

MODULE	SUBJECT	COURSE	SEMESTER	CREDITS	TYPE
Chemistry	Radiopharmacy	Starting from 2 <sup>nd</sup> yr	First	6	Optional
<b>PROFESSOR</b>			<b>FULL CONTACT ADDRESS FOR TUTORING</b>		
<ul style="list-style-type: none"> <li>Antonio Matilla Hernández</li> <li>Ricardo Navarrete Casas</li> </ul>			Department of Inorganic Chemistry, 3rd floor, Faculty of Pharmacy. Email: <a href="mailto:amatilla@ugr.es">amatilla@ugr.es</a> , Tel: 958243854, Room: 288		
			<b>TUTORING HOURS</b>		
			See Department website: <a href="http://inorganica.ugr.es/">http://inorganica.ugr.es/</a>		
<b>BELONGS TO UNDERGRADUATE DEGREE PROGRAMME</b>			<b>OTHER DEGREES IN WHICH THE SUBJECT COULD BE TAUGHT</b>		
Degree in Pharmacy			Nursing & Medicine. Nevertheless, such students would need to study an additional introductory unit on Coordination Chemistry, which would be provided at the end of the first Section of the Course.		
<b>Prerequisites and / or recommendations (if applicable)</b>					
Having adequate knowledge about: <ul style="list-style-type: none"> <li>Coordination Chemistry</li> <li>Spreadsheets and graphical software.</li> </ul>					



## BRIEF DESCRIPTION OF CONTENTS (AS GRADE VERIFICATION REPORT)

- Section 1. - Radioactivity Basics. Calculations and equations. Radioprotection
- Section 2. - Radiopharmaceuticals in the European Union. Properties. Chemical labeling reactions. Clinical indications. Preparation and control.
- Section 3. - Radioactive methods used in clinical analysis, RIA, IRMA and biomedical research.

## GENERAL AND SPECIFIC COMPETENCIES

### General skills

- To identify, design, synthesize, analyze, control and produce drugs and medicines, and other products as well as additional raw materials of health interest in human or veterinary use.
- Learning how to apply the scientific method and acquire skills in handling legislation, sources of information, scientific literature, development of protocols and other related aspects that are considered necessary for the design and critical assessment of preclinical and clinical trials.
- To design, prepare, deliver and dispense medications and other health products of interest.
- To design, implement and evaluate reagents, clinical analytical methods and techniques, knowing the basics of medical tests and the nature and content of laboratory diagnostic reports.
- To develop information and communications technology (ICT) skills, both oral and written, in order to deal with patients and users of the center where they will carry out their work. Promoting team capabilities regarding team-work multidisciplinary collaborations with related healthcare professionals.
- To recognize own limitations and the need to maintain and update professional skills, with particular emphasis on self-learning processes always based on scientific evidence.

### Specific skills

- To identify, design, synthesize, analyze and produce pharmaceutical active ingredients, drugs and other products and materials of sanitary interest
- To select appropriate techniques and procedures in the design, implementation and evaluation of reagents, methods and analytical techniques.
- To perform standard laboratory procedures including the use of scientific equipment for synthesis and analysis, including appropriate instrumentation.
- Estimating the risks associated to the use of chemicals and laboratory processes.



## OBJECTIVES (EXPRESSED AS EXPECTED RESULTS OF EDUCATION)

- Acquiring basic knowledge about radioactivity and radiation protection calculations that allows safe use of radioactive preparation methods, quality control of radiopharmaceuticals, clinical analysis and biomedical research.
- Understanding the concept of radiopharmaceuticals, knowing the radiopharmaceuticals in the EU and the chemical processes that occur during their preparation (labeling). Likewise, knowing their clinical indications and the general protocols for preparation and quality control.
- Understanding the principles of radioimmunoassay and its use in clinical analysis.
- Knowing the most common radioactive methods in biomedical research.

## DETAILED SYLLABUS

### THEORETICAL SYLLABUS:

#### SECTION 1. Basic principles of radioactivity. Calculations and equations. Radioprotection

##### UNIT 1: Constitution of matter and radioactive emissions.

Elemental particles: leptons, quarks and force carriers. Transformations responsible for radioactive emissions in the nucleus. Electronic shell and its radioactive emissions. Nuclear stability: neutron / proton ratio. Unstable nuclei: stabilization.

##### UNIT 2: Properties of radioactive emissions.

Features of radioactive decay: Characteristics of  $\alpha$ -decay, characteristics of  $\beta$ -decay (+/-), characteristics of  $\gamma$ -decay. Quantities and units used in radioactivity. Law of radioactive decay: decay constant, half-life, mean lifetime. Combined decays: decay of mixtures of radionuclides. Calculations and problems.

##### UNIT 3: Interaction of radiation with matter.

General aspects of the interaction of charged particles with matter. Interaction of  $\alpha$ -particles, mechanisms, penetration, self-absorption.  $\beta$ -particles interaction: mechanisms, penetration, braking radiation (Bremsstrahlung). Interaction of  $\gamma$ -radiation with matter: mechanisms penetration. Interaction of radiation with biological systems: chemical consequences of interaction, biological effects. Calculations and problems of penetration and shielding for different types of radiation.

##### UNIT 4: Detection and quantification of radiation.

Classification of detection systems. Gas ionization detectors: basics and types. Scintillation detectors. Solid scintillation: fundamentals, calibration. Liquid Scintillation: extinction, luminescence calibration. Semiconductor detectors: functioning and types. Thermoluminescence detectors. Photographic film detectors. Spectrometry.

##### UNIT 5: Introduction to radiation protection in radiopharmacy and health sciences.

Radioprotection: Definition. Irradiation and contamination. General safety rules for working with radioactive materials. Radiation dosimetry, dose rates: absorbed dose, equivalent dose, dose rate and cumulative dose. Dose limits. Classification of working areas. Supervised area: labeling, posting and markings. Controlled Area: labeling, posting and markings. Limited permanence zone: labeling, posting and markings. Regulated permanence area: labeling, posting and markings. Prohibited access zone: labeling, posting and markings. Commonly used equipment in radiation dosimetry. Updated review of the Spanish legislation on the protection of professionals exposed to ionizing radiation.



## SECTION 2. Radiopharmaceuticals authorized in Spain. Properties. Clinical indications. Preparation and control.

### UNIT 6: Radiopharmaceuticals.

Definition of radiopharmaceutical: Spanish law "Ley del Medicamento". Characteristics of radiopharmaceuticals. Tracers used radiopharmacy and their applications. Applications of radiopharmaceuticals in Nuclear Medicine. Diagnostic imaging: SPECT scanning techniques, PET, PET-CT. In vivo diagnosis. In vitro diagnosis. Therapy. Radiopharmaceuticals authorized in Spain. Availability of radionuclides used in the preparation of radiopharmaceuticals.

### UNIT 7: Availability of radionuclides for clinical use using generators

Principles of radionuclide generator systems. Activity calculations. Separation procedures. Classification of chromatographic column generators. Advantages and disadvantages of each type. Major generating systems. Potential problems of radionuclide generator systems.

### UNIT 8: $^{99}\text{Mo}$ / $^{99\text{m}}\text{Tc}$ Generator.

Principle of operation and construction.  $^{99}\text{Mo}$  extraction methods. Elution and performance. Eluted quality control: pH, absence of  $^{99}\text{Mo}$ . Absence of other radionuclides, absence of Al(III), radiochemical purity. Calculations and problems on performance, availability of  $^{99\text{m}}\text{Tc}$  along the generator life, successive elutions, etc.

### UNIT 9: Technetium Radiopharmaceuticals

Chemical Characteristics of technetium: chemical properties, oxidation states and stereochemistry. Coordination compounds. Tc radiopharmaceuticals preparation:  $\text{TcO}_4^-$  reduction. "Cold Kits": definition and composition. Tc radiopharmaceuticals authorized in Spain and diagnostic indications: Tc-albumin radiopharmaceuticals, radiopharmaceuticals for kidney scans, radiopharmaceuticals for brain scans, radiopharmaceuticals for bone scans, radiopharmaceuticals for heart scans, radiopharmaceuticals for cell markings. Other Tc Radiopharmaceuticals.

### UNIT 10: Radiopharmaceuticals of other radionuclides.

Iodine  $^{123}\text{I}$  and  $^{131}\text{I}$  radiopharmaceuticals, chemical properties of iodine, radiopharmaceuticals. Transition element radiopharmaceuticals:  $^{51}\text{Cr}$  radiopharmaceuticals,  $^{57}\text{Co}$  radiopharmaceuticals,  $^{90}\text{Y}$  radiopharmaceuticals. Post-Transition element radiopharmaceuticals:  $^{67}\text{Ga}$  radiopharmaceuticals,  $^{111}\text{In}$  and  $^{201}\text{Tl}$ . p-block element radiopharmaceuticals:  $^{75}\text{Se}$  radiopharmaceuticals,  $^{18}\text{F}$  radiopharmaceuticals. Noble Gases radiopharmaceuticals:  $^{81\text{m}}\text{Kr}$  and  $^{133}\text{Xe}$  radiopharmaceuticals. Radiopharmaceuticals used in radiotherapy.

### UNIT 11: Radiopharmaceuticals prepared by cell labelling.

Leukocyte labeling Technetium ( $^{99\text{m}}\text{Tc}$ -HMPAO exametazine), procedure and quality control. Platelet labeling with  $^{111}\text{In}$ -oxine, procedure and quality control. In vitro labeling of red blood cells with  $^{51}\text{Cr}$ , procedure and quality control. In vitro labeling of red blood cells with  $^{99\text{m}}\text{Tc}$ , procedure and quality control.

### UNIT 12: Quality control of radiopharmaceuticals.

Quality control of labeled compounds: radionuclide purity control, chemical purity control, radiochemical purity control, efficiency labeling control. Quality control of radiopharmaceuticals, legal framework. Minimum frequency controls: radiopharmaceuticals ready for use, radiopharmaceuticals obtained from generators and radiopharmaceutical reagents or equipment obtained from autologous samples, self-manufacturing, etc. Quality programs in Radiopharmaceutical Units.



### SECTION 3. Radioactive methods used in clinical analysis: RIA and IRMA. Techniques used in biomedical research.

#### UNIT 13: Use of radioactive isotopes in Clinical Analysis.

Radioimmunoassay RIA and IRMA. Principles, characteristics of the technique and sensitivity. General procedure. Latest developments in the radioimmunoassay technique. Data processing and selection of the most appropriate calculation method, graphical representations. Reporting and validation of results. Other laboratory tests not based on immune reactions: Shilling test,  $^{14}\text{C}$ -Urea test, etc.

#### UNIT 14: Use of radioactive isotopes in medical biology and biomedical research.

Features to consider depending on their use: chemical characteristics, availability, half-life, type of radiation, radiation energy. How to choose the right radioisotope and radioprotection measures for the most commonly used isotopes:  $^{14}\text{C}$ ,  $^3\text{H}$ ,  $^{32}\text{P}$ ,  $^{35}\text{S}$ ,  $^{45}\text{Ca}$ ,  $^{59}\text{Fe}$ , etc.

#### UNIT 15: Using radioactive methods for other uses: sterilization

Advantages and drawbacks. Frequent procedures. Considerations to select the appropriate technique. Radiation dose and its effects. Radioactive facility and security measures.

#### UNIT 16: Transport of Radioactive materials

Purpose of transport regulation of radioactive materials. Spanish regulation. International regulation. Glossary. Packaging: types, design of packages and labeling. Radioactivity on surface. Mandatory shipping information and authorization.

#### PRACTICAL SYLLABUS:

##### Seminars / Workshops

- Problem Seminars of Units 1, 2 and 3: Notations, Activity calculations, Shielding calculations.
- Problem Seminar:  $^{99}\text{Mo}$ - $^{99\text{m}}\text{Tc}$  generator. Calculation of yields and elution.

##### Laboratory practices

- Good Laboratory Practices (GLP) and Safety Guidelines in a radioactive laboratory: Regulation of a radioactive facility, labeling, precautions and conduct rules. Use of dosimeters and radiation-protection equipment.
- GM camera response curve, calculating the optimal potential and efficiency of the system.
- Use of radioactive counters: counting statistics.
- Dosimetry, dose calculation and isodose charts.
- Generator  $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$ . Use, elution and controls.
- Quality control of radiopharmaceuticals (determination of radiochemical purity)

#### BIBLIOGRAPHY

##### FUNDAMENTAL BIBLIOGRAPHY:

##### RADIOACTIVITY

- J. Ortega and J. Aramburu Jorba Bisbal. (Eds), Las radiaciones ionizantes: su utilización y riesgos. Ediciones de la Universidad Politécnica de Cataluña (UPC). Volumen 1 (1994), Volumen 2 (1996).
- Consejo de Seguridad Nuclear. Material didáctico de los Cursos de: Supervisores de instalaciones radiactivas: Módulo Básico, Módulo Medicina Nuclear y Módulo Laboratorios con Fuentes no Encapsuladas:  
<http://csn.ciemat.es/MDCSN/portal.do;jsessionid=42D23230D70BEA46549057371D68F4AB?IDM=12&NM=1>



#### MOLECULAR BIOLOGY RADIOISOTOPES AND RADIOIMMUNOASSAY

- - A. J. Moss, G. V. Dalrymple, C. M. Boyd; Practical Radioimmunoassay; The C.V. Mosby Company, 1997, 158p., ISBN: 0-8016-3561-6
- - RF Boyer Modern experimental biochemistry, Addison-Wesley Publishing Co, Reading (Mass., USA), p.185-6, 1996.

#### RADIOPHARMACY

- Gopal B. Saha, Springer-Verlag, Fundamentals of Nuclear Pharmacy, 6th ed., 2010, ISBN: 978-1-4419-5860-0, DOI:10.1007/978-1-4419-5860-0
- C. A. Sampson (Ed.), Textbook of Radiopharmacy. Theory and Practice, Gordon and Breach Science Publishers, 1999.
- R.J. Kowalsky, S.V. Falen, American Pharmacists Association, Radiopharmaceuticals in Nuclear Pharmacy and Nuclear Medicine, 3th Ed., 2011, ISBN: 978-7-58212-118-5, [www.pharmacylibrary.com](http://www.pharmacylibrary.com)
- B.T. Smith, Pharmaceutical Press, Nuclear Pharmacy , 1 th. Ed., 2010, ISBN: 978-0-85369-866-1
- Gopal B. Saha, Springer-Verlag, Basics of PET Imaging: Physics, Chemistry and Regulationsentials of Nuclear Pharmacy, 2005, ISBN: 0-387-21307-4.
- A.C. Perkins and M. Frier (Eds.); Tailor & Francis Ltd. Nuclear Medicine in Pharmaceutical Research, 1999, ISBN: 0-7484-0688-3

#### COMPLEMENTARY BIBLIOGRAPHY

- Guides of radiopharmaceutical procedures of the Spanish Agency of Medicines, AEMPS (9 guides): <http://www.aemps.es/profHumana/farmacopea/rfe/guias/home.htm>
- [CIMA: Online information center AEMPS.](#)
- [Manual for Nuclear Medicine examinations in nursing.](#)
- Spanish Pharmacopoeia 3th edition.
- 8<sup>th</sup>. Edition of European Pharmacopoeia.

#### RECOMMENDED LINKS

- The Particle Adventure: <http://particleadventure.org/index.html>
- Spanish Drug Agency: <http://www.aemps.es>
- Positron Emission Tomography (PET): <http://estaticos.elmundo.es/elmundosalud/documentos/2008/05/pet/pet.swf>
- Radiopharmaceuticals authorized by the Spanish Agency of Medicinal and Sanitary Products, AEMPS (CIMA data base, ATC code Search: V09): <http://www.aemps.gob.es/cima/fichasTecnicas.do?metodo=detalleForm>

#### TEACHING METHODOLOGY

- The student will have available a comprehensive didactic guide with all the information concerning the development of the subject, objectives, content and skills to be developed. This information will be available through the online platform PRADO.
- Expositive classes where the teacher will promote the active participation of students with questions, comments, etc.
- Seminars focused on problems where practical questions will be solved.
- Both the expositive classes and the seminars will be face-to-face or online (Scenario A) or exclusively online (Scenario B), with the online version being synchronous or asynchronous streaming classes.



- Practical classes in which the student will be introduced into the handling and use of radioactive materials and preparation of radiopharmaceuticals. Practicum will be face-to-face or online (Scenario A) or exclusively online (Scenario B).

#### EVALUATION (EVALUATION INSTRUMENTS, EVALUATION CRITERIA AND PERCENTAGE ON THE FINAL QUALIFICATION).

##### ORDINARY CALL

The evaluation will be based on different items in which students must demonstrate the skills acquired.

- Theory and Problem Exams: 70% of the grade of the subject.
- Performance at practical classes, attendance and labjournal: 20% of the grade of the subject.
- Class attendance. More than 80% attendance: 10% of the grade of the subject.

Overcoming of any of the tests will not be achieved without a uniform and balanced understanding of all matter.

##### EXTRAORDINARY CALL

- One exam of theoretical contents will be carried out. If the student asks for the consideration of the activities carried out during the course, then it will count for 70%, as the ordinary call. Note that the final grade will not be lower than the grade obtained in the theoretical exam (Theory and Problem). Otherwise, the exam will count for the 100% of the final grade.

#### DESCRIPTION OF THE EVIDENCE THAT WILL BE PART OF THE FINAL UNIQUE EVALUATION ESTABLISHED IN THE "REGULATIONS OF EVALUATION AND GRADING OF THE STUDENTS OF THE UNIVERSITY OF GRANADA"

- Those students who, for any reason, cannot attend regularly to the classes, and therefore cannot follow the continuous assessment plan, they can ask for a final single evaluation process. This request must be addressed to the Head of the Department within the first two weeks of the subject. This evaluation will consist in a single written or oral exam, which will evaluate the knowledge on the subject, with its qualification being considered as the final grade of the subject. In this Final Unique evaluation one exam of theoretical contents will be carried out, counting for 100% of the final grade.
- In this case, evaluation will be carried out face-to-face (Scenario A) or online through the online platform PRADO EXAMEN or GoogleMeet (Scenario B)

#### SCENARIO A (ON-CAMPUS AND REMOTE TEACHING AND LEARNING COMBINED)

##### TUTORIALS

###### TIMETABLE

(According to Official Academic Organization Plan)

###### TOOLS FOR TUTORIALS

(Indicate which digital tools will be used for tutorials)

Available at: <http://inorganica.ugr.es/>

Email, PRADO Platform and GoogleMeet video conference

##### MEASURES TAKEN TO ADAPT TEACHING METHODOLOGY

- The percentage of face-to-face and online classes will depend on the number of students enrolled in the Course and



the security measures dictated by the corresponding health authorities. Theoretical classes with a high number of students will be preferentially taught online while seminars and the practicum will be preferentially developed face-to-face. Despite this, the number of students will never overcome the maximum capacity of the given rooms/labs according to new COVID restrictions. All students will receive the same number of face-to-face and virtual practicum sessions per week.

- Online/virtual classes will be carried out via the Google Meet platform or any other online platform officially recommended by the University of Granada. Synchronous sessions will be preferred, although certain personal circumstances, such as sickness of the teacher or any close relative, work/life balance, etc., might encourage an asynchronous scenario which would be complemented by monitoring and specific students' follow-up activities.
- Currently, the recommended online platforms at the University of Granada are Prado, Consigna UGR, Google Meet and Google Drive by means of the official account @go.ugr and also the official @correo.ugr.es email account. If any additional platform is required, instructions will be given to students.
- Teaching materials regarding online teaching will be given to students by any the aforementioned platforms.

#### MEASURES TAKEN TO ADAPT ASSESSMENT (Instruments, criteria and percentage of final overall mark)

##### Ordinary assessment session

- The evaluation will be carried out according to the criteria indicated in the corresponding general section.
- The exams will be face-to-face provided the number of students enrolled allows it according to the safety regulations indicated by the authorities. If this is not possible, the evaluation will be online and will be carried out using the PRADO EXAMEN platform and / or the GoogleMeet video conference service.

##### Extraordinary assessment session

- The evaluation will be carried out according to the corresponding general section with face-to-face exams provided the number of enrolled students allows it according to the safety regulations indicated by the authorities. If this is not possible, the evaluation will be carried out virtually by using the PRADO EXAMEN platform and / or the GoogleMeet video conferencing service.

##### Single final assessment

- The unique evaluation will be carried out as indicated in the corresponding general section but will require on-site (face-to-face) presence of students.

### SCENARIO B (ONCAMPUS ACTIVITY SUSPENDED)

#### TUTORIALS

##### TIMETABLE

(According to Official Academic Organization Plan)

Available at: <http://inorganica.ugr.es/>

##### TOOLS FOR TUTORIALS

(Indicate which digital tools will be used for tutorials)

Email, PRADO Platform and GoogleMeet video conference

#### MEASURES TAKEN TO ADAPT TEACHING METHODOLOGY

- Synchronous or asynchronous online classes and seminars.
- Virtual practical classes.

#### MEASURES TAKEN TO ADAPT ASSESSMENT (Instruments, criteria and percentage of final overall mark)

- All theoretical classes, seminars and practicum will be virtual. They will be carried out via the Google Meet





platform or any other online platform officially recommended by the University of Granada. Synchronous sessions will be preferred, although certain personal circumstances, such as sickness of the teacher or any close relative, work/life balance, etc., might encourage an asynchronous scenario which would be complemented by monitoring and specific students' follow-up activities.

- Currently, the recommended online platforms at the University of Granada are Prado, Consigna UGR, Google Meet and Google Drive by means of the official account @go.ugr and also the official @correo.ugr.es email account. If any additional platform is required, instructions will be given to students.
- Teaching materials regarding online teaching will be given to students by any the aforementioned platforms.

#### Ordinary assessment session

- The evaluation criteria will follow that indicated in the corresponding general section,
- The exams will be carried out by using the PRADO EXAMEN platform and / or the GoogleMeet video conference service.

#### Extraordinary assessment session

- The evaluation criteria will follow that indicated in the corresponding general section.
- The exams will be carried out using the PRADO EXAMEN platform and / or the GoogleMeet video conference service.

#### Single final assessment

- The evaluation criteria will follow that indicated in the corresponding general section.
- The exams will be carried out using the PRADO EXAMEN platform and / or the GoogleMeet video conference service.

### ADDITIONAL INFORMATION

INORGANIC CHEMISTRY DEPARTMENT: EXPERIENCE IN THIS FIELD OF SCIENCE.

The Inorganic Chemistry Department has a comprehensive experience in education, research and practice in the field of radioactivity. It has its own radioactive facility and the right equipment for the use of radioactive isotopes in Radiochemistry, Environmental Sciences, Biomedical Research and Radiopharmacy. The radioactive laboratory at the Inorganic Chemistry Department was the first of our university to be authorized by the Nuclear Safety Council (CSN) in 1969. Since 1992, it is member of the Network of Spanish Environmental Radiological Surveillance Programme (REVIRA, Sampling Network Station), performing sampling and analysis for Eastern Andalusia. Since 2000, it also collaborates in the Radiological Independent Monitoring Plan of Cabril. Currently our laboratories are legally integrated as Radioactive Units of the Science and Pharmacy Faculties, approved and supervised by the CSN, as required by law relating to the use of radioactive materials.

Regarding the Unit located in the Faculty of Pharmacy, its laboratory is authorized by CSN for the use of sealed radioactive sources. In addition, this Radiolab has the adequate infrastructure for practices, (practice kits, shields, dosimeters, etc.). See [Radiopharmacy Unit](#)

The Inorganic Chemistry Department has adequately prepared the corresponding teachers with the title of Radioactive Laboratories Supervisors approved by CSN. Besides, teachers have a wide expertise in the field of radioactivity within the degrees of Chemistry, Environmental Sciences and Pharmacy.

Prof. Dr. Antonio Matilla, launched the Radiopharmacy Unit, at the Faculty of Pharmacy (<http://farmacia.ugr.es/cont.php?sec=8&pag=1> and <http://www.ugr.es/~radiofar/>) participating in its design and



in the committees of the Ministry of Education devoted to the purchase of scientific equipment. Is its Prof. A. Matilla is the director if the Radiopharmacy Unit since its formal establishment in 1997. Since then, the Unit collaborates with different University departments (Ecology Department, Animal Biology Department, Biochemistry Department, etc.) working with radioactive isotopes. This collaboration is not restricted to the radioactive measurements but also involve the design of experiments.

In the CV of Prof. A. Matilla should be noted other relevant items related to Radioactivity. He was director of the Master in Radiopharmaceutical Sciences taught at our University (1996-1997), as well as director of the Training Course for Supervisors Radioactive Facilities approved by the CSN and integrated into such Master. From 1995 until the academic course 2003-04 he taught the subject "Radionuclides And Their Applications" at the Faculty of Pharmacy (<http://www.ugr.es/~qinorgf/rn.html>). Currently, he is Professor of the Clinical Analysis School at the University of Granada (<http://www.ugr.es/~faclini1/main.html>) and teaches the Radioimmunoassay module within the Masters in Biological Analysis and Laboratory Diagnostics. He also teaches the subject "Radiopharmacy" in the Degree of Pharmacy.

