

**COURSE DATA****Data Subject**

<b>Code</b>	43039
<b>Name</b>	Evaluation of permeability in the development of medicinal products
<b>Cycle</b>	Master's degree
<b>ECTS Credits</b>	4.0
<b>Academic year</b>	2021 - 2022

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
2138 - M.D. in Research in and Rational Use of Medicines	Faculty of Pharmacy and Food Sciences	1	First term
3103 - Biomedicine and Pharmacy	Doctoral School	0	First term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
2138 - M.D. in Research in and Rational Use of Medicines	15 - Evaluation of permeability in the development of medicines	Optional
3103 - Biomedicine and Pharmacy	1 - Complementos Formación	Optional

**Coordination**

<b>Name</b>	<b>Department</b>
MERINO SANJUAN, VIRGINIA	134 - Pharmacy and Pharmaceutical Technology
NACHER ALONSO, AMPARO	134 - Pharmacy and Pharmaceutical Technology

**SUMMARY**

Subject of the research module, recommended for those students that want to realize his doctoral thesis in some topic related with the absorption of medicaments after obtaining the Master degree. Students will acquire knowledge of the anatomo-physiological characteristics of the gastrointestinal tract and of the skin, determining of the absorption. In vitro and in vivo methodologies that can be used for the study of the intestinal and transdermal absorption of drugs, as well as the methodologies that can be used to promote gastrointestinal and percutaneous absorption are taught.



The course provides students with tools to carry out responsible and sustainable research on potential absorption of drug candidates.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

There is no registration restriction

## OUTCOMES

### 2138 - M.D. in Research in and Rational Use of Medicines

- Manejar adecuadamente las fuentes de información biomédica y poseer la habilidad de hacer una valoración crítica de las mismas integrando la información para aportar conocimientos a grupos asistenciales multidisciplinares
- Utilizar adecuadamente las herramientas informáticas, métodos estadísticos y de simulación de datos, aplicando los programas informáticos y la estadística a los problemas biomédicos
- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Be able to integrate new technologies in their professional and/or research work.
- Know how to write and prepare presentations to present and defend them later.
- Ser capaces de analizar de forma crítica tanto su trabajo como el de su compañeros.
- Be able to access to information tools in other areas of knowledge and use them properly.



- To be able to assess the need to complete the scientific, historical, language, informatics, literature, ethics, social and human background in general, attending conferences, courses or doing complementary activities, self-assessing the contribution of these activities towards a comprehensive development.
- Be able to apply the research experience acquired to professional practice both in private companies and in public organisations.
- Resolver de dilemas éticos derivados del empleo de medicamentos.
- Dominar la comunicación científica. Poseer habilidades sociales y comunicativas en la práctica asistencial.

## LEARNING OUTCOMES

On having finished the process of education - learning the student will be able to:

- Approximate "a priori" the potential characteristics of absorption of a new molecule from its physicochemical parameters
- Select the most appropriate methods to carry out studies of the intrinsic absorption of active ingredients and incorporated into formulations, considering aspects such as: use of alternative methods to experimental animals or reduction of the use of animals, sustainability and respect for the environment.
- Design experiments to carry out studies of absorption
- Analyze and interpret results
- Evaluate the possibilities of action when having a molecule with poor absorption properties
- Use scientific databases, summaries, complete articles, etc. necessary to complete his/her formation on the employment of advanced technologies.

## DESCRIPTION OF CONTENTS

### 1. Anatomico-physiological characteristics of gastrointestinal tract

Absorption in the gastrointestinal tract. Small intestine: specialization in the absorbent function. Stomach and large intestine: role in the absorption after oral administration. Drug transit and recirculation of drugs in the organism: places of loss. Mechanisms of gastrointestinal absorption: passive absorption across membrane and water pores, active mechanisms of absorption and other mechanisms of absorption. Pathologies that interfere in the gastrointestinal absorption



## **2. Prediction of the potential gastrointestinal absorption of drug candidates**

Molecular properties calculated and determined experimentally: lipophilicity, solubility, molecular weight, formation of links for bridges of hydrogen. Biopharmaceutical system of classification

## **3. In vitro, in situ, in vivo methodologies for the study of the gastrointestinal absorption**

Modelos celulares y animales. Estudios en humanos. Selección de metodología adecuada de acuerdo a los objetivos que se plantean. Diseño experimental.

## **4. Mathematical models to define gastrointestinal absorption**

In vitro-in vivo correlations

## **5. Skin structure and composition**

Stratum corneum characteristics. Physiological considerations that determine transdermal absorption. Routes of penetration across the skin and mechanisms implied. Places of access of drugs

## **6. Prediction of the potential transdermal absorption of drug candidates**

Selection of candidates for transdermal administration. Physicochemical and pharmacokinetic considerations relevant in the transdermal penetration. Chemical enhancers of transdermal absorption, mechanisms of action and possibility for use. Physical enhancers of transdermal absorption, practical usefulness.

## **7. In vitro and in vivo methodologies for studying transdermal absorption**

Criteria for membrane selection. Treatment of membranes, devices to use and experimental design. Methodologies in vivo for the study of the transdermal absorption. Animal models. Studies in humans. Selection of suitable methodology based on the aims of the studies. Experimental design.

## **8. Mathematical models applying for transdermal absorption**

In vivo-in vitro correlations

## **9. Avaluació de l'absorció intestinal d'un fàrmac model**

Viewing of audiovisual material of tests in situ and in vivo.  
Calculation of parameters in Excel. Interpretation of results.

**10. Evaluation of transdermal absorption of a model drug**

In vitro assays. Calculation of parameters in Excel. Interpretation of results.

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	18,00	100
Laboratory practices	12,00	100
Seminars	10,00	100
Development of individual work	30,00	0
Readings supplementary material	20,00	0
Preparation of practical classes and problem	10,00	0
<b>TOTAL</b>	<b>100,00</b>	

**TEACHING METHODOLOGY**

During the activities, both theoretical and practical, the applications of the subject contents in relation to the Sustainable Development Goals (SDG) will be indicated. This is intended to provide knowledge, skills and motivation to understand and address these SDGs, while promoting reflection and criticism.

Theoretical classes participative

Articles discussion (readings)

Practical cases to solve

Debates or directed discussion

Experts conference

As a communication support, the Virtual Classroom platform of the University of Valencia will be used, which allows communication between student and teachers and the storage of slides and other didactic resources that are available to students.

**EVALUATION**

Continuous evaluation (50% qualification)

Individual work (50% qualification)



## REFERENCES

### Basic

- Pharmaceutical product development. Editor: D M Chilukuri, G Sunkara, D Young. Informa healthcare, 2007
- Percutaneous Absorption: Drugs-Cosmetics-Mechanisms-Methodology. Editores: R. L. Bronaugh y H. I. Maibach. Marcel dekker. 2005
- Transdermal Drug Delivery. Editores: R. H. Guy, J. Hadgraft. Marcel Dekker. 2002
- Percutaneous Penetration Enhancers. Editores: E. W. Smith, H. I. Maibach. CRC Press. 2005
- Physiology of the gastrointestinal tract. Vols 1 y 2. Editor L.R. Johnson. Raven Press. 1986

### Additional

- In Vitro models for the intestinal barrier. The Report and Recommendations of ECVAM Workshop 46. <http://altweb.jhsph.edu/publications/ECVAM/ecvam46.htm>
- Guía para la industria Exención de los estudios de biodisponibilidad y bioequivalencia para formas posológicas orales sólidas de liberación inmediata en base a un sistema de clasificación biofarmacéutica. <http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/UCM070124.pdf>
- In Vitro Percutaneous Absorption Models R. L. Bronaugh Ann N Y Acad Sci. 2000; 919:188-91.
- Waiver of In Vivo Bioavailability and Bioequivalence Studies for Immediate-Release Solid Oral Dosage Forms Based on a Biopharmaceutics Classification System <http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/UCM070246.pdf>
- OECD Guidelines for the Testing of Chemicals, Section 4 [http://www.oecd-ilibrary.org/environment/test-no-428-skin-absorption-in-vitro-method\\_9789264071087-en](http://www.oecd-ilibrary.org/environment/test-no-428-skin-absorption-in-vitro-method_9789264071087-en)
- Topical dermatology corticosteroids: in vivo bioequivalence. <http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/UCM070234.pdf>
- Además, al comienzo del curso les serán suministradas revisiones bibliográficas especializadas en estos temas, que sirvan de base para la elaboración del trabajo individualizado

## ADDENDUM COVID-19

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

Face-to-face teaching is planned, but if attendance is not possible due to the establishment of new sanitary measures, the following addendum will be applied:



## **1. Contents**

All the contents initially programmed in the teaching guide will be kept.

## **2. Loadwork**

The weight of the different activities will be maintained.

## **3. Teaching methodology**

Upload the necessary materials to the virtual classroom, which will be adapted to the materials provided in the original guide for non-face-to-face teaching, incorporating annotations and explanatory phrases so that the student can access them at any time. Synchronous or asynchronous videoconferences by BBC will also be used, respecting the same dates and times originally programmed.

The tasks derived from the work carried out individually and in groups must be delivered through the "Task" option of the virtual classroom. If the oral presentation of the papers is required to be non-face-to-face, it will be done by BBC videoconference at the time established for the sessions.

For the Tutorials that are carried out at the request of the student, the email or virtual classroom forum will be used and if necessary by videoconference.

## **4. Evaluation**

The evaluation will be carried out in a similar way to that indicated in the teaching guide. If attendance is not possible, the relative weight of each block will be maintained as indicated in the Teaching Guide for the subject, adapting the activities to the use of the virtual classroom platform if necessary.

## **5. Bibliography**

The bibliography recommended in the teaching guide is maintained