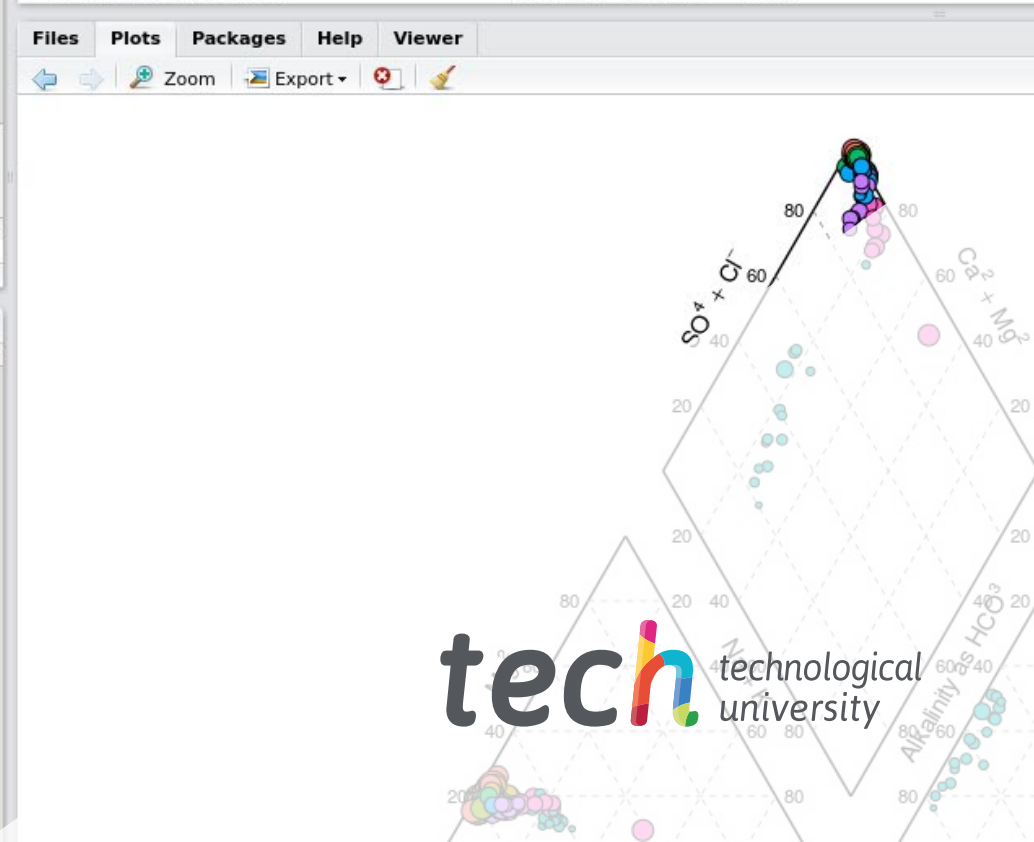


# Postgraduate Certificate

## R Programming Language in Genomic Oncology

```
..._data)  
R Script  
...0", "E"))  
data$Mg, Cl=data$Cl, SO4= data$SO4, name=data$Water  
...und  
...station=="YL-SW-2"|Station=="YL-SW-3"|Station=="YL-SW-4"|Station=="  
...=="YL-SW-7"|Station=="YL-SW-8")  
...er_data1(data, name=data$WT)  
...e added like...  
... + geom_point(aes(x,y), data=piper_data)  
...ge:  
...2 rows containing missing values (geom_point).  
...coloring the points can be done using the observation value.  
...plot_piper() + geom_point(shape=21, aes(x,y, fill=St, size=CE), data=piper_data)
```

```
... variables  
... of 4 variables  
... obs. of 4 variables  
4 obs. of 4 variables  
4 obs. of 4 variables  
636 obs. of 6 variables  
function (x, y, width, height, cations, anions  
function ()  
function (X)  
function (X)  
function (xCat, yCat, zCat, xAn, yAn, zAn, Pl  
function (cations, anions, Stiff = list(fill =  
function (Mg, Ca, Cl, SO4, name = NULL)  
function (X, name = NULL)
```





## Postgraduate Certificate R Programming Language in Genomic Oncology

Course Modality: **Online**

Duration: **2 months**

Qualification: **TECH Technological University**

Official N° of hours: **300 h.**

Website: [www.techtute.com/us/medicine/postgraduate-certificate/r-programming-language-genomic-oncology](http://www.techtute.com/us/medicine/postgraduate-certificate/r-programming-language-genomic-oncology)

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# 01

# Introduction

The concept of genomic or precision oncology is not entirely new; physicians have been using blood type to tailor blood transfusions for over a century. What is different today is the rapid growth of genomic data that can be collected quickly and cheaply from the patient and the community at large, and the potential to gain insights from sharing that data. The scale and complexity of genomic data dwarf the measurements traditionally used in laboratory testing.



“

*Improve your knowledge in R Programming Language in Genomic Oncology through this program, where you will find the best teaching material with real clinical cases. Learn here about the latest advances in the specialty to be able to perform a quality medical practice"*

A fundamental objective of the program is to bring students closer to and disseminate informatics knowledge is already applied in other areas of knowledge, but has a minimal implementation in the medical world, despite the fact that for genomic medicine to become a reality, it is necessary to accurately interpret the huge volume of clinical information currently available and associate it with the biological data generated after a bioinformatics analysis. While this is a difficult challenge, it will allow the effects of genetic variation and potential therapies to be explored quickly, inexpensively and with greater precision than is currently possible.

Humans are not naturally equipped to perceive and interpret genomic sequences, to understand all the mechanisms, pathways and interactions that take place within a living cell, nor to make medical decisions with tens or hundreds of variables. To move forward, a system with superhuman analytical capabilities is required to simplify the work environment and show the relationships and proximities between variables. In genomics and biology, it is now recognized that it is better to spend resources on new computational techniques than on pure data collection, something that is possibly the same in medicine and, of course, oncology.

We have millions of data or publications, but when they are analyzed by physicians or biologists, the conclusions are totally subjective and relative to the available publications or data, which are prioritized arbitrarily. This generates partial knowledge, which is increasingly distanced from the genetic and biological knowledge available and supported by computation, so a giant step in the implementation of precision medicine is to reduce this distance through the massive analysis of available medical and pharmacological information.

This **Postgraduate Certificate in R Programming Language in Genomic Oncology** contains the most complete and up-to-date scientific program on the market. The most important features include:

- Development of case studies presented by experts in R Programming Language in Genomic Oncology
- Its graphic, schematic and eminently practical contents provide scientific and practical information on those disciplines that are essential for professional practice
- Developments on R Programming Language in Genomic Oncology
- It contains practical exercises where the self-assessment process can be carried out to improve learning
- Special emphasis on innovative methodologies in R Programming Language of Bioinformatics in Genomic Oncology
- All of this will be complemented by 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



*Update your knowledge through the program in R Programming Language in Genomic Oncology”*



“

*This may be the best investment you can make in the selection of a refresher program for two reasons: in addition to updating your knowledge in R Programming Language in Genomic Oncology, you will obtain a qualification from TECH Technological University"*

It includes in its teaching staff professionals belonging to the field of R Programming Language in Genomic Oncology, who pour into this program the experience of their work, as well as recognized specialists belonging to reference societies and prestigious universities.

Thanks to its multimedia content elaborated with the latest educational technology, this program will allow the professional a situated and contextual learning, that is to say, a simulated environment that will provide an immersive learning programmed to work in real situations.

This program is designed around Problem-Based Learning, whereby the students must try to solve the different professional practice situations that arise throughout the program. For this purpose, the student will be assisted by an innovative interactive video system developed by recognized experts in the field of R Programming Language in Genomic Oncology with extensive teaching experience.

*Increase your decision-making confidence by updating your knowledge through this program.*

*Take the opportunity to learn about the latest advances in the R Programming Language in Genomic Oncology and improve the care of your patients.*



02

# Objectives

The program in R Language Programming in Genomic Oncology is aimed at facilitating the performance of the physician dedicated to the treatment of oncological pathology, in which it is necessary to accurately interpret the huge volume of clinical information currently available and associate it with the biological data generated after a bioinformatics analysis.





“

*This program will provide you with the skills to carry out your medical praxis with confidence and will help you to grow both personally and professionally”*



## General Objective

- Be able to accurately interpret the volume of clinical information currently available and associated with the biological data generated after a bioinformatic analysis



*Make the most of this opportunity to learn about the latest advances in this subject to apply it to your daily practice"*





## Specific Objectives

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- Discuss how the adoption of next-generation sequencing (NGS) in a diagnostic context raises numerous questions regarding the identification and reporting of variants in secondary genes for patient pathology
- Get started in the R programming language, which has the advantages of being an open-source programming language and has multiple statistical analysis packages available
- Learn basic R programming concepts such as data types, vector arithmetic and indexing
- Performing operations in R, including sorting, creating or importing data
- Learn how problem solving begins with a modular decomposition and then further decompositions of each module in a process called successive refinement
- Learn the basics of statistical inference to understand and calculate p-values and confidence intervals while analyzing data with R
- Provide examples of R programming in a way that will help make the connection between concepts and their implementation
- Describe the most appropriate statistical techniques as an alternative when data do not conform to the assumptions required by the standard approach
- Learn the basics of conducting reproducible research by using R scripts to analyze data
- Using visualization techniques to explore new datasets and determine the most appropriate approach
- Learn how to visualize data to extract information, better understand data and make more effective decisions
- Teach how to take data that at first glance has little meaning and visually present that data in a form that makes sense for analysis
- Learn how to use the three main graph sources in R: base, lattice and ggplot2
- Know what each graphics package is based on in order to define which one to use and the advantages offered by one or the other



03

# Course Management

The program includes in its teaching staff reference specialists in R Language Programming in Genomic Oncology, who pour into this program the experience of their work. In addition, other specialists of recognized prestige participate in its design and elaboration, completing the program in an interdisciplinary manner.



“

*Learn from leading professionals, the latest advances in procedures in the field of R Programming Language in Genomic Oncology"*

## Management



### Dr. Oruezábal Moreno, Mauro Javier

- ♦ Head of the medical Oncology Service at La Paz University Hospital since 2017.
- ♦ Research Visitors at University of Southampton
- ♦ Master's Degree in Bioinformatics and Biostatistics UOC-UB
- ♦ Master's Degree in bioinformatics analysis by the University Pablo de Olavide
- ♦ Doctor of Medicine from the Complutense University of Madrid. Outstanding Cum Laude Qualification.
- ♦ Member of the Spanish Society of Medical Oncology and GECP Group (Spanish Group of Lung Cancer)
- ♦ Specialist (MIR) in Medical Oncology, University Hospital San Carlos of Madrid.
- ♦ Degree in Medicine and Surgery, Navarra University





### **Dr. Krallinger, Martin**

- ♦ Head of the text mining unit at the Spanish National Cancer Research Center (CNIO)
- ♦ He has completed the selection process for the position of head of the text mining unit at the Barcelona Supercomputing Center (BSC)
- ♦ Expert in the field of biomedical and clinical text mining and linguistic technologies
- ♦ Expert in specific text mining applications for drug safety, molecular systems biology and oncology
- ♦ Participated in the implementation and evaluation of biomedical named entity recognition components, information extraction systems, semantic indexing of large datasets of heterogeneous document types
- ♦ Participated in the development of the first biomedical text annotation meta-server (biocreative metaserver - BCMS) and the BeCalm metaserver
- ♦ Organizer of BioCreative community evaluation challenges for the evaluation of natural language processing tools and has participated in the organization of biomedical text mining tasks in various international community challenges, including IberEval and CLEF

## Professors

### Dr. Alberich Martí, Ricardo

- ♦ Full university professor of Mathematics, Sciences and Computing (Director)
- ♦ Computer Science and Artificial Intelligence University of the Balearic Islands

### Dr. Burón Fernández, María Rosario

- ♦ Internal Medicine Service
- ♦ Infanta Cristina University Hospital

### Dr. Gomila Salas, Juan Gabriel

- ♦ University Professor Mathematical Sciences and Computer Science and Artificial Intelligence, University of the Balearic Islands

### Torres, Arnau Mir

- ♦ Full university Professor of Mathematical Sciences and Computer Science and Artificial Intelligence , University of the Balearic Islands





“

*A unique, key and decisive  
program to boost your  
professional development”*

# 04

# Structure and Content

The structure of the contents has been designed by a team of professionals from the best educational centers, universities, and companies in the national territory, aware of the relevance of current specialization in order to intervene in the training and support of students, and committed to quality teaching through New Educational Technologies.







“

*This Postgraduate Certificate in R Programming Language in Genomic Oncology contains the most complete and up-to-date scientific program on the market”*

## Module 1. Data Analysis Processing in Big Data Projects: R Language Programming

- 1.1. Introduction to R programming language
  - 1.1.1. What is R?
  - 1.1.2. R Installation and the Graphic Interface of R
  - 1.1.3. Packages
    - 1.1.3.1. Standard Packages
    - 1.1.3.2. Contributed Packages and CRAN
- 1.2. Basic Features of R
  - 1.2.1. The Environment of R
  - 1.2.2. Software and Related Documentation
  - 1.2.3. R and Statistics
  - 1.2.4. R and the Window System
  - 1.2.5. Using R Interactively
  - 1.2.6. An Introductory Session
  - 1.2.7. Obtaining Help with Functions and Features
  - 1.2.8. R Commands, Cap Sensitivity, Etc
  - 1.2.9. Recovery and Correction of Previous Commands
  - 1.2.10. Execute Commands or Diverting the Output to a File
  - 1.2.11. Data Storage and Object Deletion
- 1.3. Types of Objects in R
  - 1.3.1. Simple Manipulations; Numbers and Vectors
    - 1.3.1.1. Vectors and Their Assignment
    - 1.3.1.2. Vector Arithmetic
    - 1.3.1.3. Generating Regular Sequences
    - 1.3.1.4. Logical Vectors
    - 1.3.1.5. Lost Values
    - 1.3.1.6. Character Vectors
    - 1.3.1.7. Index Vectors
      - 1.3.1.7.1. Selecting and Modifying Subsets of a Dataset
    - 1.3.1.8. Other Types of Objects
  - 1.3.2. Objects, Their Modes and Attributes
    - 1.3.2.1. Intrinsic Attributes: Mode and Length
    - 1.3.2.2. Changing the Length of an Object
    - 1.3.2.3. Obtaining and Configuring Attributes
    - 1.3.2.4. The Class of an Object
  - 1.3.3. Sorted and Unsorted Factors
    - 1.3.3.1. A Specific Example
    - 1.3.3.2. The Tapply () Function and Unequal Matrices
    - 1.3.3.3. Sorted Factors
  - 1.3.4. Matrices
    - 1.3.4.1. Matrices
    - 1.3.4.2. Matrix Indexation. The Subsections of a Matrix
    - 1.3.4.3. Index Matrices
    - 1.3.4.4. The Array () Function
    - 1.3.4.5. Mixed Arithmetic of Vectors and Matrices. The Recycling Rule
    - 1.3.4.6. The Outer Product of Two Matrices
    - 1.3.4.7. The General Transposition of a Matrix
    - 1.3.4.8. Matrix Multiplication
    - 1.3.4.9. Eigenvalues and Eigenvectors
    - 1.3.4.10. Decomposition of Singular Values and Determinants
    - 1.3.4.11. Forming Partitioned Matrices, Cbind () and Rbind ()
    - 1.3.4.12. The Concatenation Function, c (), With Matrices
  - 1.3.5. Factor Frequency Tables
  - 1.3.6. Lists
    - 1.3.6.1. Creating and Modifying Lists
    - 1.3.6.2. Concatenation Lists
  - 1.3.7. Dataframes
    - 1.3.7.1. How to Create Dataframes?
    - 1.3.7.2. Attach () and Separate ()
    - 1.3.7.3. Working With Dataframes



- 1.4. Reading and Writing Data
  - 1.4.1. The Read.Table () Function
  - 1.4.2. The Scan () Function
  - 1.4.3. Access to the Sets of Incorporated Data
  - 1.4.4. Loading Data from Other R Packages
  - 1.4.5. Editing Data
- 1.5. Grouping, Loops and Conditional Execution
  - 1.5.1. Grouped Expressions
  - 1.5.2. Control Statements
    - 1.5.2.1. Conditional Execution: If Sentences
    - 1.5.2.2. Repetitive Execution: For Loops, Repetition and Time
- 1.6. Writing Your Own Functions
  - 1.6.1. Simple Examples
  - 1.6.2. Defining New Binary Operators
  - 1.6.3. Arguments With Name and Default Value
  - 1.6.4. Argument "..."
  - 1.6.5. Assignments Within Functions

## Module 2. Statistical Analysis in R

- 2.1. Discrete Probability Distributions
- 2.2. Continuous Probability Distributions
- 2.3. Introduction to Inference and Sampling (Point Estimate)
- 2.4. Confidence Intervals
- 2.5. Hypothesis Testing
- 2.6. ANOVA of a Factor
- 2.7. Adjustment Bondat (Chi-Square Test)
- 2.8. Fitdist Package
- 2.9. Introduction to Multivariate Statistics

## Module 3. Graphical Environment in R

- 3.1. Graphical Procedures
  - 3.1.1. High-Level Plotting Commands
    - 3.1.1.1. The Plot () Function
    - 3.1.1.2. Multivariate Data Visualization
    - 3.1.1.3. Screen Graphics
    - 3.1.1.4. High-Level Plotting Arguments
  - 3.1.2. Low-Level Plotting Commands
    - 3.1.2.1. Mathematical Annotation
    - 3.1.2.2. Hershey Vectorial Sources
  - 3.1.3. Interacting With Graphics
  - 3.1.4. The Use of Graphic Parameters
    - 3.1.4.1. Permanent Changes: The Par () Function
    - 3.1.4.2. Temporal Changes: Arguments to Graphical Functions
  - 3.1.5. List of Graphic Parameters
    - 3.1.5.1. Graphical Elements
    - 3.1.5.2. Axles and Markings
    - 3.1.5.3. Figure Margins
    - 3.1.5.4. Multi-Figure Environment
  - 3.1.6. Descriptive Statistics: Graphical Representations

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 Certificate in R Programming Language in Genomic Oncology guarantees you, in addition to the most rigorous and up-to-date training, access to a Postgraduate Certificate issued by TECH Technological University.





“

*Successfully complete this program  
and receive your university degree  
without travel or laborious paperwork”*

This **Postgraduate Certificate in R Programming Language in Genomic Oncology** 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 Certificate** issued by **TECH Technological University** via tracked delivery\*.

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

Title: **Postgraduate Certificate in R Programming Language in Genomic Oncology**

Official N° of hours: **300 h.**



\*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.



future

health confidence people

education information tutors

guarantee accreditation teaching

institutions technology learning

community commitment

personalized service innovation

knowledge present quality

online training

development

languages

virtual classroom

**tech** technological  
university

**Postgraduate Certificate**  
R Programming Language  
in Genomic Oncology

Course Modality: Online

Duration: 2 months

Endorsed by: TECH Technological University

Official N° of hours: 300 h.

# Postgraduate Certificate

## R Programming Language in Genomic Oncology