# Postgraduate Diploma

## Bioinformatics and Big Data In Medicine

tech technological university

tech technological university

# 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/computer-science/postgraduate-diploma/postgraduate-diploma-bioinformatics-big-data-medicine

# Index


01
Introduction
p. 4

02
Objectives
p. 8

03
Course Management
p. 12

04
Structure and Content
p. 16

05
Methodology
p. 22

06
Certificate
p. 30

01

# Introduction

The development of bioinformatics and Big Data tools applied to the field of medicine has favored the creation of increasingly effective strategies for research in this sector. Thanks to this, it has also been possible to apply techniques such as data computing or the automation of diagnostic technologies, aspects that have undoubtedly helped to create more effective, personalized and globalized health care. And in order for more and more IT professionals to gain access to this growing industry, TECH has developed a program focused on their specialization. This is an online, multidisciplinary and cutting-edge program that will allow the graduate to learn in detail the developments related to the creation and management of biomedical databases and the application of Big Data in the massive processing of clinical information.

*Specializing in Bioinformatics and Big Data in a 100% online way and in only 6 months is now possible thanks to this exhaustive and intensive program that TECH puts at your disposal"*

Advances in the field of bioinformatics have benefited many sectors, including medicine. Thanks to the development of increasingly specific and concrete techniques, it has been possible to expand the applications of E-Health in today's environment, optimizing tasks and favoring the processing and massive analysis of biological data. Among the most common strategies is the use of Big Data for data processing through structural genomics, which has made it possible, among other things, to discover new biomarkers and therapeutic targets.

As this is such a broad and complex field, it requires extensive knowledge to dedicate oneself to it. For this reason, and in view of the growing demand for IT professionals specialized in this sector, TECH and its team of experts have decided to create a 100% online program that allows any graduate to specialize in this area. This is an academic experience with which they can delve into the latest developments in computing, as well as the creation and management of biomedical databases from scratch. Additionally, it also places special emphasis on data processing through the most sophisticated tools and software.

In addition to the syllabus and case studies, they will be provided with 450 hours of diverse material: detailed videos, research articles, supplementary readings, research articles, self-awareness exercises and dynamic summaries. In conclusion, everything they need to obtain from this academic experience, the broadest and most comprehensive knowledge to adapt their professional profile to the specifications of the sector and the current labor demand.

This **Postgraduate Diploma in Bioinformatics and Big Data in Medicine** contains the most complete and up-to-date educational program on the market. The most important features include:

- 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 Postgraduate Diploma course you will be able to master the management of the multiple databases that exist today"*

*You will be able to implement to your skills catalog the extensive and specialized handling of the most innovative techniques for bioinformatics computation"*

*You will be able to access the Virtual Campus from any device with Internet connection, whether it is a PC, tablet or cell phone.*

*A unique academic opportunity to implement the most innovative and effective enrichment and clustering techniques in your practice.*

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.

Its multimedia content, developed with the latest educational technology, will allow the professional a situated and contextual learning, that is, a simulated environment that will provide an immersive training programmed to train in real situations.

The design of this program focuses on Problem-Based Learning, in which the professional will have to try to solve the different professional practice situations that will arise throughout the academic course. For this purpose, the student will be assisted by an innovative interactive video system created by renowned experts.

02

# Objectives

The objective of this Postgraduate Diploma in Bioinformatics and Big Data is to guide the graduate in their extensive knowledge of this sector. That is why TECH and its team of experts have invested a great deal of time to shape a highly enabling academic experience, which will allow them to know in detail the most comprehensive and detailed information, including the necessary ones to handle perfectly the tools for processing, computing or creating databases.

*A program designed in a dynamic and innovative way, which will make your course an unparalleled academic experience"*

## 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 health care 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 eHealth
- 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 eHealth
- 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

*If your objectives include mastering the use of the main bioinformatics search engines, this Postgraduate Diploma will give you the keys to achieve it"*

## 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

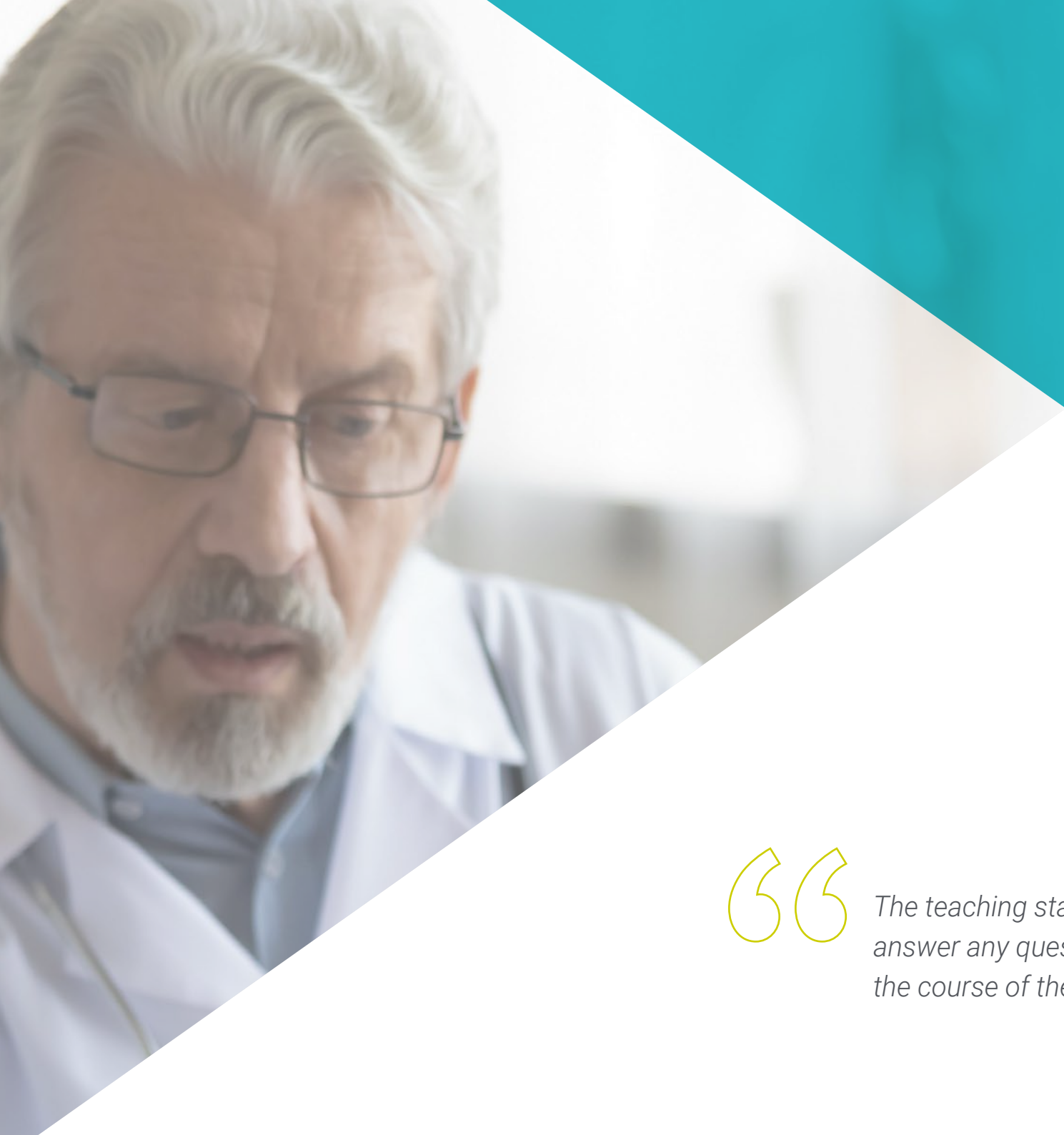
- Develop specialized knowledge on mass data collection techniques in biomedicine
- Analyze the importance of data preprocessing in Big Data
- Determine the differences between the data derived from different massive data collection techniques, as well as their special characteristics in terms of pre-processing 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

*A unique, key, and decisive training experience to boost your professional development"*

03

# Course Management

Achieving mastery of bioinformatics will be a much easier task thanks to the specialized faculty included in this Postgraduate Diploma. TECH has selected for it a team of professionals specialized in computer science and engineering with a wide and extensive work experience in the participation of projects related to E-Health. Thanks to this, they will be able to use their experience to acquire from this academic experience a superior performance, as well as specialized and updated knowledge.



*The teaching staff will be at your disposal to answer any questions you may have during the course of the program"*

## Management

### Ms. Sirera Pérez, Ángela

- Biomedical Engineer expert in Nuclear Medicine and exoskeleton design
- Designer of specific parts for 3D printing at Technadi
- Technician in the Nuclear Medicine area of the University Clinic of Navarra.
- Degree in Biomedical Engineering from the University of Navarra
- MBA and Leadership in Health care and Medical Technology Companies

## Professors

**Mr. Piró Cristobal, Miguel**

- E-Health Support Manager at ERN Transplantchild
- Electromedical Technician. Electromedical Business Group GEE
- Data and Analysis Specialist - Data and Analysis Team. BABEL
- 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 of Madrid
- Master's Degree in Financial Technologies: Fintech Carlos III University of Madrid
- Training in Data Analysis in Biomedical Research. La Paz University Hospital

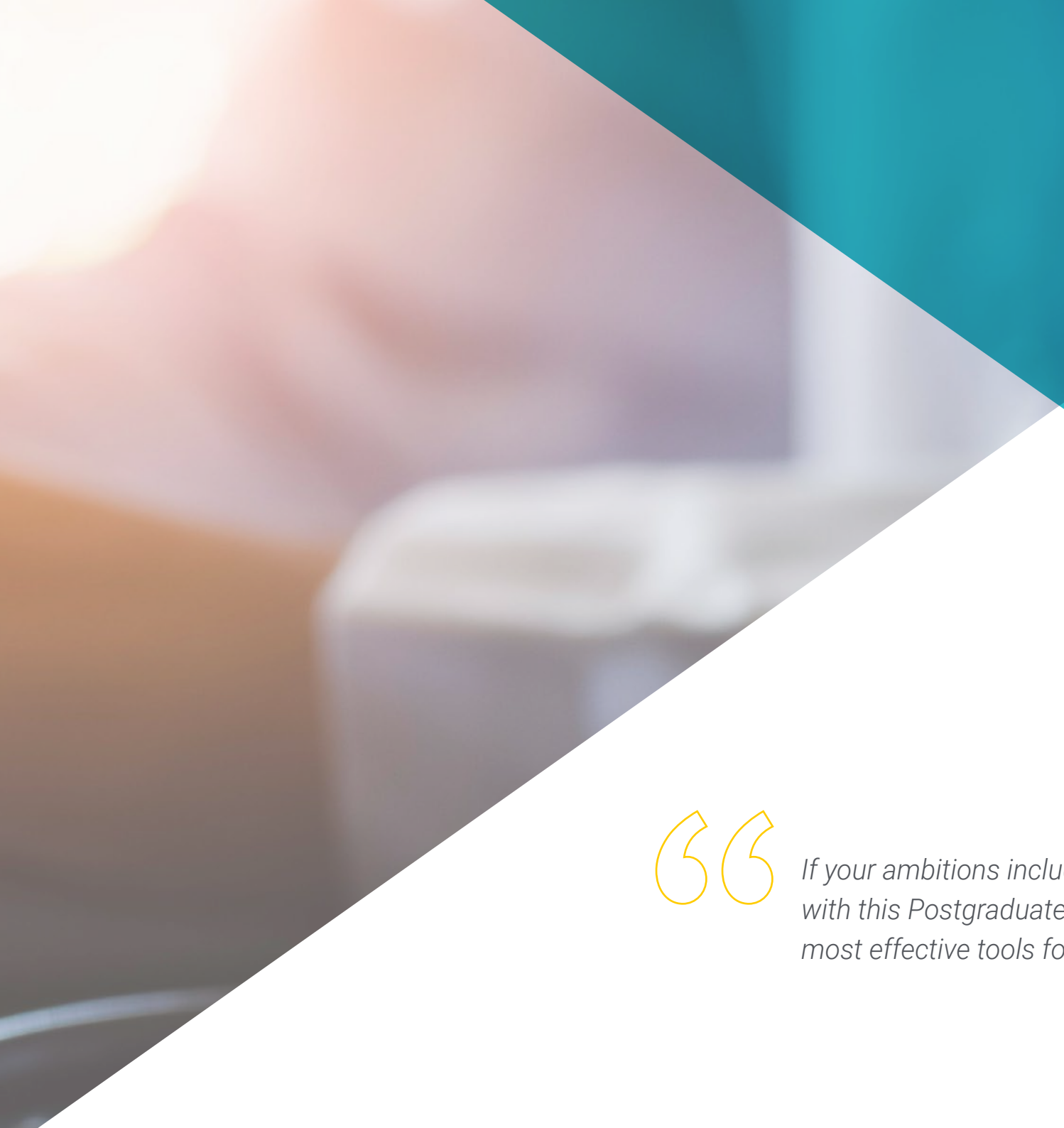
**Ms. Ruiz de la Bastida, Fátima**

- Data Scientist at IQVIA
- Area Specialist, Bioinformatics Unit, Jimenez Diaz Foundation Research Institute
- Oncology Researcher at the La Paz University Hospital
- Graduate in Biotechnology, University of Cadiz
- Master's Degree in Bioinformatics and Computational Biology, Autonomous University of Madrid
- Specialist in Artificial Intelligence and Data Analysis at the University of Chicago

04

# Structure and Content

TECH distinguishes itself from other universities by creating highly capable, dynamic and innovative programs, but through a convenient and accessible 100% online format. This is possible thanks to the use of the latest educational technology, the best pedagogical strategy and the collaboration of a team of experts for the collection of syllabus information and the design of additional material. As a result, it is possible to offer a highly empowering academic experience in a short period of time.



*If your ambitions include mastering data mining, with this Postgraduate Diploma you will master the most effective tools for this purpose"*

## **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

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
- 2.10.3. Access to Health Data. BORRAR Legislation BORRAR

## **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 Performance (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

*Do not miss the opportunity to orient your professional career towards a booming sector such as bioinformatics and start an academic experience that will open many doors in the future"*

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"*

## Case Study to contextualize all content

Our program offers a revolutionary approach to developing skills and knowledge. Our goal is to strengthen skills in a changing, competitive, and highly demanding environment.

*At TECH, you will experience a learning methodology that is shaking the foundations of traditional universities around the world"*

*You will have access to a learning system based on repetition, with natural and progressive teaching throughout the entire syllabus.*

*The student will learn to solve complex situations in real business environments through collaborative activities and real cases.*

## A learning method that is different and innovative

This TECH program is an intensive educational program, created from scratch, which presents the most demanding challenges and decisions in this field, both nationally and internationally. This methodology promotes personal and professional growth, representing a significant step towards success. The case method, a technique that lays the foundation for this content, ensures that the most current economic, social and professional reality is taken into account.

> *Our program prepares you to face new challenges in uncertain environments and achieve success in your career"*

The case method has been the most widely used learning system among the world's leading Information Technology schools for as long as they have existed. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

What should a professional do in a given situation? This is the question that you are presented with in the case method, an action-oriented learning method. Throughout the course, students will be presented with multiple real cases. They will have to combine all their knowledge and research, and argue and defend their ideas and decisions.

## Relearning Methodology

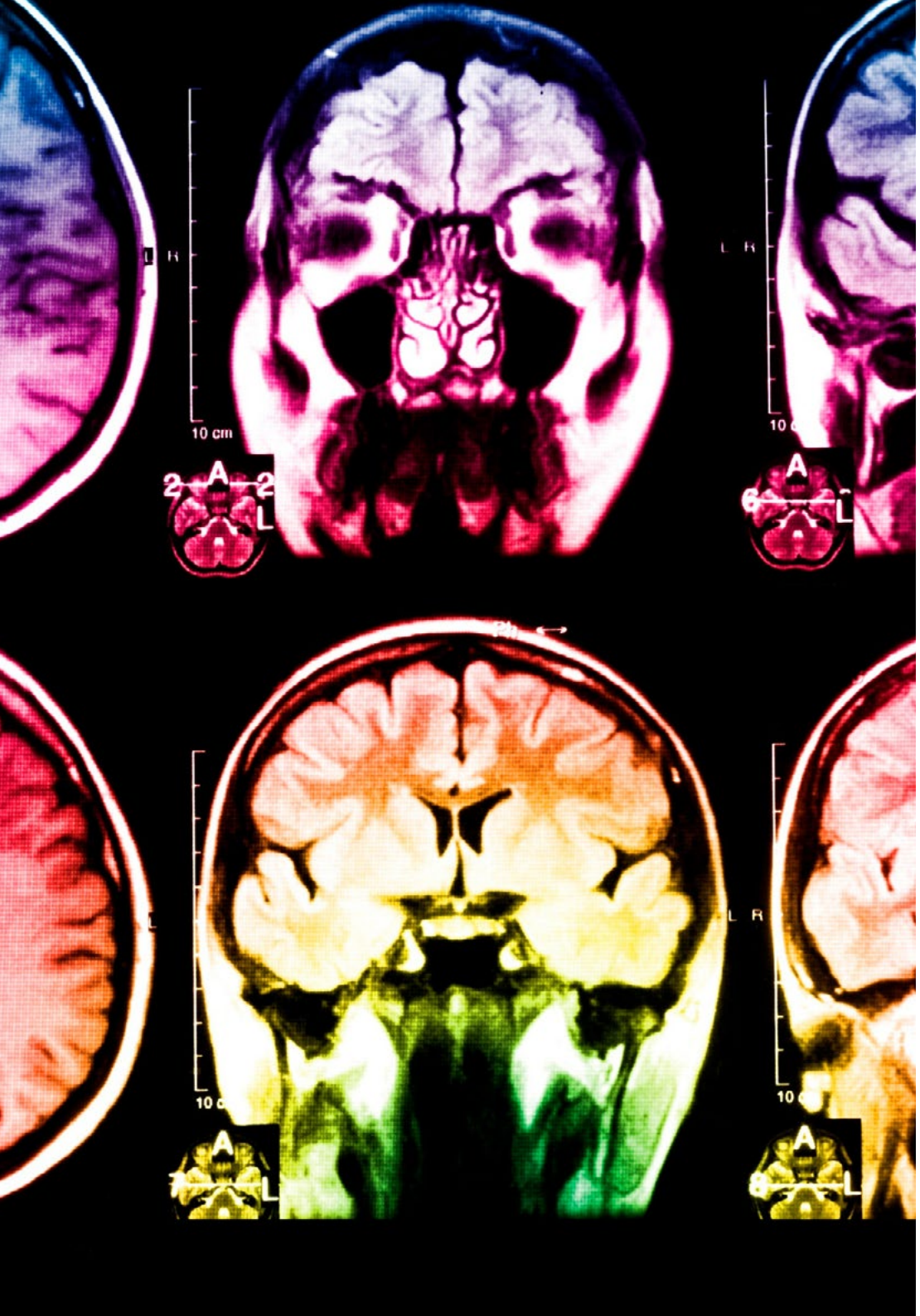
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines different teaching elements in each lesson.

We enhance the Case Study with the best 100% online teaching method: Relearning.

*In 2019, we obtained the best learning results of all online universities in the world.*

At TECH you will learn using a cutting-edge methodology designed to train the executives of the future. This method, at the forefront of international teaching, is called Relearning.

Our university is the only one in the world authorized to employ this successful method. In 2019, we managed to improve our students' overall satisfaction levels (teaching quality, quality of materials, course structure, objectives...) based on the best online university indicators.



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. This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

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

From the latest scientific evidence in the field of neuroscience, not only do we know how to organize information, ideas, images and memories, but we know that the place and context where we have learned something is fundamental for us to be able to remember it and store it in the hippocampus, to retain it in our long-term memory.

In this way, and in what is called neurocognitive context-dependent e-learning, the different elements in our program are connected to the context where the individual carries out their professional activity.

**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.

### Classes

There is scientific evidence suggesting that observing third-party experts can be useful.

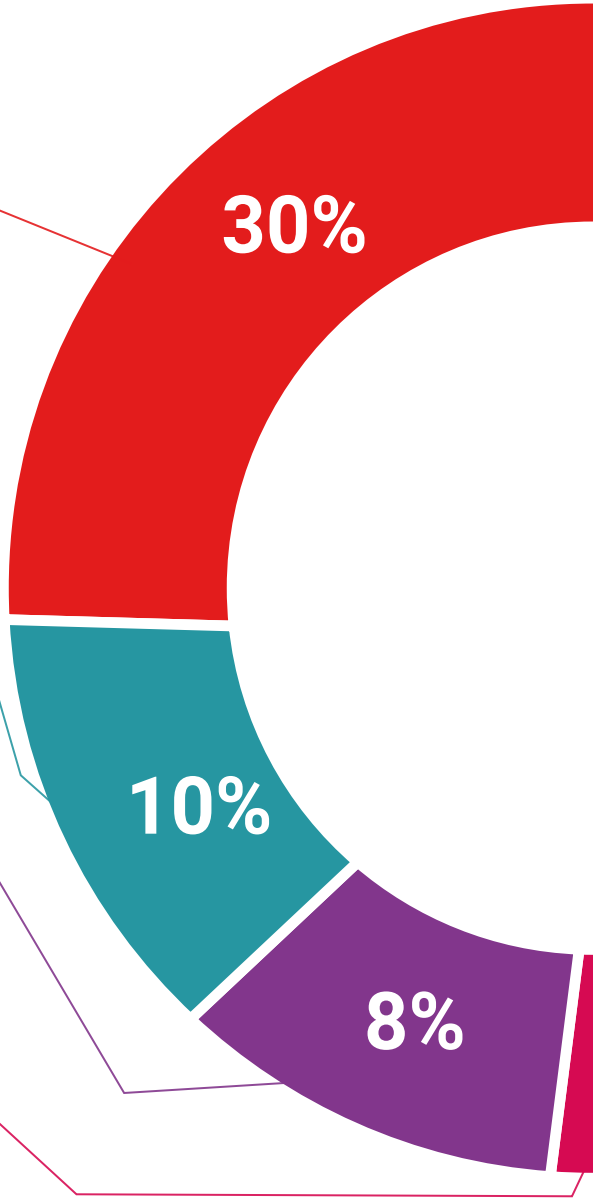
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

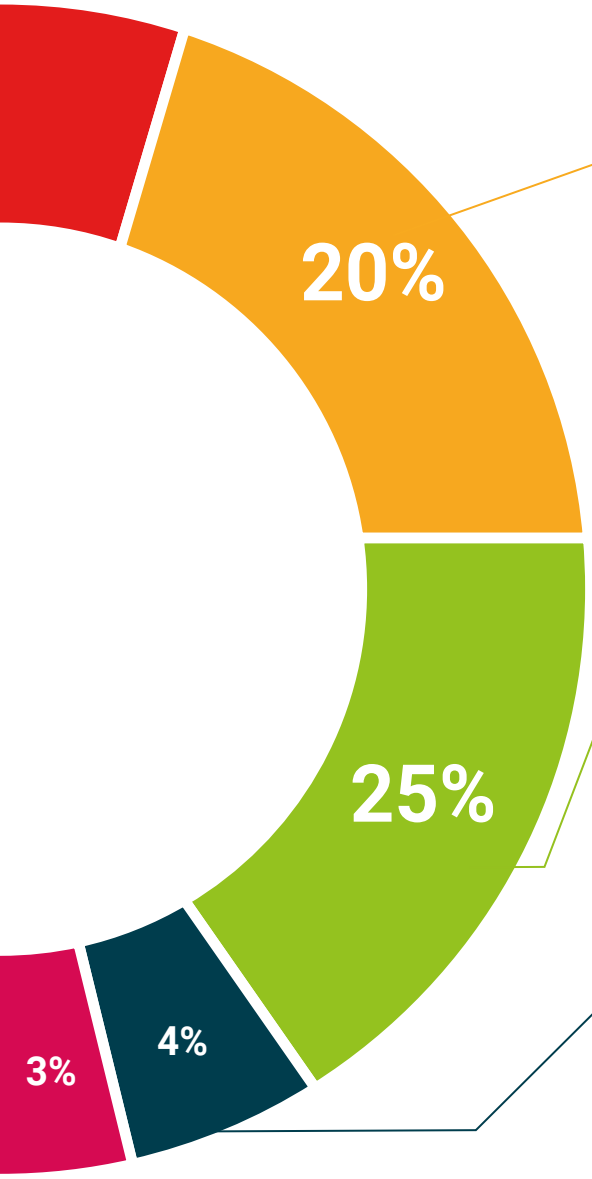
### Practising Skills and Abilities

They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.

### 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.






### Case Studies

Students will complete a selection of the best case studies chosen specifically for this program. Cases that are presented, analyzed, and supervised by the best specialists in the world.

### 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".

### 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.

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"*

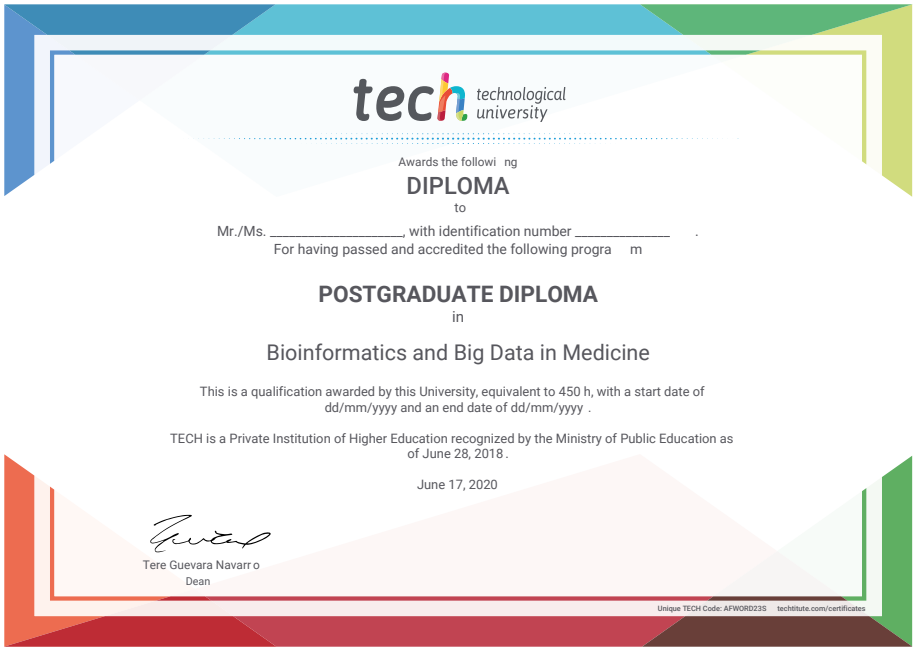
This **Postgraduate Diploma in Bioinformatics and Big Data in Medicine** contains the most complete and up-to-date program on the market.

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.

Certificate: **Postgraduate Diploma in Bioinformatics and Big Data in Medicine**

Official Nº of hours: **450 h.**


tech technological university

Awards the followi ng

DIPLOMA

to

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

For having passed and accredited the following progra m

POSTGRADUATE DIPLOMA

in

Bioinformatics and Big Data in Medicine

This is a qualification awarded by this University, equivalent to 450 h, 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 Navarr o

Dean

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.

tech technological university

# 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**

# Postgraduate Diploma

## Bioinformatics and Big Data In Medicine

tech technological university