma in Bioinformatics and Big Data in Medicine** contains the most complete and up-to-date scientific program on the market.

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

The diploma 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 in Bioinformatics and Big Data in Medicine**

Official Nº of Hours: **450 h.**


tech technological university

Awards the following

DIPLOMA

to

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

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Bioinformatics and Big Data in Medicine

This is a qualification awarded by this University, equivalent to 500 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 diploma issued with an apostille, TECH EDUCATION will make the necessary arrangements to obtain it, at an additional cost.

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