

# Hybrid Professional Master's Degree

## Clinical Analysis





## Hybrid Professional Master's Degree Clinical Analysis

Course Modality: Hybrid (Online + Clinical Internship)

Duration: 12 months

Certificate: TECH Technological University

Teaching Hours: 1,620 h.

Website: [www.techtitute.com/us/medicine/hybrid-professional-master-degree/hybrid-professional-master-degree-clinical-analysis](http://www.techtitute.com/us/medicine/hybrid-professional-master-degree/hybrid-professional-master-degree-clinical-analysis)

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# 01

# Introduction

The recent pandemic situation has motivated the incorporation of new techniques in the field of Clinical Analysis. Therefore, nowadays, physicians have at their disposal new tests with which to make diagnoses and monitor the situation of patients. For this reason, an update is necessary, and this program offers it to the physician, who will be able to learn about the latest developments in biochemistry, genetics or hematology thanks to its complete educational itinerary. In addition, the professional will be able to spend 3 weeks in a prestigious clinical center where they will put into practice all the new knowledge they have acquired.



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*You will learn about the latest developments in clinical analysis techniques through an innovative educational program that includes a 3-week internship”*

The healthcare situation in recent years has led to a transformation in various clinical fields, which have adopted new techniques, updating their procedures according to the latest scientific evidence. Therefore, the physician working in this area will need a complete update in order to be aware of the most important innovations in terms of clinical analysis and tests. In addition, the current situation has led to the profile of the specialist focused on this area becoming highly demanded.

For these reasons, this Hybrid Professional Master's Degree in Clinical Analysis is perfect to update the professional, who will be able to learn throughout the learning process the latest advances in issues such as the study of urine in the urology laboratory and pathological anatomy, the diagnosis of platelet alterations, microscopic techniques in clinical analysis or the biochemical study of vitamins and vitamin deficiencies, among others.

The teaching process in this program is divided into 2 distinct parts: an online stage and an on-site stage. In the online phase, the physician will enjoy a flexible methodology that will allow them to continue developing their work comfortably, without interruptions or fixed schedules. In addition, they will benefit from the best multimedia materials: case studies, master classes, videos of procedures or interactive summaries.

In the on-site stage, the professional will carry out an internship in a center of recognized prestige in this health field, where they will be able to carry out various activities related to laboratory techniques, being able to update themselves in an agile way, with the accompaniment of great specialists from the clinical institution itself.

This **Hybrid Professional Master's Degree in Clinical Analysis** contains the most complete and up-to-date scientific program on the market. The most important features include:

- More than 100 cases presented by Communication Management experts in clinical analysis
- The graphic, schematic, and practical contents with which they are created, provide scientific and practical information on the disciplines that are essential for professional practice
- Assessment of clinical tests, taking into account the most advanced technologies in this field
- Comprehensive systematized action plans for the main tests and analyses to be performed
- Presentation of practical workshops on clinical analysis techniques
- An algorithm-based interactive learning system for decision-making in the clinical situations presented throughout the course
- Guidelines for the performance of different clinical analyses
- Special emphasis on test-based medicine and research methodologies
- 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
- Furthermore, you will be able to carry out a clinical internship in one of the best hospitals

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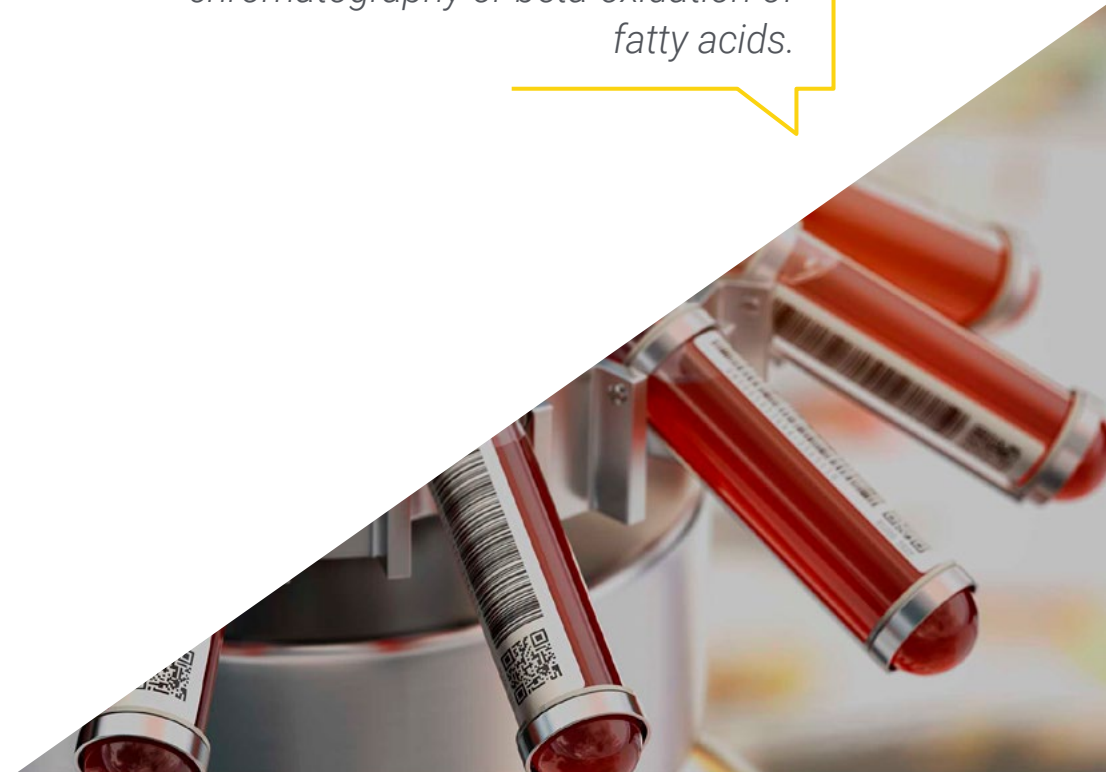
*The latest knowledge will be at your fingertips, providing you with an immediate update on the most innovative clinical analysis procedures”*

This Master's program, of a professionalizing nature and hybrid learning modality, is aimed at updating medical professionals who carry out their daily work by performing clinical analysis. The contents are based on the latest scientific evidence, and oriented in a didactic way to integrate theoretical knowledge into medical practice.

Thanks to the multimedia content, developed with the latest educational technology, medical professionals will benefit from situated and contextual learning, i.e., a simulated environment that will provide immersive learning programmed to train 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 throughout the program. For this purpose, the student will be assisted by an innovative interactive video system created by renowned experts.

*The most specialized teaching staff will accompany you throughout the learning process, ensuring that you comfortably integrate the latest developments in this area into your daily work.*

*This Hybrid Professional Master's Degree will allow you to delve deeper into issues such as gas-liquid chromatography or beta-oxidation of fatty acids.*



02

# Why Study this Hybrid Professional Master's Degree?

The area of Clinical Analysis is in constant evolution, mainly due to its relationship and relevance with the rest of medical specialties. This proposes a more than favorable field of action for specialists in this field, especially when advances in laboratory management processes and technologies in sample studies are continually occurring. For this reason, TECH has created the present program, a Hybrid Professional Master's Degree that provides the opportunity to access both the most modern scientific postulates and the most demanding and efficient practical current affairs.





Why Study this Hybrid Professional | 09  
Master's Degree?

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*After graduating from this Hybrid Professional Master's Degree you will be able to take to your own daily practice the most avant-garde and rigorous current events in Clinical Analysis”*

### 1. Updating from the latest technology available

Clinical laboratories were positioned as fundamental during the COVID-19 pandemic, which has led to a technological and organizational revolution in them. In this Hybrid Professional Master's Degree the student will have access to the latest technology available in database organization, analytical management, screening tests and more techniques of the most advanced Clinical Analysis.

### 2. Gaining In-Depth Knowledge from the Experience of Top Specialists

Both in the theoretical and practical stages, the student will be accessing the most advanced knowledge in Clinical Analysis. All the syllabus has been prepared by experts in different areas of biotechnology and analytics, which guarantees a rigorous and exhaustive content. At the same time, during the internship, the specialist will be integrated in a multidisciplinary work team composed of professionals with extensive experience, being able to benefit from a work methodology enhanced over the years.

### 3. Entering First-Class Clinical Environments

The centers chosen by TECH to carry out internships in programs such as this Hybrid Professional Master's Degree program meet the highest quality standards. This means that students are guaranteed access to a first class clinical environment, with the most advanced laboratory technology and a team that will guide them throughout the process.



#### 4. Combining the Best Theory with State-of-the-Art Practice

Thanks to the exhaustive theory presented in this Hybrid Professional Master's Degree, the specialist will then be able to take all the advanced techniques and analysis studied into the practical field. This will allow them to have an even greater understanding and depth throughout the entire updating process, resulting in a much more efficient and rewarding academic experience.

#### 5. Expanding the Boundaries of Knowledge

The area of Clinical Analysis is in constant evolution and expansion, so it is logical that specialists in the area are constantly looking for an update in all the work methodology and new technologies. This degree is a unique opportunity in the academic market to carry out this update, as it combines the most rigorous and current scientific postulates with practical experience together with a highly experienced professional team in Clinical Analysis at the highest level.

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*You will have full practical immersion  
at the center of your choice”*

# 03 Objectives

The main objective of this Hybrid Professional Master's Degree in Clinical Analysis is to provide the physician with the best and most advanced techniques in the performance of scientific and laboratory tests focused on healthcare. And to achieve this, the program offers a teaching staff composed of active professionals of great prestige in this clinical area, an online teaching methodology that adapts to the student's circumstances, and an internship with which they can apply all the skills acquired during the online phase of the qualification.



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*This program will enable you to achieve all your professional goals by delving into the latest methods in the field of clinical analysis”*



## General Objective

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- The general objective of this program is to analyze and carry out the instrumental techniques and sample collection processes specifically applied to the clinical analysis laboratory, to assess the ISO standards of a clinical laboratory and to examine the etiological basis, pathogenesis, epidemiology, treatment and diagnosis of the main microbial and parasitic diseases affecting human beings



*The most advanced procedures will be at your disposal thanks to this Hybrid Professional Master's Degree*





## Specific Objectives

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### **Module 1. Legal Framework and Standard Parameters of the Clinical Analysis Laboratory**

- ♦ Define the workflows within a Clinical Analysis laboratory
- ♦ Identify the evacuation plan during a health emergency
- ♦ Develop the types of sanitary waste
- ♦ Present the need for process management
- ♦ Develop the administrative procedure for health documentation
- ♦ Identify the types of health inspections
- ♦ Define ISO accreditations, within the framework of an audit
- ♦ Develop the reference intervals, through validation guidelines
- ♦ Analyze the steps of the scientific method
- ♦ Present the levels of scientific evidence, and its relation to Clinical Analyses

### **Module 2. Instrumental Techniques in the Clinical Analysis Laboratory**

- ♦ Compile the instrumental techniques used in a clinical analysis laboratory
- ♦ Determine the procedures involved in microscopic, microbiological, spectral, molecular biology, separation and cell counting techniques
- ♦ Develop the fundamental, theoretical concepts for understanding in-depth instrumental techniques
- ♦ Establish the direct applications of instrumental techniques of clinical analysis in human health as a diagnostic and preventive element
- ♦ Analyze the previous process, necessary for the use of instrumental techniques, which must be developed in the clinical analysis laboratory

- ♦ Justify the rationale for using one practice over another, depending on diagnostic, staffing, management and other factors
- ♦ Propose a practical learning of instrumental techniques, through the use of clinical cases, practical examples and exercises
- ♦ Assess the information obtained from the use of instrumental techniques for the interpretation of results

### **Module 3. Biochemistry I**

- ♦ Analyze, with critical capacity and rigor, analytical data leading to a molecular diagnosis
- ♦ Propose specific biochemical tests for the diagnosis of a molecular pathology
- ♦ Develop practical skills in the management of reference intervals and critical biochemical parameters for diagnosis
- ♦ Compile and review scientific literature in an agile and exhaustive manner, to direct molecular diagnostics
- ♦ Demonstrate the ability to understand and explain physiological and pathological mechanisms from a molecular perspective
- ♦ Explain the applications of biochemical analysis in the clinical diagnosis of diseases
- ♦ Identify the importance and complexity of the regulation of biochemical processes, which give rise to the various functions of the organism

### **Module 4. Biochemistry II**

- ♦ Develop specialized knowledge of the different molecular mechanisms involved in a biological process
- ♦ Analyze the relative problems in the molecular bases of physiological processes and their consequences
- ♦ Generate advanced knowledge in relation to the genetic basis of diseases
- ♦ Demonstrate a good management of laboratory practice with clinical orientation
- ♦ Analyze the experimental approximations and their limitations
- ♦ Interpret scientific results and establish a relationship between those results and the genetic bases of the disease
- ♦ Identify the applications of molecular diagnostic applications in clinical practice

### **Module 5. Biochemistry III**

- ♦ Develop specialized knowledge about motor function disorders and their diagnosis
- ♦ Associate the cardiac alterations with their molecular markers
- ♦ Define specific kidney and liver diseases
- ♦ Develop specialized knowledge of gastrointestinal alterations
- ♦ Associate neurodegenerative diseases with their molecular bases
- ♦ Analyze the alterations of various endocrine glands
- ♦ Examine the different diagnosis techniques



**Module 6. Biochemistry IV**

- ♦ Evaluate the most frequent gynecological and andrological problems in the clinical laboratory
- ♦ Specify assisted reproduction techniques, such as artificial insemination
- ♦ Identify the legal framework of the gamete donation bank
- ♦ Develop the stages of the embryo under the inverted microscope
- ♦ Define the parameters of cellular culture
- ♦ Analyze the hematoxylin-eosin staining technique
- ♦ Examine the types of tumor markers
- ♦ Analyze the usefulness of a uroanalysis

**Module 7. Hematology**

- ♦ Determine the quantitative and qualitative alterations of the different blood cells
- ♦ Delve into the study of peripheral blood, red blood series alterations
- ♦ Identify white blood cell abnormalities and their main causes
- ♦ Present the most frequent platelet disorders
- ♦ Propose a differential diagnosis of myelodysplastic and myeloproliferative syndromes
- ♦ Analyze the battery of complementary tests for the initial assessment of acute leukemias
- ♦ Establish a differential diagnosis of the main acute and chronic lymphoid neoplasms
- ♦ Identify the various coagulation pathologies
- ♦ Establish appropriate guidelines for transfusion procedures

**Module 8. Microbiology and Parasitology**

- ♦ Acquire advanced knowledge in Clinical Microbiology and Parasitology Study the main infectious diseases of clinical interest
- ♦ Identify disease-causing microorganisms in humans, to understand the pathophysiology and practice detection and diagnostic techniques, within a framework of responsibility and health safety
- ♦ Organize the preparation of the necessary material for its use in the microbiology laboratory, and control its sterility when necessary
- ♦ Know the basis and operation of any culture medium in order to use it to perform the different tests used in the microbiology laboratory
- ♦ Correctly handle the different apparatus and equipment used in the microbiology laboratory
- ♦ Establish a proper functioning, through a registration system, for sample collection and processing
- ♦ Design specific work protocols for each pathogen, selecting the appropriate parameters for its correct diagnosis, based on criteria of effectiveness and efficiency
- ♦ Interpret the sensitivity to antimicrobial or antiparasitic agents, in order to orientate the best treatment
- ♦ Know the new techniques used for the identification of pathogens
- ♦ Establish proper communication between the laboratory and the clinic
- ♦ Promote and monitor compliance with internal and external quality controls and safety standards

### Module 9. Immunology

- ♦ Define the molecular and cellular components and organ organization of the immune system
- ♦ Analyze innate and adaptive immune responses, both humoral and cellular based
- ♦ Examine the immunological processes that occur in pathological processes such, as cancer, transplantation, autoimmunity and allergies
- ♦ Apply and integrate the most commonly used immunoanalytical techniques in Clinical Analysis
- ♦ Diagnose alterations of the immune system based on the assessment of the analytical results obtained
- ♦ Develop integrated thinking and critical reasoning, for immunological problem solving
- ♦ Propose and design new experiments to improve or incorporate new immunological techniques, as well as to know their limitations

### Module 10. Genetics

- ♦ Build family trees in detail, and perform segregation analysis
- ♦ Examine karyotypes and identify chromosomal abnormalities
- ♦ Analyze the probability of transmission of genetically based diseases and identify potential carriers
- ♦ Fundamentals of the application of different molecular biology techniques for the diagnosis and investigation of genetic diseases: PCR, hybridization techniques, restriction and sequencing assays, among others



- ♦ Interpret the results obtained from analysis techniques, used in the characterization of genetic alterations or molecular markers
- ♦ Identify different genetically based diseases in detail, establish their causes and diagnostic methods
- ♦ Establish the legal and ethical aspects related to medical genetics and new technologies developed in the field of genetics
- ♦ Present the new genomic and bio-informatics tools, their benefits and scope of application  
Perform searches in genomic databases

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*The most advanced procedures will be at your disposal thanks to this Hybrid Professional Master's Degree”*

# 04 Skills

This Hybrid Professional Master's Degree in Clinical Analysis will allow the specialist to develop new competencies in this complex health field, by incorporating the most innovative procedures into their daily work. In this way, they will not only improve their medical practice, but will also improve their professional profile, since nowadays there is a need for specialists focused on laboratory tasks.





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*Get ready to face the present  
and future challenges of  
medicine and clinical analysis  
with this updating program”*

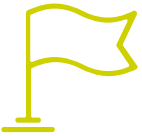


## General Skills

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- Provide students with the necessary skills to perform their work with the utmost excellence as clinical personnel in a laboratory
- Know the latest instrumentation and technology for the successful development of clinical analysis
- Apply the latest developments in the scientific field to clinical analysis
- Perform the most appropriate tests to obtain the most accurate results





## Specific Skills

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- ♦ Select, recommend, perform and take samples of laboratory procedures appropriate to the study of the patient's situation, ensuring the issuance of quality-assured, cost-optimal results
  - ♦ Interpret the results obtained, in relation to the clinical situation of the patient, providing this information to the clinicians
  - ♦ Gain specialized knowledge, focused on the clinical utility of laboratory procedures, assessing and maintaining the quality of available methods, and designing and implementing new analytical methods
  - ♦ Analyze and assess, rigorously, the results of biochemical laboratory analyses, and conclude an accurate molecular diagnosis
  - ♦ Analyze the results of biochemical laboratory tests and relate them to different diseases based on inborn errors of metabolism
  - ♦ Understand how the main functions of the human body develop, as well as the alterations that give rise to the most common pathologies that may occur
  - ♦ Perform more frequent clinical analyses, in public and private health care settings, such as urine culture or analysis of nasopharyngeal samples for the detection of COVID-19
  - ♦ Study the alterations of the hemostatic system; hemorrhagic pathology and problems of hypercoagulability or thrombosis, in addition to improving skills in hemotherapy and transfusion medicine
- ♦ Be able to perform clinical and microbiological analysis of human biological samples, and choose the appropriate techniques, in order to obtain the correct microbiological diagnosis
  - ♦ Have a broad vision of the study of immunological processes within a Clinical Analysis laboratory
  - ♦ Understand the different types of genetic alterations that give rise to diseases, analyze their transmission, identify carriers, and develop methods of prevention and treatment



*You will combine theory and professional practice through a demanding and rewarding educational approach”*

# 05 Course Management

TECH has brought together a teaching staff of great prestige in the field of medicine and biology, and will transfer to the professional the most up-to-date knowledge in this area. Therefore, the student will have access to the latest techniques, transmitted by professors who are actively engaged in this clinical field, which will allow them to integrate them directly into their work.







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*Highly respected and practicing professionals will guide the physician throughout the entire teaching process, ensuring effective learning”*

## International Guest Director

Jeffrey Jhang, M.D. is a dedicated expert in Clinical Pathology and Laboratory Medicine. He has won several awards in these areas, including the Dr. Joseph G. Fink Award from the Columbia University College of Medicine and Surgery, among other recognitions from the College of American Pathologists.

His scientific leadership has been latent thanks to his exhaustive work as Medical Director of the Clinical Laboratory Center, attached to the Icahn School of Medicine at Mount Sinai. At the same institution, he coordinates the Department of Transfusion Medicine and Cell Therapy. In addition, Dr. Jhang has held management positions in the Clinical Laboratory at the Langone Health Center of New York University and as Chief of the Laboratory Service at Tisch Hospital.

Through these experiences, the expert has mastered different functions such as the supervision and management of laboratory operations, complying with the main regulatory standards and protocols. In turn, he has collaborated with interdisciplinary teams to contribute to the accurate diagnosis and care of different patients. On the other hand, he has spearheaded initiatives to improve the quality, performance and efficiency of analytical technical facilities.



## Dr. Jhang, Jeffrey

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- ♦ Director of Clinical Laboratories at NYU Langone Health, New York, United States
- ♦ Director of Clinical Laboratories at NYU Tisch Hospital, New York
- ♦ Professor of Pathology at the NYU Grossman School of Medicine
- ♦ Medical Director of the Clinical Laboratory Center at Mount Sinai Health System
- ♦ Director of the Blood Bank and Transfusion Service at Mount Sinai Hospital
- ♦ Director of Hematology and Coagulation Specialty Laboratory at Columbia University Irving Medical Center
- ♦ Director of the Parathyroid Tissue Collection and Processing Center at Columbia University Irving Medical Center
- ♦ Assistant Director of Transfusion Medicine at Columbia University Irving Medical Center
- ♦ Transfusion Medicine Specialist at the New York Blood Bank
- ♦ M.D. from the Icahn School of Medicine at Mount Sinai
- ♦ Anatomic and Clinical Pathology Residency at NewYork-Presbyterian Hospital

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*Thanks to TECH, you will be able to learn with the best professionals in the world”*

## Management



### Ms. Cano Armenteros, Montserrat

- ♦ Coordinator of research studies at 12 de Octubre University Hospital
- ♦ Vaccine and Infection Studies Coordinator at CSISP-Salud Publica
- ♦ Clinical Research Assistant at TFS HealthScience
- ♦ Professor in postgraduate university studies
- ♦ Degree in Biology from the University of Alicante
- ♦ Master's Degree in Clinical Trials from the University of Seville
- ♦ Master's Degree in Clinical Analysis from the CEU Cardenal Herrera University
- ♦ Master's Degree in Primary Care Research from the Miguel Hernández University of Elche

## Professors

### Mr. Del Río Riego, Javier

- ♦ Embryologist at La Paz Hospital
- ♦ Degree in Biology from the University of Seville
- ♦ Specialized in Assisted Human Reproduction by the University of Oviedo
- ♦ Graduate Biologist in the Andrology and Assisted Human Reproduction section
- ♦ of the Clinical Analysis Service of La Paz University Hospital
- ♦ Postgraduate Diploma in Medical Genetics from the University of Valencia
- ♦ Master's Degree in Reproductive Biology and Technology

### Ms. Aparicio Fernández, Cristina

- ♦ Researcher in Biomedicine
- ♦ Graduate in Biotechnology from the University of León
- ♦ Master's Degree in Advanced Immunology from the University of Barcelona
- ♦ Professional Master's Degree in Management and Monitoring of Clinical Trials by the CEU Cardenal Herrera University

**Mr. Carmona Talavera, Diego**

- ♦ Biochemist Specialist in Clinical Analysis at Fisabio Foundation
- ♦ Clinical Analysis Specialist, Head of the Laboratory of the Vithas Valencia Consuelo Hospital
- ♦ Resident member of the National Commission of Clinical Analysis (Ministry of Health)
- ♦ Master's Degree on Theoretical Basis and Laboratory Procedures of Assisted Reproduction by the UV
- ♦ Master's Degree in Bioethics by the UM
- ♦ Graduate in Biochemistry from the UCO
- ♦ Postgraduate Diploma in Medical Genetics and Genomics, UCAM
- ♦ Specialist Certificate in Health Services Management from the University of Santiago de Compostela
- ♦ Member of AEFA

**Dr. Naranjo Santana, Yurena**

- ♦ Technical Director at Eurofins Megalab Canaria of the San Roque Hospital
- ♦ Clinical Analysis Specialist at Benidorm Clinic Hospital and San Juan University Hospital
- ♦ Head of the Clinical Analysis Service at Perpetuo Socorro Hospital of the Vithas Group
- ♦ Technical Pharmaceutical Director at A.G. y Asociados IMPOCAN
- ♦ PhD in Public Health from the ULPGC
- ♦ Master's Degree in Public Health Therapy by the UMH
- ♦ Member of: Spanish Association of Medical Biopathology, Spanish Association of Analytical Pharmacists

**Dr. Calle Guisado, Violeta**

- ♦ Microbiology Researcher
- ♦ Head of the Microbiology Laboratory at Gallina Blanca
- ♦ Research Laboratory Technician at the University of Extremadura
- ♦ Researcher in several university centers and hospitals
- ♦ Professor in university studies and job training courses
- ♦ PhD in Public and Animal Health from the UEx
- ♦ Degree in Biology from the Uex
- ♦ Master's Degree in Science Research from the UEx

**Dr. Corbacho Sánchez, Jorge**

- ♦ Expert Researcher in Genomics
- ♦ Postdoctoral Researcher at the Andalusian Center for Developmental Biology
- ♦ Technical Specialist in the Functional Genomics Service of the Andalusian Center of Developmental Biology
- ♦ PhD in Plant Molecular Biology from the University of Extremadura
- ♦ Degree in Biology from the UEx
- ♦ Master's Degree in Food Science and Technology from the UEx
- ♦ Master's Degree in Advanced Bioinformatics Analysis from the UPO

**Ms. Tapia Poza, Sandra**

- ◆ Biologist specialized in Clinical Analysis
- ◆ Degree in Biology from the University of Alcalá de Henares
- ◆ Master's Degree in Microbiology and Parasitology: Research and Development from the Complutense University of Madrid
- ◆ Postgraduate Course in Clinical Analysis and Hematology Laboratory from San Jorge University
- ◆ University Specialization Course in Biostatistics Applied to Health Sciences from the European University Miguel de Cervantes

**Ms. Utrilla Carriazo, Carmen Lucía**

- ◆ Biochemist Specialist in Neurosciences
- ◆ Collaborating researcher at the Achucarro Basque Center for Neuroscience
- ◆ Science dissemination Youtuber in the channel Science with Carmen
- ◆ Graduate in Biochemistry from the Complutense University of Madrid
- ◆ Master's Degree in Neurosciences from the UCM

**Ms. Cela Rodríguez, Carmela**

- ◆ Specialist in Biochemistry and Clinical Analysis
- ◆ FPI Predoctoral Researcher at the Center for Molecular Biology Severo Ochoa (CBMSO)
- ◆ Co-founder and member of the management committee of the SEI Young Group
- ◆ Graduate in Biochemistry from the UCM
- ◆ Master's Degree in Immunology Research from the UCM
- ◆ Master's Degree in Immunology Research from the UCM
- ◆ Expert in Public Communication and Science Dissemination from the UAM
- ◆ Academic-Scientific Internship at Trinity College Dublin





**Dr. Santo Quiles, Ana María**

- ♦ PhD in Pharmacy from the University Miguel Hernández of Elche
- ♦ Pharmacist Specialist in Clinical Analyses through FIR
- ♦ Degree in Pharmacy from the University of Miguel Hernández of Elche
- ♦ University Specialist in Human Reproductive Biology in the VII Edition of the Official Postgraduate Course of the Department of Histology and Anatomy of the Miguel Hernández University in collaboration with the Vistahermosa Clinic

**Ms. Solar Málaga, Soraya**

- ♦ Scientific and Research Staff in the Intracellular Signaling and Reproductive Technology Group (SINTREP)
- ♦ Graduate in Biochemistry from the University of Extremadura
- ♦ Master's Degree in Agri-Food Production from the University of Cadiz
- ♦ Author and speaker at several congresses in the service of her specialty

# 06

## Educational Plan

The online contents of this Hybrid Professional Master's Degree in Clinical Analysis are structured in 10 specialized modules, through which the physician will be able to delve into issues such as the management of health care waste, the preparation of reagents, solutions, buffers and controls, serum protein electrophoresis, major and minor histocompatibility antigens or the detection and amplification of specific DNA sequences.







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*Enroll now and advance in your field of work with a comprehensive program that will allow you to put into practice everything you have learned”*

## Module 1. Legal Framework and Standard Parameters of the Clinical Analysis Laboratory

- 1.1. ISO Standards, Applicable to a Modernized Clinical Laboratory
    - 1.1.1. Work Flow and Free of Waste
    - 1.1.2. Continuous Mapping of Procedures
    - 1.1.3. Physical Filing of Personnel Functions
    - 1.1.4. Monitoring of Analytical Stages, with Clinical Indicators
    - 1.1.5. Internal and External Communication Systems
  - 1.2. Safety and Management of Sanitary Waste
    - 1.2.1. Safety in a Laboratory Clinic
      - 1.2.1.1. Emergency Evacuation Plan
      - 1.2.1.2. Risk Assessment
      - 1.2.1.3. Standardized Rules of Work
      - 1.2.1.4. Unsupervised Work
    - 1.2.2. Management of Sanitary Waste
      - 1.2.2.1. Classes of Sanitary Waste
      - 1.2.2.2. Packaging
      - 1.2.2.3. Destination
  - 1.3. Standardization Model for Sanitary Processes
    - 1.3.1. Concepts and Objectives of the Standardization Processes
    - 1.3.2. Clinical Variability
    - 1.3.3. Need for Process Management
  - 1.4. Health Care Documentation Management
    - 1.4.1. Archive Installation
      - 1.4.1.1. Established Conditions
      - 1.4.1.2. Incident Prevention
    - 1.4.2. Safety in the Archives
    - 1.4.3. Administrative Procedures
      - 1.4.3.1. Standardized Work Plan
      - 1.4.3.2. Records
      - 1.4.3.3. Location
      - 1.4.3.4. Transfer
      - 1.4.3.5. Conservation
    - 1.4.3.6. Withdrawal
    - 1.4.3.7. Elimination
  - 1.4.4. Electronic Archive Records
  - 1.4.5. Quality Guarantee
  - 1.4.6. Closing the Archive
- 1.5. Quality Control in a Clinical Laboratory
  - 1.5.1. Legal Context of Health Care Quality
  - 1.5.2. Personnel Functions as a Quality Guarantee
  - 1.5.3. Health Inspections
    - 1.5.3.1. Concept
    - 1.5.3.2. Types of Inspections
      - 1.5.3.2.1. Studies
      - 1.5.3.2.2. Facilities
      - 1.5.3.2.3. Processes
  - 1.5.4. Clinical Data Audits
    - 1.5.4.1. Concept of an Audit
    - 1.5.4.2. ISO Accreditation
      - 1.5.4.2.1. Laboratory ISO 15189, ISO 17025
      - 1.5.4.2.2. ISO 17020, ISO 22870
    - 1.5.4.3. Certifications
- 1.6. Evaluation of Analytical Quality: Clinical Indicators
  - 1.6.1. System Description
  - 1.6.2. Flowchart of Work
  - 1.6.3. Importance of Quality in the Laboratory
  - 1.6.4. Procedure Management, in Clinical Analyses
    - 1.6.4.1. Quality Control
    - 1.6.4.2. Extraction and Management of Samples
    - 1.6.4.3. Verification and Validation in the Methods
- 1.7. Clinical Decision Levels, within Reference Ranges
  - 1.7.1. Clinical Laboratory Analysis
    - 1.7.1.1. Concept
    - 1.7.1.2. Standard Clinical Parameters

- 1.7.2. Reference Intervals
  - 1.7.2.1. Laboratory Ranges International Units
  - 1.7.2.2. Analytical Method Validation Guide
- 1.7.3. Clinical Decision Levels
- 1.7.4. Sensitivity and Specificity in Clinical Results
- 1.7.5. Critical Values Variability
- 1.8. Processing of Requests for Clinical Trials
  - 1.8.1. Most Common Types of Requests
  - 1.8.2. Efficient Use vs. Excess Demand
  - 1.8.3. Practical Example of Requests in the Hospital Field
- 1.9. Scientific Method in Clinical Analysis
  - 1.9.1. PICO Question
  - 1.9.2. Protocol
  - 1.9.3. Bibliographic Search
  - 1.9.4. Study Design
  - 1.9.5. Obtaining Results
  - 1.9.6. Statistical Analysis and Interpretation of Results
  - 1.9.7. Publication of Results
- 1.10. Medicine Based on Scientific Evidence. Application in Clinical Analysis
  - 1.10.1. Concept of Scientific Evidence
  - 1.10.2. Classification of the Scientific Evidence Levels
  - 1.10.3. Routine Clinical Practice Guidelines
  - 1.10.4. Evidence Applied in Clinical Analysis Magnitude of Benefit
- 2.1.4. Preparation of Reagents, Solutions, Buffers and Controls
- 2.1.5. Equipment Calibration
  - 2.1.5.1. Importance of Calibration
  - 2.1.5.2. Methods of Calibration
- 2.1.6. Clinical Analysis Process
  - 2.1.6.1. Reasons for Requesting a Clinical Analysis
  - 2.1.6.2. Phases of the Analysis Process
  - 2.1.6.3. Patient Preparation and Sample Taking
- 2.2. Microscopic Techniques in Clinical Analysis
  - 2.2.1. Introduction and Concepts
  - 2.2.2. Types of Microscopes
    - 2.2.2.1. Optical Microscopes
    - 2.2.2.2. Electronic Microscopes
  - 2.2.3. Lenses, Light and Image Formation
  - 2.2.4. Management and Maintenance of Light Optical Microscopes
    - 2.2.4.1. Handling and Properties
    - 2.2.4.2. Maintenance
    - 2.2.4.3. Observation Incidents
    - 2.2.4.4. Application in Clinical Analysis
  - 2.2.5. Other Microscopes Characteristics and Management
    - 2.2.5.1. Dark Field Microscope
    - 2.2.5.2. Polarized Light Microscope
    - 2.2.5.3. Interference Microscope
    - 2.2.5.4. Inverted Microscope
    - 2.2.5.5. Ultraviolet Light Microscope
    - 2.2.5.6. Fluorescence Microscope
    - 2.2.5.7. Electronic Microscope
- 2.3. Microbiological Techniques in Clinical Analysis
  - 2.3.1. Introduction and Concept
  - 2.3.2. Design and Work Standards of the Clinical Microbiology Laboratory
    - 2.3.2.1. Necessary Rules and Resources
    - 2.3.2.2. Routines and Procedures in the Laboratory
    - 2.3.2.3. Sterilization and Contamination

## Module 2. Instrumental Techniques in the Clinical Analysis Laboratory

- 2.1. Instrumental Techniques in Clinical Analysis
  - 2.1.1. Introduction
  - 2.1.2. Fundamental Concepts
  - 2.1.3. Classification of Instrumental Methods
    - 2.1.3.1. Classic Methods
    - 2.1.3.2. Instrumental Methods

- 2.3.3. Cellular Culture Techniques
  - 2.3.3.1. Growth Environment
- 2.3.4. Most Commonly used Extension and Staining Procedures in Clinical Microbiology
  - 2.3.4.1. Bacteria Recognition
  - 2.3.4.2. Cytological
  - 2.3.4.3. Other Procedures
- 2.3.5. Other Methods of Microbiological Analysis
  - 2.3.5.1. Direct Microscopic Examination Identification of Normal and Pathogenic Flora
  - 2.3.5.2. Identification by Biochemical Tests
  - 2.3.5.3. Rapid Immunological Test
- 2.4. Volumetric, Gravimetric, Electrochemical and Titration Techniques
  - 2.4.1. Volumetrics Introduction and Concept
    - 2.4.1.1. Classification of Methods
    - 2.4.1.2. Laboratory Procedure to Perform a Volumetric Analysis
  - 2.4.2. Gravimetry
    - 2.4.2.1. Introduction and Concept
    - 2.4.2.2. Classification of Gravimetric Methods
    - 2.4.2.3. Laboratory Procedure to Perform a Gravimetric Analysis
  - 2.4.3. Electrochemical Techniques
    - 2.4.3.1. Introduction and Concept
    - 2.4.3.2. Potentiometry
    - 2.4.3.3. Amperometry
    - 2.4.3.4. Coulometry
    - 2.4.3.5. Conductometry
    - 2.4.3.6. Application in Clinical Analysis
  - 2.4.4. Evaluation
    - 2.4.4.1. Acid Base
    - 2.4.4.2. Precipitation
    - 2.4.4.3. Complex Formation
    - 2.4.4.4. Application in Clinical Analysis
- 2.5. Spectral Techniques in Clinical Analysis
  - 2.5.1. Introduction and Concepts
    - 2.5.1.1. Electromagnetic Radiation and its Interaction with the Material
    - 2.5.1.2. Radiation Absorption and Emission
  - 2.5.2. Spectrophotometry Application in Clinical Analysis
    - 2.5.2.1. Instruments
    - 2.5.2.2. Procedure
  - 2.5.3. Atomic Absorption Spectrophotometry
  - 2.5.4. Flame Emission Photometry
  - 2.5.5. Fluorimetry
  - 2.5.6. Nephelometry and Turbidimetry
  - 2.5.7. Mass and Reflectance Spectrometry
    - 2.5.7.1. Instruments
    - 2.5.7.2. Procedure
  - 2.5.8. Applications of the Most Commonly Used Spectral Techniques in Clinical Analysis
- 2.6. Immunoanalysis Techniques in Clinical Analysis
  - 2.6.1. Introduction and Concepts
    - 2.6.1.1. Immunological Concepts
    - 2.6.1.2. Types of Immunoanalysis
    - 2.6.1.3. Cross-Reactivity and Antigen
    - 2.6.1.4. Detection Molecules
    - 2.6.1.5. Quantification and Analytical Sensitivity
  - 2.6.2. Immunohistochemical Techniques
    - 2.6.2.1. Concept
    - 2.6.2.2. Immunohistochemical Procedures
  - 2.6.3. Enzymatic Immunohistochemistry Technique
    - 2.6.3.1. Concept and Procedure
  - 2.6.4. Immunofluorescence
    - 2.6.4.1. Concept and Classification
    - 2.6.4.2. Immunofluorescence Procedure
  - 2.6.5. Other Methods of Immunoanalysis
    - 2.6.5.1. Immuno-nephelometry
    - 2.6.5.2. Radial Immunodiffusion
    - 2.6.5.3. Immunoturbidimetry

- 2.7. Separation Techniques in Clinical Analysis. Chromatography and Electrophoresis
  - 2.7.1. Introduction and Concepts
  - 2.7.2. Chromatographic Techniques
    - 2.7.2.1. Principles, Concepts and Classification
    - 2.7.2.2. Gas-Liquid Chromatography Concepts and Procedure
    - 2.7.2.3. High Efficacy Liquid Chromatography Concepts and Procedure
    - 2.7.2.4. Thin Layer Chromatography
    - 2.7.2.5. Application in Clinical Analysis
  - 2.7.3. Electrophoretic Techniques
    - 2.7.3.1. Introduction and Concepts
    - 2.7.3.2. Instruments and Procedures
    - 2.7.3.3. Purpose and Field of Application in Clinical Analysis
    - 2.7.3.4. Capillary Electrophoresis
      - 2.7.3.4.1. Serum Protein Electrophoresis
  - 2.7.4. Hybrid Techniques: ICP Masses, Gases Masses and Liquids Masses
- 2.8. Molecular Biology Techniques in Clinical Analysis
  - 2.8.1. Introduction and Concepts
  - 2.8.2. DNA and RNA Extraction Techniques
    - 2.8.2.1. Procedure and Conservation
  - 2.8.3. Chain Reaction of PCR Polymers
    - 2.8.3.1. Concept and Foundation
    - 2.8.3.2. Instruments and Procedures
    - 2.8.3.3. Modifications of the PCR Method
  - 2.8.4. Hybridization Techniques
  - 2.8.5. Sequencing
  - 2.8.6. Protein Analysis by Western Blotting
  - 2.8.7. Proteomics and Genomics
    - 2.8.7.1. Concepts and Procedures in Clinical Analysis
    - 2.8.7.2. Types of Proteomic Studies
    - 2.8.7.3. Bioinformatics and Proteomics
    - 2.8.7.4. Metabolomics
    - 2.8.7.5. Relevance in Biomedicine
- 2.9. Techniques for the Determination of Form Elements Flow Cytometry Bedside Testing
  - 2.9.1. Red Blood Cells Count
    - 2.9.1.1. Cellular Count Procedure
    - 2.9.1.2. Pathologies Diagnosed with this Methodology
  - 2.9.2. Leukocyte Count
    - 2.9.2.1. Procedure
    - 2.9.2.2. Pathologies Diagnosed with this Methodology
  - 2.9.3. Flow Cytometry
    - 2.9.3.1. Introduction and Concepts
    - 2.9.3.2. Technique Procedure
    - 2.9.3.3. Cytometry Applications in Clinical Analysis
      - 2.9.3.3.1. Applications in Oncohematology
      - 2.9.3.3.2. Applications in Allergies
      - 2.9.3.3.3. Applications in Infertility
  - 2.9.4. Bedside Testing
    - 2.9.4.1. Concept
    - 2.9.4.2. Sample Types
    - 2.9.4.3. Techniques Used
    - 2.9.4.4. Most Used Applications, from Analysis to the Patient's Bedside
- 2.10. Interpretation of Results, Analytical Method Evaluation and Analytical Interferences
  - 2.10.1. Laboratory Report
    - 2.10.1.1. Concept
    - 2.10.1.2. Characteristic Elements of a Laboratory Report
    - 2.10.1.3. Interpretation of the Report
  - 2.10.2. Evaluation of Analytical Methods in Clinical Analysis
    - 2.10.2.1. Concepts and Objectives
    - 2.10.2.2. Linearity
    - 2.10.2.3. Truthfulness
    - 2.10.2.4. Precision
  - 2.10.3. Analytical Interferences
    - 2.10.3.1. Concept, Foundation and Classification
    - 2.10.3.2. Endogenous Interferents
    - 2.10.3.3. Exogenous Interferents
    - 2.10.3.4. Procedures to Detect and Quantify an Interference, in a Specific Method or Analysis

### Module 3. Biochemistry I

- 3.1. Biochemical and Molecular Base of Diseases
  - 3.1.1. Genetic Alterations
  - 3.1.2. Cell Signaling Alterations
  - 3.1.3. Metabolism Alterations
- 3.2. Metabolism of Nutrients
  - 3.2.1. Concept of Metabolism
  - 3.2.2. Biochemical Phases of Nutrition: Digestion, Transport, Metabolism, Excretion
  - 3.2.3. Clinical Laboratory in the Study of Alterations in Digestion, Absorption and Metabolism of Nutrients
- 3.3. Biochemical Study of Vitamins and Vitamin Deficiency
  - 3.3.1. Liposoluble Vitamins
  - 3.3.2. Hydrosoluble Vitamins
  - 3.3.3. Vitamin Deficiencies
- 3.4. Biochemical Study of Protein Alterations and Nitrogen Compounds
  - 3.4.1. Plasmatic Proteins
  - 3.4.2. Clinical Enzymology
  - 3.4.3. Evaluation of Biochemical Markers in Renal Function
- 3.5. Biochemical Study of Carbohydrate Metabolism Regulation and its Pathophysiological Alterations
  - 3.5.1. Hypoglycemia
  - 3.5.2. Hyperglycemia
  - 3.5.3. Diabetes Mellitus: Diagnosis and Monitoring in a Clinical Laboratory
- 3.6. Biochemical Study of the Pathophysiological Alterations of Lipids and Plasma Lipoproteins
  - 3.6.1. Lipoproteins
  - 3.6.2. Primary Dyslipidemia
  - 3.6.3. Hyperlipoproteinemia
  - 3.6.4. Sphingolipidosis

- 3.7. Biochemistry of Blood in a Chemical Laboratory
  - 3.7.1. Blood Hemostasis
  - 3.7.2. Coagulation and Fibrinolysis
  - 3.7.3. Biochemical Analysis of Iron Metabolism
- 3.8. Mineral Metabolism and its Clinical Alterations
  - 3.8.1. Calcium Homeostasis
  - 3.8.2. Phosphorus Homeostasis
  - 3.8.3. Magnesium Homeostasis
  - 3.8.4. Biochemical Markers of Bone Remodeling
- 3.9. Acid-Base Balance and Peripheral Blood Gas Study
  - 3.9.1. Acid-Base Balance
  - 3.9.2. Peripheral Blood Gasometry
  - 3.9.3. Gasometry Markers
- 3.10. Hydroelectrolyte Balance and its Alterations
  - 3.10.1. Sodium
  - 3.10.2. Potassium
  - 3.10.3. Chlorine

### Module 4. Biochemistry II

- 4.1. Congenital Alterations of Carbohydrate Metabolism
  - 4.1.1. Alterations in the Digestion and Intestinal Absorption of Carbohydrates
  - 4.1.2. Galactose Metabolism Alterations
  - 4.1.3. Fructose Metabolism Alterations
  - 4.1.4. Glucogen Metabolism Alterations
    - 4.1.4.1. Glucogenesis: Types
- 4.2. Congenital Alterations of Amino Acid Metabolism
  - 4.2.1. Aromatic Amino Acid Metabolism Alterations
    - 4.2.1.1. Phenylketonuria
    - 4.2.1.2. Glutaric Aciduria Type 1
  - 4.2.2. Alterations of Branched Amino Acid Metabolism
    - 4.2.2.1. Maple Syrup Urine Disease
    - 4.2.2.2. Isovaleric Acidemia
  - 4.2.3. Alterations in the Metabolism of Sulfur Amino Acids
    - 4.2.3.1. Homocysturia

- 4.3. Congenital Alterations of Lipid Metabolism
  - 4.3.1. Beta-Oxidation of Fatty Acids
    - 4.3.1.1. Introduction to Beta-Oxidation of Fatty Acids
    - 4.3.1.2. Fatty Acid Beta-Oxidation Alterations
  - 4.3.2. Carnitine Cycle
    - 4.3.2.1. Introduction to Carnitine Cycle
    - 4.3.2.2. Carnitine Cycle Alterations
- 4.4. Urea Cycle Disorders
  - 4.4.1. Urea Cycle
  - 4.4.2. Genetic Alterations of the Urea Cycle
    - 4.4.2.1. Ornithine Transcarbamylase (OTC) Deficiency
    - 4.4.2.2. Other Urea Cycle Disorders
  - 4.4.3. Diagnosis and Treatment of Urea Cycle Diseases
- 4.5. Molecular Pathologies of Nucleotide Bases Alterations of Purine and Pyrimidine Metabolism
  - 4.5.1. Introduction to Purine and Pyrimidine Metabolism
  - 4.5.2. Purine Metabolism Disorders
  - 4.5.3. Pyrimidine Metabolism Disorders
  - 4.5.4. Diagnosis of Purine and Pyrimidine Disorders
- 4.6. Porphyrins. Alterations in the Synthesis of the Heme Group
  - 4.6.1. Heme Group Synthesis
  - 4.6.2. Porphyrins: Types
    - 4.6.2.1. Liver Porphyrins
      - 4.6.2.1.1. Acute Porphyrins
      - 4.6.2.2. Hematopoietic Porphyrins
  - 4.6.3. Diagnosis and Treatment of Porphyrins
- 4.7. Jaundice Bilirubin Metabolism Disorders
  - 4.7.1. Introduction to Bilirubin Metabolism
  - 4.7.2. Congenital Jaundice
    - 4.7.2.1. Unconjugated hyperbilirubinaemia
    - 4.7.2.2. Unconjugated hyperbilirubinaemia
  - 4.7.3. Diagnosis and Treatment of Jaundice
- 4.8. Oxidative Phosphorylation
  - 4.8.1. Mitochondria
    - 4.8.1.1. Enzymes and Proteins, Mitochondrial Constituents
  - 4.8.2. Electronic Transport Chain
    - 4.8.2.1. Electronic Transporters
    - 4.8.2.2. Electronic Complexes
  - 4.8.3. Coupling of Electronic Transport to ATP Synthesis
    - 4.8.3.1. ATP Synthase
    - 4.8.3.2. Oxidative Phosphorylation Uncoupling Agents
  - 4.8.4. NADH Shuttle
- 4.9. Mitochondrial Disorders
  - 4.9.1. Maternal Inheritance
  - 4.9.2. Heteroplasmy and Homoplasmy
  - 4.9.3. Mitochondrial Diseases
    - 4.9.3.1. Leber Hereditary Optic Neuropathy
    - 4.9.3.2. Leigh Disease
    - 4.9.3.3. Melas Syndrome
    - 4.9.3.4. Myoclonic Epilepsy with Ragged Red Fibers (MERRF)
  - 4.9.4. Diagnosis and Treatment of Mitochondrial Diseases
- 4.10. Other Disorders Produced by Alterations in Other Organelles
  - 4.10.1. Lysosomes
    - 4.10.1.1. Lysosomal Diseases
      - 4.10.1.1.1. Sphingolipidosis
      - 4.10.1.1.2. Mucopolysaccharidosis
  - 4.10.2. Peroxisomes
    - 4.10.2.1. Lysosomal Diseases
      - 4.10.2.1.1. Zellweger Syndrome
  - 4.10.3. Golgi Apparatus
    - 4.10.3.1. Golgi Apparatus Diseases
      - 4.10.3.1.1. Mucopolidosis II

## Module 5. Biochemistry III

- 5.1. Study of Motor Function
  - 5.1.1. Overview of Motor Function and Osteoarticular System
  - 5.1.2. Alterations of Motor Function
  - 5.1.3. Diagnosis of Alterations of Motor Function
    - 5.1.3.1. Diagnostic Techniques
    - 5.1.3.2. Molecular Markers
- 5.2. Study of Cardiac Function
  - 5.2.1. Overview of Cardiac Function
  - 5.2.2. Alterations of Cardiac Function
  - 5.2.3. Diagnosis of Alterations of Cardiac Function
    - 5.2.3.1. Diagnostic Techniques
    - 5.2.3.2. Molecular Markers
- 5.3. Study of Renal Function
  - 5.3.1. Overview of Renal Function
  - 5.3.2. Alterations of Renal Function
  - 5.3.3. Diagnosis of Alterations of Renal Function
    - 5.3.3.1. Diagnostic Techniques
    - 5.3.3.2. Molecular Markers
- 5.4. Study of Liver Function
  - 5.4.1. Overview of Liver Function
  - 5.4.2. Alterations of Liver Function
  - 5.4.3. Diagnosis of Alterations of Liver Function
    - 5.4.3.1. Diagnostic Techniques
    - 5.4.3.2. Molecular Markers
- 5.5. Study of Neurological Function
  - 5.5.1. Overview of Neurological Function
  - 5.5.2. Alterations in Neurological Function (Neurodegenerative Diseases)
  - 5.5.3. Diagnosis of Alterations of Neurological Function
    - 5.5.3.1. Diagnostic Techniques
    - 5.5.3.2. Molecular Markers
- 5.6. Study of Hypothalamic and Pituitary Functions
  - 5.6.1. Overview of Hypothalamic and Pituitary Functions
  - 5.6.2. Alterations in Hypothalamic and Pituitary Functions
  - 5.6.3. Diagnosis of Alterations in Hypothalamic and Pituitary Functions
    - 5.6.3.1. Diagnostic Techniques
    - 5.6.3.2. Molecular Markers
- 5.7. Study of Pancreatic Function
  - 5.7.1. Overview of Pancreatic Function
  - 5.7.2. Alterations of Pancreatic Function
  - 5.7.3. Diagnosis of Alterations in Pancreatic Function
    - 5.7.3.1. Diagnostic Techniques
    - 5.7.3.2. Molecular Markers
- 5.8. Study of Thyroid and Parathyroid Function
  - 5.8.1. Overview of Thyroid and Parathyroid Functions
  - 5.8.2. Alterations of Thyroid and Parathyroid Function
  - 5.8.3. Diagnosis of Alterations in Thyroid and Parathyroid Functions
    - 5.8.3.1. Diagnostic Techniques
    - 5.8.3.2. Molecular Markers
- 5.9. Study of Adrenal Gland Function
  - 5.9.1. Overview of Adrenal Gland Function
  - 5.9.2. Alterations of Adrenal Gland Function
  - 5.9.3. Diagnosis of Alterations in Adrenal Gland Function
    - 5.9.3.1. Diagnostic Techniques
    - 5.9.3.2. Molecular Markers
- 5.10. Study of Gonad Function
  - 5.10.1. Overview of Gonad Function
  - 5.10.2. Alterations of Gonad Function
  - 5.10.3. Diagnosis of Alterations in Gonad Function
    - 5.10.3.1. Diagnostic Techniques
    - 5.10.3.2. Molecular Markers



**Module 6. Biochemistry IV**

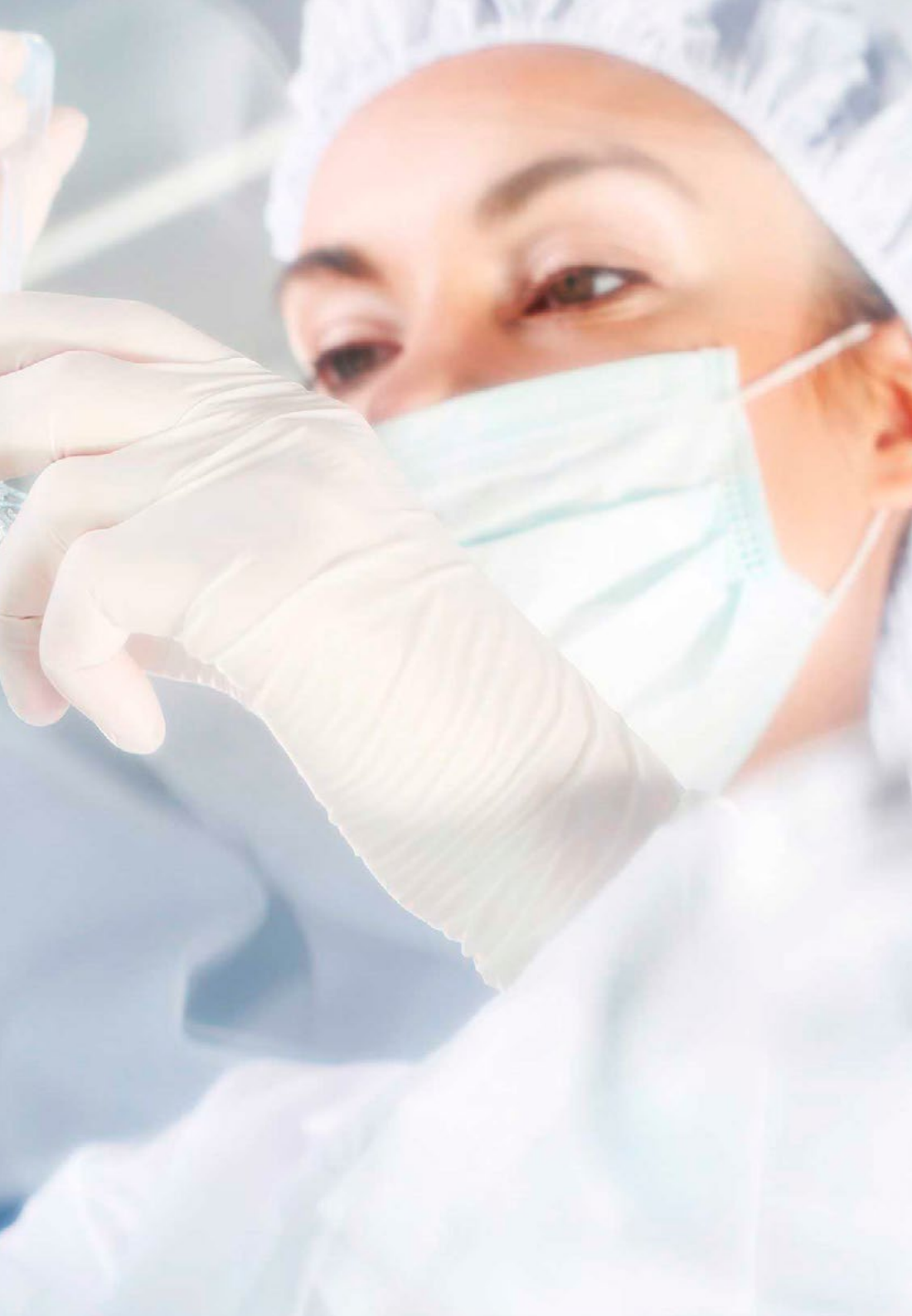
- 6.1. Study of Human Fertility and Infertility
  - 6.1.1. Most Frequent Gynecological Problems
    - 6.1.1.1. Reproductive System Abnormalities
    - 6.1.1.2. Endometriosis
    - 6.1.1.3. Polycystic Ovaries
    - 6.1.1.4. FSH Serum Concentration
  - 6.1.2. Most Common Andrological Problems
    - 6.1.2.1. Seminal Quality Alteration
    - 6.1.2.2. Retrograde Ejaculation
    - 6.1.2.3. Neurological Lesions
    - 6.1.2.4. FSH Concentration
- 6.2. Current Assisted Reproduction Techniques
  - 6.2.1. Artificial Insemination
  - 6.2.2. IUI-H
  - 6.2.3. IUI-D
  - 6.2.4. Ovarian Puncture
  - 6.2.5. In Vitro Fertilization and Intracytoplasmic Sperm Injection
  - 6.2.6. Gamete Transfer
- 6.3. Techniques for Gamete Conservation in a Urology Laboratory Gamete Donation Bank
  - 6.3.1. Current Legal Framework
  - 6.3.2. Principles of Cell Cryopreservation
  - 6.3.3. Oocyte Freezing/Thawing Protocol
  - 6.3.4. Semen Freezing/Thawing Protocol
  - 6.3.5. Gamete Donation Bank
    - 6.3.5.1. Concept and Purpose of Assisted Reproduction
    - 6.3.5.2. Donor Characteristics
- 6.4. Study of Embryology and Andrology in the Clinical Laboratory
  - 6.4.1. Pre-embryo and Sperm Culture
  - 6.4.2. Embryo Stages
  - 6.4.3. Seminal Study Techniques
    - 6.4.3.1. Seminogram
    - 6.4.3.2. Seminal Lavage
- 6.5. Laboratory Techniques for the Study of Cell Growth, Senescence and Apoptosis
  - 6.5.1. Study of Cell Growth
    - 6.5.1.1. Concept
    - 6.5.1.2. Conditioning Parameters of Cell Growth
      - 6.5.1.2.1. Viability
      - 6.5.1.2.2. Multiplication
      - 6.5.1.2.3. Temperature
      - 6.5.1.2.4. External Agents
    - 6.5.1.3. Practical Applications in Clinical Analysis
  - 6.5.2. Study of Cellular Senescence and Apoptosis
    - 6.5.2.1. Concept of Senescence
  - 6.5.3. Hematoxylin/Eosin Staining
  - 6.5.4. Clinical Application of Oxidative Stress
- 6.6. Analysis of Body Fluids
  - 6.6.1. Amniotic Fluid
  - 6.6.2. Saliva Nasopharynx
  - 6.6.3. LCR
  - 6.6.4. Synovial Fluid
  - 6.6.5. Pleural
  - 6.6.6. Pericardial
  - 6.6.7. Peritoneal
- 6.7. Urine Study in the Urology and Pathological Anatomy Laboratory
  - 6.7.1. Systematic Uroanalysis
  - 6.7.2. Urine culture
  - 6.7.3. Pathological Anatomy Cytology
- 6.8. Clinical Study of Stools
  - 6.8.1. Physical Study
  - 6.8.2. Hidden Blood in Stools
  - 6.8.3. Fresh Study
  - 6.8.4. Stool Culture

- 6.9. Molecular Study of Cancer. Most Common Tumor Markers
  - 6.9.1. PSA
  - 6.9.2. EGFR
  - 6.9.3. HER2 Gene
  - 6.9.4. CD20
  - 6.9.5. Neuron-Specific Enolase NSE
  - 6.9.6. FAP
  - 6.9.7. ALK Gene
  - 6.9.8. ROS1 Gene
  - 6.9.9. BRAF V600e Mutation
- 6.10. Therapeutic Drug Monitoring Pharmacokinetics
  - 6.10.1. Concept
  - 6.10.2. Study Parameters
    - 6.10.2.1. Absorption
    - 6.10.2.2. Distribution
    - 6.10.2.3. Elimination
  - 6.10.3. Aplicaciones clínicas de la farmacocinética

## Module 7. Hematology

- 7.1. Introduction to the Hematopoietic System and Study Techniques
  - 7.1.1. Classification of Blood Cells and Hematopoiesis
  - 7.1.2. Hemacytometry and Blood Smear Study
  - 7.1.3. Bone Marrow Study
  - 7.1.4. Role of Immunophenotyping in the Diagnosis of Hematological Diseases
  - 7.1.5. Cytogenetics and Molecular Biology in Hematologic Diagnosis
- 7.2. Diagnosis of Erythrocyte Disorders Anemias, Erythrocytosis, Hemoglobinopathies and Thalassemias
  - 7.2.1. Classification of the Types of Anaemia
    - 7.2.1.1. Etiopathogenic Classification
    - 7.2.1.2. Classification According to VCM
      - 7.2.1.2.1. Microcytic Anemia
      - 7.2.1.2.2. Normocytic Anemia
      - 7.2.1.2.3. Macrocytic Anemia





- 7.2.2. Erythrocytosis Differential Diagnosis
  - 7.2.2.1. Primary Erythrocytosis
  - 7.2.2.2. Secondary Erythrocytosis
- 7.2.3. Hemoglobinopathies and Thalassemias
  - 7.2.3.1. Classification
  - 7.2.3.2. Laboratory Diagnosis
- 7.3. Quantitative Alterations of the White Series
  - 7.3.1. Neutrophils: Neutropenia and Neutrophilia
  - 7.3.2. Lymphocytes: Lymphopenia and Lymphocytosis
- 7.4. Diagnosis of Platelet Disorders
  - 7.4.1. Morphologic Alterations: Thrombocytopathies
  - 7.4.2. Thrombocytopenia Diagnostic Approximation
- 7.5. Myeloproliferative and Myelodysplastic Syndromes
  - 7.5.1. Laboratory Findings and Complementary Examinations
    - 7.5.1.1. Hemogram and Peripheral Blood Smear
    - 7.5.1.2. Bone Marrow Study
      - 7.5.1.2.1. Bone Marrow Morphology
      - 7.5.1.2.2. Flow Cytometry
      - 7.5.1.2.3. Cytogenetics
      - 7.5.1.2.4. Molecular Biology
  - 7.5.2. Diagnosis Classification Differential Diagnosis
- 7.6. Monoclonal Gammopathies Multiple Myeloma
  - 7.6.1. Study of Monoclonal Gammopathies
    - 7.6.1.1. Bone Marrow Morphology
    - 7.6.1.2. Study of the Monoclonal Component
    - 7.6.1.3. Other Laboratory Studies
  - 7.6.2. Classification of Monoclonal Gammopathies Differential Diagnosis
    - 7.6.2.1. Monoclonal Gammopathy of Uncertain Significance and Quiescent Myeloma
    - 7.6.2.2. Multiple Myeloma
      - 7.6.2.2.1. Diagnostic Criteria
    - 7.6.2.3. Amyloidosis
    - 7.6.2.4. Waldenström's Macroglobulinemia

- 7.7. Differential Diagnosis of Acute Leukemia
    - 7.7.1. Acute Myeloid Leukemia. Promyelocytic Leukemia
      - 7.7.1.1. Laboratory Findings and Complementary Examinations
      - 7.7.1.2. Hemogram and Peripheral Blood Smear
      - 7.7.1.3. Bone Marrow Study
        - 7.7.1.3.1. Bone Marrow Morphology
        - 7.7.1.3.2. Flow Cytometry
        - 7.7.1.3.3. Cytogenetics
        - 7.7.1.3.4. Molecular Biology
      - 7.7.1.4. Diagnosis Classification
    - 7.7.2. Acute Lymphoid Leukemia
      - 7.7.2.1. Laboratory Findings and Complementary Examinations
      - 7.7.2.2. Hemogram and Peripheral Blood Smear
      - 7.7.2.3. Bone Marrow Study
        - 7.7.2.3.1. Bone Marrow Morphology
        - 7.7.2.3.2. Flow Cytometry
        - 7.7.2.3.3. Cytogenetics
        - 7.7.2.3.4. Molecular Biology
      - 7.7.2.4. Diagnosis Classification
  - 7.8. Mature B- and T-Lymphoid Neoplasms
    - 7.8.1. Chronic Lymphoproliferative Syndromes B. Chronic Lymphocytic Leukemia
      - 7.8.1.1. Laboratory Studies and Differential Diagnosis
        - 7.8.1.1.1. Chronic Lymphocytic Leukemia
        - 7.8.1.1.2. Tricholeukemia
        - 7.8.1.1.3. Splenic Marginal Zone Lymphoma
        - 7.8.1.1.4. Prolymphocytic Leukemia
        - 7.8.1.1.5. Granular Lymphocyte Leukemia
    - 7.8.2. Non-Hodgkin's Lymphomas
      - 7.8.2.1. Initial Study and Diagnosis
      - 7.8.2.2. Classification of Lymphoid Neoplasms
        - 7.8.2.2.1. Follicular Lymphoma
        - 7.8.2.2.2. Mantle Cell Lymphoma
        - 7.8.2.2.3. Diffuse Large B-cell Lymphoma
        - 7.8.2.2.4. MALT Lymphoma
        - 7.8.2.2.5. Burkitt Lymphoma
        - 7.8.2.2.6. Peripheral T Lymphomas
        - 7.8.2.2.7. Cutaneous Lymphomas
        - 7.8.2.2.8. Others
  - 7.8.3. Hodgkin's Lymphomas
    - 7.8.3.1. Complementary Tests
    - 7.8.3.2. Histological Classification
- 7.9. Diagnosis of Coagulation Disorders
  - 7.9.1. Study of Hemorrhagic Diatheses
    - 7.9.1.1. Initial Tests
    - 7.9.1.2. Specific Studies
  - 7.9.2. Congenital Coagulation Alterations
    - 7.9.2.1. Hemophilia A and B
    - 7.9.2.2. Von Willebrand Disease
    - 7.9.2.3. Other Congenital Coagulopathies
  - 7.9.3. Acquired Coagulation Alterations
  - 7.9.4. Thrombosis and Thrombophilia Antiphospholipid Syndrome
  - 7.9.5. Monitoring of Antocoagulant Therapy
- 7.10. Introduction to Hemotherapy
  - 7.10.1. Blood Groups
  - 7.10.2. Blood Components
  - 7.10.3. Recommendations for the Use of Blood Derivatives
  - 7.10.4. Most Common Transfusional Reactions

**Module 8. Microbiology and Parasitology**

- 8.1. General Concepts of Microbiology
  - 8.1.1. Structure of Microorganisms
  - 8.1.2. Nutrition, Metabolism and Microbial Growth
  - 8.1.3. Microbial Taxonomy
  - 8.1.4. Microbial Genomes and Genetics
- 8.2. Study of Infectious Bacteria
  - 8.2.1. Gram Positive Cocci
  - 8.2.2. Gram Negative Cocci
  - 8.2.3. Gram Positive Bacilli
  - 8.2.4. Gram Negative Bacilli
  - 8.2.5. Other Bacteria of Clinical Interest
    - 8.2.5.1. Legionella Pneumophila
    - 8.2.5.2. Mycobacteria
- 8.3. General Techniques in Microbiology
  - 8.3.1. Processing of Microbiological Samples
  - 8.3.2. Types of Microbiological Samples
  - 8.3.3. Planting Techniques
  - 8.3.4. Types of Staining in Microbiology
  - 8.3.5. Current Microorganism Identification Techniques
    - 8.3.5.1. Biochemical Tests
    - 8.3.5.2. Manual or Automatic Commercial Systems and Multitest Galleries
    - 8.3.5.3. MALDI TOF Mass Spectrometry
    - 8.3.5.4. Molecular Tests
      - 8.3.5.4.1. 16S rRNA
      - 8.3.5.4.2. 16S-23S rRNA
      - 8.3.5.4.3. 23S rRNA
      - 8.3.5.4.4. rpoB Gene
      - 8.3.5.4.5. gyrB Gene
    - 8.3.5.5. Serological Diagnosis of Microbial Infections
- 8.4. Antimicrobial Sensitivity Tests
  - 8.4.1. Antimicrobial Resistance Mechanisms
  - 8.4.2. Sensitivity Test
  - 8.4.3. Antibacterials
- 8.5. Study of Viral Infections
  - 8.5.1. Basic Principles of Virology
  - 8.5.2. Taxonomy
  - 8.5.3. Viruses Affecting the Respiratory System
  - 8.5.4. Viruses Affecting the Digestive System
  - 8.5.5. Viruses Affecting the Central Nervous System
  - 8.5.6. Viruses Affecting the Reproductive System
  - 8.5.7. Systemic Viruses
- 8.6. General Techniques in Virology
  - 8.6.1. Processing of Samples
  - 8.6.2. Laboratory Techniques for Viral Diagnosis
  - 8.6.3. Antivirals
- 8.7. Most Common Fungal Infections
  - 8.7.1. General Information on Fungi
  - 8.7.2. Taxonomy
  - 8.7.3. Primary Mycoses
  - 8.7.4. Opportunist Mycoses
  - 8.7.5. Subcutaneous Mycoses
  - 8.7.6. Cutaneous and Superficial Mycoses
  - 8.7.7. Mycosis of Atypical Etiology
- 8.8. Diagnostic Techniques in a Clinical Mycology
  - 8.8.1. Processing of Samples
  - 8.8.2. Study of Superficial Mycoses
  - 8.8.3. Study of Subcutaneous Mycoses
  - 8.8.4. Study of Deep Mycoses
  - 8.8.5. Study of Opportunist Mycoses
  - 8.8.6. Diagnostic Techniques
  - 8.8.7. Antifungal

- 8.9. Parasitic Diseases
  - 8.9.1. General Concepts of Parasitology
  - 8.9.2. Protozoa
    - 8.9.2.1. Amoeba (Sarcodina)
    - 8.9.2.2. Ciliates (Ciliophora)
    - 8.9.2.3. Flagellates (Mastigophora)
    - 8.9.2.4. Apicomplexa
    - 8.9.2.5. Plasmodium
    - 8.9.2.6. Sarcocystis
    - 8.9.2.7. Microsporidiosis
  - 8.9.3. Helminths
    - 8.9.3.1. Nematodes
    - 8.9.3.2. Platyhelminthes
      - 8.9.3.2.1. Cestodes
      - 8.9.3.2.2. Trematodes
  - 8.9.4. Arthropods
- 8.10. Diagnostic Techniques in a Clinical Parasitology
  - 8.10.1. Processing of Samples
  - 8.10.2. Diagnostic Methods
  - 8.10.3. Antiparasitics II

## Module 9. Immunology

- 9.1. Immune System Organs
  - 9.1.1. Primary Lymphoid Organs
    - 9.1.1.1. Fetal Liver
    - 9.1.1.2. Bone Marrow
    - 9.1.1.3. Thymus
  - 9.1.2. Secondary Lymphoid Organs
    - 9.1.2.1. Bladder
    - 9.1.2.2. Lymph Nodes
    - 9.1.2.3. Mucosal-Associated Lymphoid Tissue
  - 9.1.3. Tertiary Lymphoid Organs
  - 9.1.4. Lymphatic system
- 9.2. Immune System Cells
  - 9.2.1. Granulocytes
    - 9.2.1.1. Neutrophils
    - 9.2.1.2. Eosinophils
    - 9.2.1.3. Basophils
  - 9.2.2. Monocytes and Macrophages
  - 9.2.3. Lymphocytes
    - 9.2.3.1. T Lymphocytes
    - 9.2.3.2. B Lymphocytes
  - 9.2.4. Natural Killer Cells
  - 9.2.5. Antigen Presenting Cells
- 9.3. Antigens and Immunoglobulins
  - 9.3.1. Antigenicity and Immunogenicity
    - 9.3.1.1. Antigen
    - 9.3.1.2. Immunogen
    - 9.3.1.3. Epitopes
    - 9.3.1.4. Haptens and Carriers
  - 9.3.2. Immunoglobulins
    - 9.3.2.1. Structure and Function
    - 9.3.2.2. Classification of Immunoglobulins
    - 9.3.2.3. Somatic Hypermutation and Isotype Shift
- 9.4. Complement System
  - 9.4.1. Functions
  - 9.4.2. Activation Routes
    - 9.4.2.1. Classical Pathway
    - 9.4.2.2. Alternative Pathway
    - 9.4.2.3. Lectin Pathway
  - 9.4.3. Complement Receptors
  - 9.4.4. Complements and Inflammation
  - 9.4.5. Complement Cascade
- 9.5. Major Histocompatibility Complex
  - 9.5.1. Major and Minor Histocompatibility Antigens
  - 9.5.2. HLA Genetics
  - 9.5.3. HLA and Disease

- 9.5.4. Transplant Immunology
- 9.6. Immune Response
  - 9.6.1. Innate and Adaptive Immune Response
  - 9.6.2. Humoral Immune Response
    - 9.6.2.1. Primary Response
    - 9.6.2.2. Secondary Response
  - 9.6.3. Cellular Immune Response
- 9.7. Autoimmune Diseases
  - 9.7.1. Immunogenic Tolerance
  - 9.7.2. Autoimmunity
  - 9.7.3. Autoimmune Diseases
  - 9.7.4. Study of Autoimmune Diseases
- 9.8. Immunodeficiencies
  - 9.8.1. Primary Immunodeficiencies
  - 9.8.2. Secondary Immunodeficiencies
  - 9.8.3. Antitumor Immunity
  - 9.8.4. Evaluation of Immunity
- 9.9. Hypersensitivity Reactions
  - 9.9.1. Classification of Hypersensitivity Reactions
  - 9.9.2. Type I Hypersensitivity or Allergic Reactions
  - 9.9.3. Anaphylaxis
  - 9.9.4. Allergological Diagnostic Methods
- 9.10. Immunoanalytical Techniques
  - 9.10.1. Precipitation and Agglutination Techniques
  - 9.10.2. Complement Fixation Techniques
  - 9.10.3. ELISA Techniques
  - 9.10.4. Immunochromatography Techniques
  - 9.10.5. Radioimmunoanalysis Techniques
  - 9.10.6. Isolation of Lymphocytes
  - 9.10.7. Microlymphocytotoxicity Technique
  - 9.10.8. Mixed Lymphocyte Culture
  - 9.10.9. Flow Cytometry Applied to Immunology
  - 9.10.10. Flow Cytometry

## Module 10. Genetics

- 10.1. Introduction to Genetic Medicine Genealogies and Inheritance Patterns
  - 10.1.1. Historical Development of Genetics Key Concepts
  - 10.1.2. Structure of Genes and Regulation of Genetic Expression Epigenetics
  - 10.1.3. Genetic Variability Mutation and Repairation of DNA
  - 10.1.4. Human Genetics Organization of the Human Genome
  - 10.1.5. Genetic Diseases Morbidity and Mortality
  - 10.1.6. Human Inheritance Concept of Genotype and Phenotype
    - 10.1.6.1. Mendelian Inheritance Patterns
    - 10.1.6.2. Multigene and Mitochondrial Inheritance
  - 10.1.7. Construction of Genealogies
    - 10.1.7.1. Allele, Genotypic and Phenotypic Frequency Estimation
    - 10.1.7.2. Segregation Analysis
  - 10.1.8. Other Factors which Affect the Phenotype
- 10.2. Molecular Biology Techniques Used in Genetics
  - 10.2.1. Genetics and Molecular Diagnostics
  - 10.2.2. Polymerase Chain Reaction (PCR) Applied to Diagnosis and Research in Genetics
    - 10.2.2.1. Detection and Amplification of Specific Sequences
    - 10.2.2.2. Quantification of Nucleic Acids (RT-PCR)
  - 10.2.3. Cloning Techniques: Isolation, Restriction and Ligation of DNA Fragments
  - 10.2.4. Detection of Mutations and Measurement of Genetic Variability: RFLP, VNTR, SNPs
  - 10.2.5. Mass Sequencing Techniques. NGS
  - 10.2.6. Transgenesis Genetic Therapy
  - 10.2.7. Cytogenetic Techniques
    - 10.2.7.1. Chromosome Banding
    - 10.2.7.2. FISH, CGH
- 10.3. Human Cytogenetics Numerical and Structural Chromosomal Abnormalities
  - 10.3.1. Study of Human Cytogenetics Features
  - 10.3.2. Chromosome Characterization and Cytogenetic Nomenclature

- 10.3.2.1. Chromosomal Analysis: Karyotyping
- 10.3.3. Anomalies in the Number of Chromosomes
  - 10.3.3.1. Polyploidies
  - 10.3.3.2. Aneuploidies
- 10.3.4. Structural Chromosomal Alterations Genetic Dosis
  - 10.3.4.1. Deletions
  - 10.3.4.2. Duplications
  - 10.3.4.3. Inversions
  - 10.3.4.4. Translocations
- 10.3.5. Chromosomal Polymorphisms
- 10.3.6. Genetic Imprinting
- 10.4. Prenatal Diagnosis of Genetic Alterations and Congenital Defects Preimplantational Genetic Diagnosis
  - 10.4.1. Prenatal Diagnosis. What Does It Entail?
  - 10.4.2. Incidence of Congenital Defects
  - 10.4.3. Indications for Performing Prenatal Diagnosis
  - 10.4.4. Prenatal Diagnostic Methods
    - 10.4.4.1. Non-Invasive Procedures: First and Second Trimester Screening TPNI
    - 10.4.4.2. Invasive Procedures: Amniocentesis, Cordocentesis and Chorionic Biopsy
  - 10.4.5. Preimplantational Genetic Diagnosis Indications
  - 10.4.6. Embryo Biopsy and Genetic Analysis
- 10.5. Genetic Diseases I
  - 10.5.1. Diseases with Autosomal Dominant Inheritance
    - 10.5.1.1. Achondroplasia
    - 10.5.1.2. Huntington's Disease
    - 10.5.1.3. Retinoblastoma
    - 10.5.1.4. Charcot-Marie-Tooth Disease
  - 10.5.2. Diseases with Autosomal Recessive Inheritance
    - 10.5.2.1. Phenylketonuria
    - 10.5.2.2. Sickle Cell Anemia
    - 10.5.2.3. Cystic fibrosis
    - 10.5.2.4. Laron Syndrome
  - 10.5.3. Diseases with Sex-Linked Inheritance
    - 10.5.3.1. Rett Syndrome
    - 10.5.3.2. Haemophilia
    - 10.5.3.3. Duchenne Muscular Dystrophy
- 10.6. Genetic Diseases II
  - 10.6.1. Mitochondrial Inheritance Diseases
    - 10.6.1.1. Mitochondrial Encephalomyopathies
    - 10.6.1.2. Leber Hereditary Optic Neuropathy (NOHL)
  - 10.6.2. Genetic Anticipation Phenomena
    - 10.6.2.1. Huntington's Disease
    - 10.6.2.2. Fragile X Syndrome
    - 10.6.2.3. Spinocerebellar Ataxias
  - 10.6.3. Allelic Heterogeneity
    - 10.6.3.1. Usher Syndrome
- 10.7. Complex Diseases Genetics Molecular Basis of Family and Sporadic Cancer
  - 10.7.1. Multifactorial Inheritance
    - 10.7.1.1. Polygenes
  - 10.7.2. Contribution of Environmental Factors on Complex Diseases
  - 10.7.3. Quantative Genetics
    - 10.7.3.1. Heritability
  - 10.7.4. Common Complex Diseases
    - 10.7.4.1. Diabetes Mellitus
    - 10.7.4.2. Alzheimer's Disease
  - 10.7.5. Behavioral Diseases and Personality Disorders: Alcoholism, Autism and Schizophrenia
  - 10.7.6. Cancer: Molecular Base and Environmental Factors
    - 10.7.6.1. Genetics of Cycle Cell Proliferation and Differentiation Processes
    - 10.7.6.2. DNA Reparation Genes, Oncogenes and Tumor Suppressor Genes
    - 10.7.6.3. Environmental Influence of the Occurrence of Cancer
  - 10.7.7. Familial Cancer

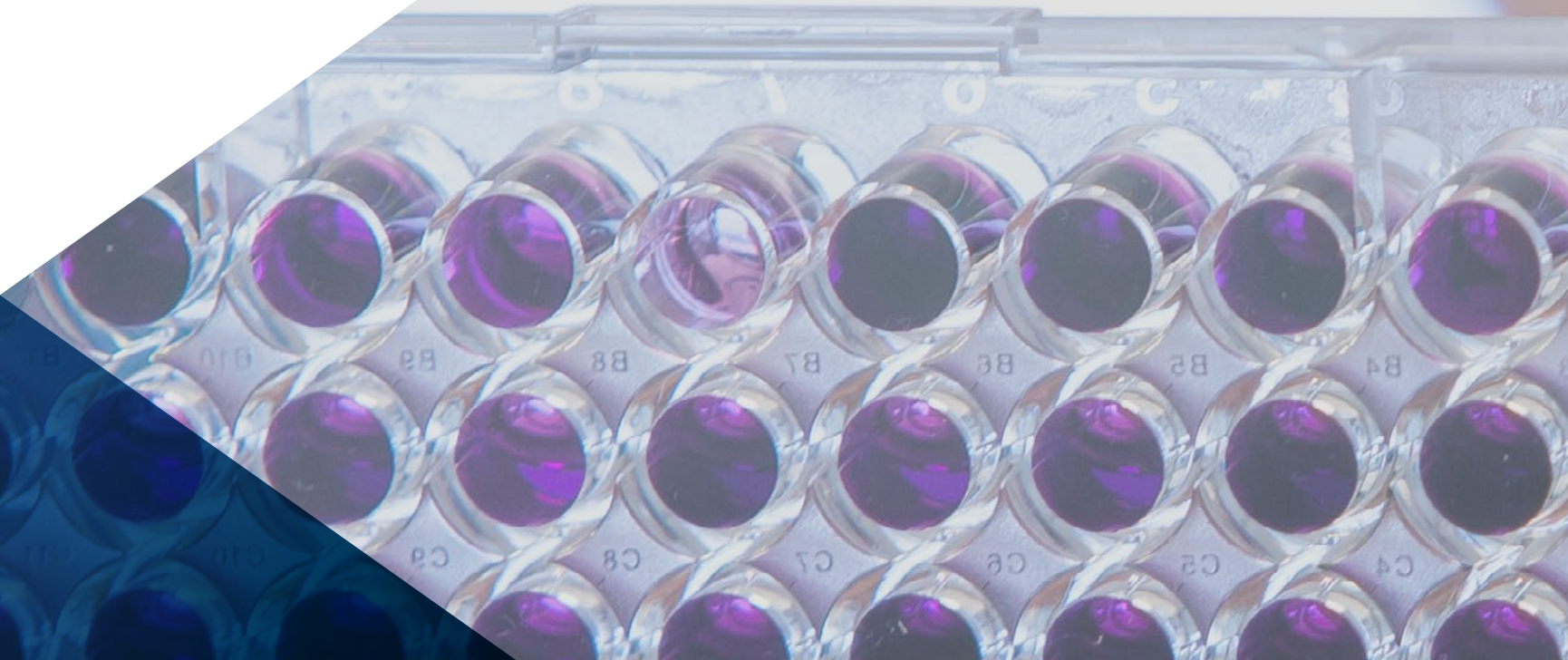


- 10.8. Genomics and Proteomics
  - 10.8.1. Omic Sciences and their Usefulness in Medicine
  - 10.8.2. Genome Sequencing and Analysis
    - 10.8.2.1. DNA Libraries
  - 10.8.3. Comparative Genomics
    - 10.8.3.1. Organisms Model
    - 10.8.3.2. Sequencing Comparison
    - 10.8.3.3. Human Genome Project
  - 10.8.4. Functional Genomics
    - 10.8.4.1. Transcriptomics
    - 10.8.4.2. Structural and Functional Organization of the Genome
    - 10.8.4.3. Functional Genomic Elements
  - 10.8.5. From the Genome to the Proteome
    - 10.8.5.1. Post-translational Modifications
  - 10.8.6. Strategies for the Separation and Purification of Proteins
  - 10.8.7. Identification of Proteins
  - 10.8.8. Interactom
- 10.9. Genetic Assessment Ethical and Legal Aspects of Diagnosis and Research in Genetics
  - 10.9.1. Genetic Assessment Concepts and Base Techniques
    - 10.9.1.1. Risk of Recurrence of Genetically-Based Diseases
    - 10.9.1.2. Genetic Assessment in Prenatal Diagnosis
    - 10.9.1.3. Ethical Principles in Genetic Assessment
  - 10.9.2. Legislation of New Genetic Technology
    - 10.9.2.1. Genetic Engineering
    - 10.9.2.2. Human Cloning
    - 10.9.2.3. Genetic Therapy
  - 10.9.3. Bioethics and Genetics
- 10.10. Biobanks and Bioinformatics Tools
  - 10.10.1. Biobanks Concept and Functions
  - 10.10.2. Organization, Management and Quality of Biobanks
  - 10.10.3. Spanish Network of Biobanks
  - 10.10.4. Computational Biology
  - 10.10.5. Big Data and Machine Learning
  - 10.10.6. Bioinformatics Applications in Biomedicine
    - 10.10.6.1. Sequences Analysis
    - 10.10.6.2. Image Analysis
    - 10.10.6.3. Personalized and Precision Medicine

07

# Clinical Internship

Once the online learning period is over, the physician has the opportunity to carry out an internship in a center of recognized prestige in the field of clinical analysis. This internship will take place over a period of 3 weeks and will allow the specialist to come into contact with great experts in this area, who will guide them throughout the entire period, ensuring that the stay is absolutely profitable.





“

*This program will allow the physician to carry out an on-site internship in a prestigious center where they will perform numerous activities related to clinical analysis”*

The practical teaching will be carried out with the active participation of the student performing the activities and procedures of each area of knowledge (learning to learn and learning to do), with the accompaniment and guidance of teachers and other fellow trainees that facilitate teamwork and multidisciplinary integration as transversal competencies for the practice of Clinical Analysis (learning to be and learning to relate).

The procedures described below will form the basis of the practical part of the training, and their implementation is subject to both the suitability of the patients and the availability of the center and its workload, with the proposed activities being as follows:

“

*These internships will allow you to keep up-to-date with the latest developments in this area in a totally dynamic and effective way”*





Module	Practical Activity
<b>Instrumental, Management and Biochemistry Techniques in the Clinical Analysis Laboratory</b>	Apply the most modern microscopic techniques to the study of samples
	Use chromatography and electrophoresis
	Evaluate the possible analytical interferences in the interpretation of results
	Perform a biochemical study of vitamins and vitamin deficiencies
	Perform a laboratory analysis of blood biochemistry
	Examine congenital alterations of amino acid and lipid metabolism
	Assess the reliability of the results obtained in the analysis procedure
	Communicate the results of analyses according to the protocol in force
	Manage the stock of material and supplies of the clinical laboratory
<b>Hematology, Microbiology and Parasitology</b>	Assess anemias, erythrocytosis, hemoglobinopathies and other erythrocyte disorders
	Perform a differential diagnosis of acute leukemias
	Examine monoclonal gammopathies and multiple myeloma
	Study common viral infections and applicable state-of-the-art analytics
	Develop general virology techniques with best results
	Perform various parasitic disease analyses
	Apply hematological analysis techniques on samples received
	Perform microbiological analysis on samples and cultures
	Apply immunological techniques to biological samples
Perform analysis of biochemical parameters (cholesterol, triglycerides, glucose, uric acid, bilirubin, transaminases, etc.)	
<b>Immunology and Genetics in the Clinical Laboratory</b>	Perform prenatal diagnostic assessments
	Perform analysis of hypersensitivity reactions
	Analyze patient's immune response
	Perform genomics and proteomics assessments
	Employ the most advanced bioinformatics tools in clinical data management

## Civil Liability Insurance

This institution's main concern is to guarantee the safety of the trainees and other collaborating agents involved in the internship process at the company. Among the measures dedicated to achieve this is the response to any incident that may occur during the entire teaching-learning process.

To this end, this entity commits to purchasing a civil liability insurance policy to cover any eventuality that may arise during the course of the internship at the center.

This liability policy for interns will have broad coverage and will be taken out prior to the start of the practical training period. That way professionals will not have to worry in case of having to face an unexpected situation and will be covered until the end of the internship program at the center.



## General Conditions of the Internship Program

The general terms and conditions of the internship agreement for the program are as follows:

**1. TUTOR:** During the Hybrid Professional Master's Degree, students will be assigned with two tutors who will accompany them throughout the process, answering any doubts and questions that may arise. On the one hand, there will be a professional tutor belonging to the internship center who will have the purpose of guiding and supporting the student at all times. On the other hand, they will also be assigned with an academic tutor whose mission will be to coordinate and help the students during the whole process, solving doubts and facilitating everything they may need. In this way, the student will be accompanied and will be able to discuss any doubts that may arise, both clinical and academic.

**2. DURATION:** The internship program will have a duration of three continuous weeks, in 8-hour days, 5 days a week. The days of attendance and the schedule will be the responsibility of the center and the professional will be informed well in advance so that they can make the appropriate arrangements.

**3. ABSENCE:** If the students does not show up on the start date of the Hybrid Professional Master's Degree, they will lose the right to it, without the possibility of reimbursement or change of dates. Absence for more than two days from the internship, without justification or a medical reason, will result in the professional's withdrawal from the internship, therefore, automatic termination of the internship. Any problems that may arise during the course of the internship must be urgently reported to the academic tutor.

**4. CERTIFICATION:** Professionals who pass the Hybrid Professional Master's Degree will receive a certificate accrediting their stay at the center.

**5. EMPLOYMENT RELATIONSHIP:** the Hybrid Professional Master's Degree shall not constitute an employment relationship of any kind.

**6. PRIOR EDUCATION:** Some centers may require a certificate of prior education for the Hybrid Professional Master's Degree. In these cases, it will be necessary to submit it to the TECH internship department so that the assignment of the chosen center can be confirmed.

**7. DOES NOT INCLUDE:** The Hybrid Professional Master's Degree will not include any element not described in the present conditions. Therefore, it does not include accommodation, transportation to the city where the internship takes place, visas or any other items not listed.

However, students may consult with their academic tutor for any questions or recommendations in this regard. The academic tutor will provide the student with all the necessary information to facilitate the procedures in any case.

08

# Where Can I Do the Clinical Internship?

This program includes a clinical internship in a health center of reference in the field of clinical analysis. Therefore, TECH has selected the most prestigious institutions in this field so that the physician can have access to the latest developments in this complex medical area, more topical than ever due to the recent situation in the field of clinical analysis.





“

*In addition to online learning, these clinical internships will complete a first-class educational itinerary”*



The student will be able to complete the internship of this Hybrid Professional Master's Degree at the following centers:



Medicine

### Diagnoslab

Country	City
Spain	Madrid

Address: C. Cam. del Berrocal, 4, 28400 Collado Villalba, Madrid

Clinical Analysis Laboratory for Medical Diagnostics

**Related internship programs:**

- Clinical Analysis
- Nursing in the Gynecology Service



Medicine

### Hospital HM Modelo

Country	City
Spain	La Coruña

Address: Rúa Virrey Osorio, 30, 15011, A Coruña

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

**Related internship programs:**

- Anaesthesiology and Resuscitation
- Palliative Care



Medicine

### Hospital Maternidad HM Belén

Country	City
Spain	La Coruña

Address: R. Filantropía, 3, 15011, A Coruña

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

**Related internship programs:**

- Update in Assisted Reproduction
- Hospitals and Health Services Management



Medicine

### Hospital HM Rosaleda

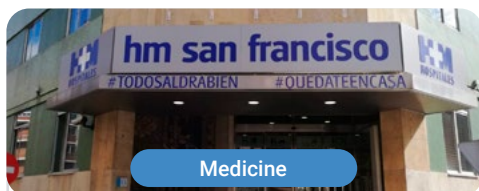
Country	City
Spain	La Coruña

Address: Rúa de Santiago León de Caracas, 1, 15701, Santiago de Compostela, A Coruña

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

**Related internship programs:**

- Hair Transplantation
- Orthodontics and Dentofacial Orthopedics



Medicine

### Hospital HM San Francisco

Country	City
Spain	León

Address: C. Marqueses de San Isidro, 11, 24004, León

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

**Related internship programs:**

- Update in Anesthesiology and Resuscitation
- Trauma Nursing



Medicine

### Hospital HM Regla

Country	City
Spain	León

Address: Calle Cardenal Landázuri, 2, 24003, León

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

**Related internship programs:**

- Update on Psychiatric Treatment in Minor Patients



Medicine

### Hospital HM Nou Delfos

Country	City
Spain	Barcelona

Address: Avinguda de Vallcarca, 151, 08023 Barcelona

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

**Related internship programs:**

- Aesthetic Medicine
- Clinical Nutrition in Medicine



Medicine

### Hospital HM Madrid

Country	City
Spain	Madrid

Address: Pl. del Conde del Valle de Súchil, 16, 28015, Madrid

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

**Related internship programs:**

- Palliative Care
- Anaesthesiology and Resuscitation



Medicine

### Hospital HM Montepríncipe

Country: Spain  
City: Madrid

Address: Av. de Montepríncipe, 25, 28660, Boadilla del Monte, Madrid

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

- Related internship programs:**
- Palliative Care
  - Aesthetic Medicine



Medicine

### Hospital HM Torrelodones

Country: Spain  
City: Madrid

Address: Av. Castillo Olivares, s/n, 28250, Torrelodones, Madrid

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

- Related internship programs:**
- Anaesthesiology and Resuscitation
  - Palliative Care



Medicine

### Hospital HM Sanchinarro

Country: Spain  
City: Madrid

Address: Calle de Oña, 10, 28050, Madrid

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

- Related internship programs:**
- Anaesthesiology and Resuscitation
  - Palliative Care



Medicine

### Hospital HM Nuevo Belén

Country: Spain  
City: Madrid

Address: Calle José Silva, 7, 28043, Madrid

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

- Related internship programs:**
- General and Digestive System Surgery
  - Clinical Nutrition in Medicine



Medicine

### Hospital HM Puerta del Sur

Country: Spain  
City: Madrid

Address: Av. Carlos V, 70, 28938, Móstoles, Madrid

Network of private clinics, hospitals and specialized centers distributed throughout Spain.

- Related internship programs:**
- Palliative Care
  - Clinical Ophthalmology



Medicine

### Clínica Integria

Country: Spain  
City: Granada

Address: Calle Torre de Comares, 2, 18007 Granada

INTÉGRIA, clinic with more than 20 years of experience in Aesthetic Medicine, General Medicine, Capillary Surgery and Aesthetic Surgery

- Related internship programs:**
- Clinical Analysis
  - Aesthetic Plastic Surgery

09

# 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.



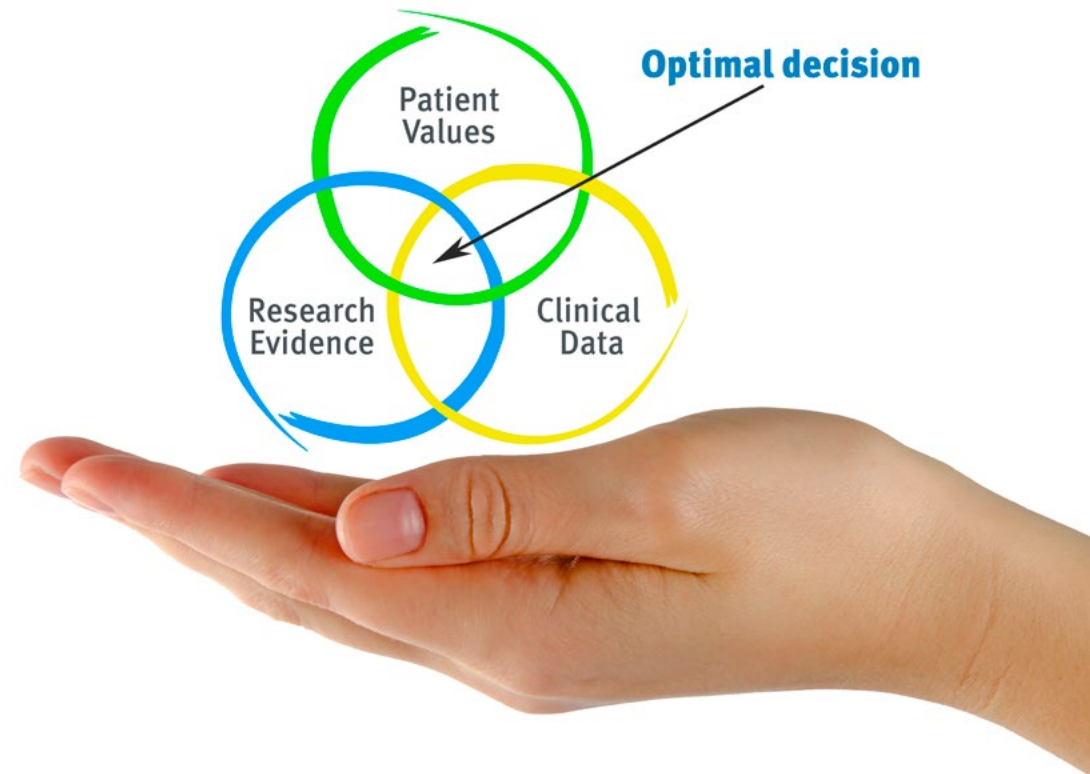
“

*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.

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*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.

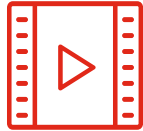
*Relearning will allow you to learn with less effort and better performance, involving you more in your specialization, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation to success.*

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

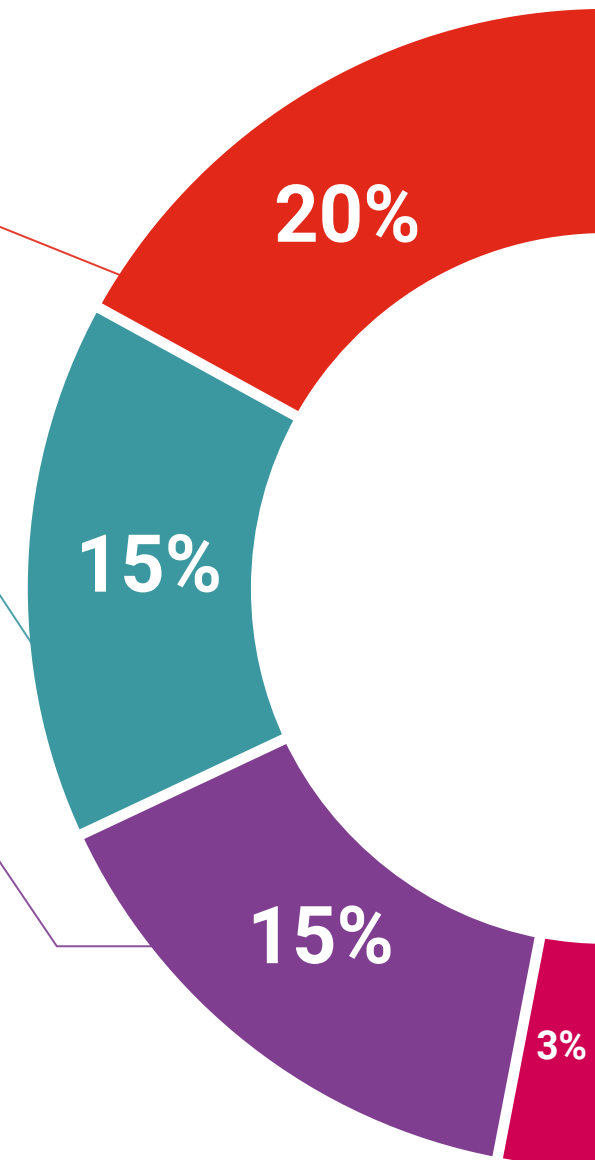
The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

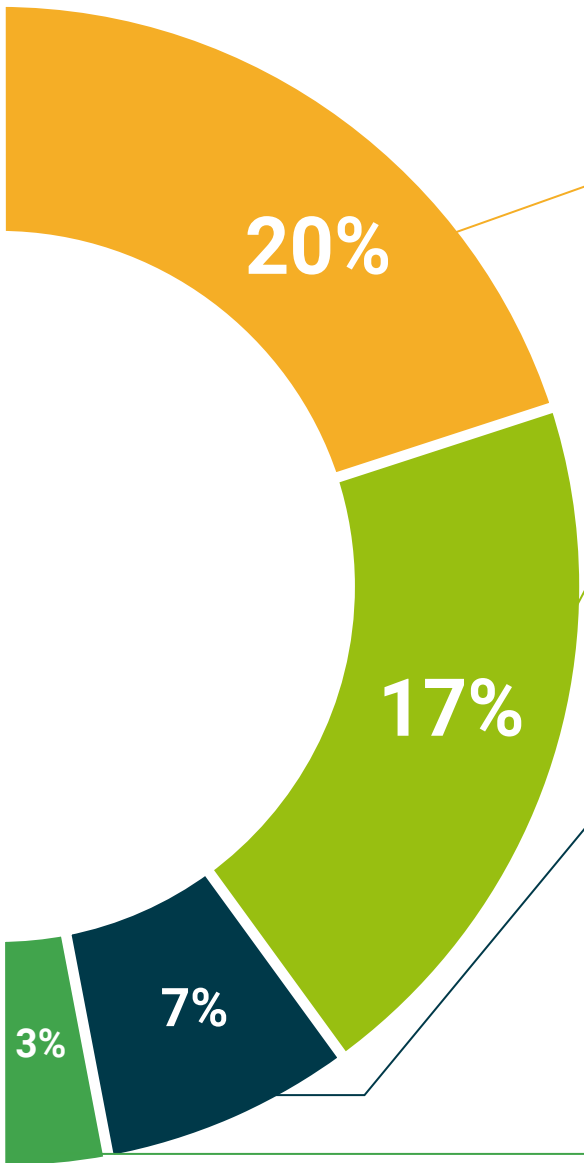
This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".



#### 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.



# 10 Certificate

The Hybrid Professional Master's Degree in Clinical Analysis guarantees students, in addition to the most rigorous and up-to-date education, access to a Hybrid Professional Master's Degree diploma issued by TECH Technological University.



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

This **Hybrid Professional Master's Degree in Clinical Analysis** contains the most complete and up-to-date program on the professional and educational field.

After the student has passed the assessments, they will receive their corresponding Hybrid Professional Master's Degree diploma issued by TECH Technological University via tracked delivery\*.

In addition to the diploma, students will be able to obtain an academic transcript, as well as a certificate outlining the contents of the program. In order to do so, students should contact their academic advisor, who will provide them with all the necessary information.

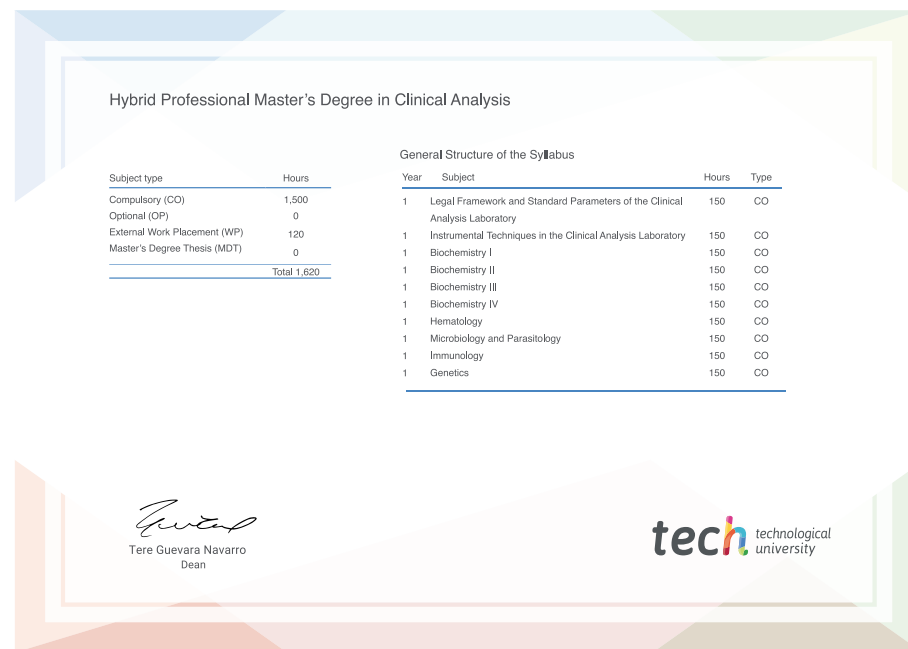
Program: **Hybrid Professional Master's Degree in Clinical Analysis**

Course Modality: **Hybrid (Online + Clinical Internship)**

Duration: **12 months**

Certificate: **TECH Technological University**

Teaching Hours: **1,620 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.



## Hybrid Professional Master's Degree

### Clinical Analysis

Course Modality: Hybrid (Online + Clinical Internship)

Duration: 12 months

Certificate: TECH Technological University

Teaching Hours: 1,620 h.

# Hybrid Professional Master's Degree Clinical Analysis

