UNIVERSITAT DE BARCELONA

**Facultat de Medicina**

**PLA DOCENT DE L'ASSIGNATURA**

## GENERAL INFORMATION

**Course unit name:** Translational Medical Research in Oncology

**Code:** 364461

**Academic year:** 2016-17

**Modality:** Optional

**Coordinator:** Josep M Llovet Bayer

**Department:** Department of Medicine

**Credits:** 3 ECTS

**Estimated hours for the course:** 75h

- **Face-to-face learning activities:** 35h (Lecture: 31h, Seminar: 4h)
- **Independent learning:** 40h

## Recommendations

B2 Level of English is required

**Further recommendations**

- Capacity to contribute to scientific debates, discuss results and analyse bibliographic studies
- Ability to understand:

  -the structure and function of genes
  -the basic molecular principles and associated mechanisms of gene expression, and the variability and evolution of genes in specific populations,
  -the role of genes in human disease and to classify genetic anomalies
  -the principal methods for diagnosing common genetic disorders

- Understanding of and ability to describe the structure, function and mechanisms of action of the principal signaling pathways and divers involved in carcinogenesis
- Capacity to provide reasoned explanations of the concept and general characteristics of disease and the mechanisms through which diseases develop.

**Requisites**

364440 - Patologia Molecular d'Òrgans i Sistemes I (Recommended)

364441 - Patologia Molecular d'Òrgans i Sistemes II (Recommended)

364476 - Biologia Cel·lular (Recommended)

364489 - Biologia del Càncer (Recommended)

364415 - Biologia Cel·lular de la Patologia (Recommended)

364414 - Biologia Cel·lular (Recommended)

364490 - Biologia del Càncer (Recommended)

364477 - Biologia Cel·lular de la Patologia (Recommended)

364407 - Estadística (Recommended)

364469 - Estadística (Recommended)

## Competences to be gained during study

**Common generic competences for all degrees**

- Capacity for learning and responsibility (capacity for analysis and synthesis, to adopt global perspectives and to apply the knowledge acquired/capacity to take decisions and adapt to new situations).

**Generic competences for the degree**

- Learning skills that are necessary to undertake further study with a high degree of autonomy.

**Specific competences for the degree**

- Ability to explain the structure and function of genes, the basic molecular principles and associated mechanisms of gene expression, and the variability and evolution of genes in specific populations, ability to identify the role of genes in human cancer and to define molecular subclasses of neoplasm, and acquire a basic understanding of oncodrivers and targeted therapies.

## Learning objectives

- Assimilate the basic concepts in translational medical research, such as personalized medicine, oncogenic addiction, gene signatures, genetic mutations, epigenetic aberrations, oncogenesis.
- Acquire knowledge in complex genomic technologies, such as microarray profiling, genome sequencing and methylation profiling.
- Understand the methodological basis of genomic analysis, and the role of bioinformatics in data mining.
- Develop the skills to find and interpret genomic information in public databases.
- Acquire knowledge in complex proteomic-based technologies.
- Study models of translational research in oncology and their impact on handling patients ("from bench to bedside").
- Acquire skill for the understanding of the rationale behind clinical trials of molecular therapies in oncology.
- Get trained in how to analyze bibliographic studies.
- Develop skills in communication of scientific knowledge
- Identify the requirements and qualities needed to develop careers in science.
- Gain knowledge of the most important pre-clinical and clinical findings that have occurred in oncology and other pathologies.
- Understand the design of clinical trials based on biomarkers: enrichment trials
- Understand cancer treatments based on scientific evidences

## Teaching blocks and contents

1.BASIC PRINCIPLES

1.1. Objectives and methodology
1.2. Biomarkers: discovery and clinical evaluation
1.3. Principles of genetic disorders
1.4. Role of epigenetics in human diseases
1.5. Bioinformatics, bases of genomic studies
1.6. Basic principles of  experimental models
1.7. Gene therapy and virotherapy
1.8. Immunology and cancer
1.9. Personalized medicine in oncology: current status and future prospects

2.HIGH-THROUGHPUT TECHNOLOGY (genomics, mutations, SNPs, proteomics, metabolomics)
- 2.1. Principles of sequencing technologies and achievements
- 2.2. Exome sequencing
- 2.3. Identification of novel drivers in oncology
- 2.4. Microarrays

3.SIGNALING PATHWAYS
- 3.1. Signaling pathways (I).
- 3.2. Signaling pathways (II): Resistance to molecular therapies

4. GENOMICS IN CANCER
- 4.1. Molecular classification of hepatocellular carcinoma
- 4.2. Molecular therapies and immunotherapy in melanoma
- 4.3. Molecular classification of breast cancer
- 4.4. Colorectal cancer: genetics and genomics
- 4.5. Deep Sequencing in colorectal cancer

5.GENOMICS IN OTHER HUMAN DISEASES
- 5.1. Next generation sequencing in hematological diseases
- 5.2. Genomics in autoimmune encephalitis
- 5.3. Genomics in autoimune diseases

6.TRIAL DESIGN AND BIOMARKERS
- 6.1. Design of Clinical Trials in the genomic era
- 6.2. Trial design and innovation (from Bench to Spin off)
- 6.3. Statistical principles for clinical trials

7.SEMINARS

## Methodology and general organization

**Lectures:**

Lectures will be in English; and students will be encouraged to actively contribute and participate in them. The presentations shown in each class will be posted on the virtual space of the UB. Thus, students will have the opportunity to prepare the topics before each class. All documents provided during the lectures will help the students to understand and integrate the presented concepts**.**

**Practical Sessions:**
There will be seminars to discuss scientific articles and translational medicine concepts:

*Journal club*: Students will analyze and discuss scientific articles under the supervision of the professors. The articles will be uploaded in the virtual space of the UB in advance so that students can prepare them before the session. Seminars will be interactive. Students will have to discuss the ideas and results presented in the selected articles.

*Presentation of data*: Groups of 3-4 students will dissect and present data from a selected original manuscript of a high impact topic in translational medicine. These presentations will follow the structure of an international scientific forum; each speech will last 10 minutes followed by 5 minutes for questions.

## Evaluation

**Evaluation criteria:** 50% of the final score will depend on the attendance and active participation in class. The remaining 50% will be obtained through a written exam and presentation of data. The written exam will be based on a multiple option test with 50 questions.
Examination reviews: The final scores will be announced at the appropriate section of the Virtual Space.

Attendance (Max.50 points) if attendance:
100% = 50 points
80% =40 points
30-80% =20 points
<30% = Subject Failure

Multi-test Exam: Max 50 points
Minimum requested= 20 points

**To pass the module, students have to score over 50 (with a minimum requested 20 points from exam; 20 points from attendance).**

## Reading and study resources

### Books

- *Translational Medicine: The Future of Therapy?*
  Autors: James Mittra and Christopher-Paul Milne
  Data: Apr 17, 2013

- *Genomic and Personalized Medicine, Second Edition: V1-2*
  Autors: Geoffrey S. Ginsburg and Huntington F Willard PhD
  Data: Nov 29, 2012

- *Translational Medicine and Drug Discovery*
  Autors: Bruce H. Littman MD and Rajesh Krishna PhD FCP
  Data: Oct 15, 2014

### Articles


- Albani S, Prakken B. *The advancement of translational medicine-from regional challenges to global solutions.* **Nat Med.** 2009;15:1006-9.

- Berger B, Peng J, Singh M. *Computational solutions for omics data*. **Nat Rev Genet**. 2013;14(5):333-46.

- Garraway LA, Lander ES. *Lessons from the cancer genome*. **Cell**. 2013;153(1):17-37.

- Hanahan D, Weinberg RA. *Hallmarks of cancer: the next generation*. **Cell.** 2011;144(5):646-74.

- Heyn H, Esteller M. *DNA methylation profiling in the clinic: applications and challenges.* **Nat Rev Genet**. 2012;13(10):679-92

- McGranahan N, Swanton C. *Biological and therapeutic impact of intratumor heterogeneity in cancer evolution.* **Cancer Cell.** 2015;27(1):15-26.

- Pardoll DM. *The blockade of immune checkpoints in cancer immunotherapy.* **Nat Rev Cancer.** 2012;12(4):252-64

- Rezza A, Sennett R, Rendl M. et al. *Adult stem cell niches: cellular and molecular components.* **Curr Top Dev Biol**. 2014;107:333-72.

- Schulze K, Imbeaud S, Letouzé E, Alexandrov LB, Calderaro J, Rebouissou S, et al. *Exome sequencing of hepatocellular carcinomas identifies new mutational signatures and potential therapeutic targets.* **Nat Genet**. 2015;47(5):505-11

- Sia D, Hoshida Y, Villanueva A, Roayaie S, Ferrer J, Tabak B, et al. *Integrative molecular analysis of intrahepatic cholangiocarcinoma reveals 2 classes that have different outcomes.* **Gastroenterology**. 2013;144(4):829-40.

- Vogelstein B, Papadopoulos N, Velculescu VE, Zhou S, Diaz LA Jr, Kinzler KW. *Cancer genome landscapes.* **Science**. 2013;339(6127):1546-58.

- Wan L, Pantel K, Kang Y. *Tumor metastasis: moving new biological insights into the clinic.* **Nat Med**. 2013;19:1450-64.

- Zucman-Rossi J, Villanueva A, Nault JC, Llovet JM. *Genetic Landscape and Biomarkers of Hepatocellular Carcinoma.* Gastroenterology. 2015 Oct;149(5):1226-1239. Nat Rev Genet. 2012;13(10):679-92.