Virology course overview

1. Teaching activity identification

The Advanced Virology course is an optional subject in the Biology degree that will be offered in the third three-month period of the year.
The number of places for this course is 48.

2. Coordination and teaching staff

The teaching activities at the UPF will be coordinated by Andreas Meyerhans (Infection Biology Group). Additional teachers will be Javier Martinez (Infection Biology Group) and Juana Díez (Molecular Virology Group). The language of the course will be English.

3. Competences

3.1 Theoretical competences

a. To know the main virus groups and the human viruses causing the most important diseases.
b. To know the elementary features of a virus to be successful.
c. To know how different viruses utilize the target cell for amplifying their genomes and to expand in numbers.
d. To know how viruses manage to expand within a host organism and avoid immune-mediated destruction.
e. To know some fundamental mechanisms of viral-induced pathogenesis.
f. To know how to get rid of viruses.
g. To know about the use of viruses for medical benefit (i.e. gene therapy and anti-cancer treatment).

3.2 Practical competences

a. To visualize cytopathic effects of viruses.
b. To diagnose viral infections of humans.
c. To determine features of proliferating immune cells by CFSE staining and analysis of the dye distribution amongst cell generations.

4. General objectives

The teaching project addresses the 3 fundamental aspects that any virus has to handle: (i) how to amplify within a cell, (ii) how to amplify within a whole organism and (iii) how to spread within a population of organisms. With this, the students will be provided with a broad and general knowledge of modern Virology. The discussion on how viruses enter target cells, amplify their genomes and exit from these target cells will give a general view on the intimate relationship of viruses and cells, and will highlight the importance of host factors for virus survival. The discussion on the expansion of viruses within host organisms will emphasize the ongoing struggle between viruses with the immune system, and will address the ways that viruses use to outmanoeuvre host defences. The intra-host dynamics and the transmission dynamics of viruses will be presented to understand what a virus needs to be successful. Finally, fundamental outcomes of infections will be discussed as well as ways to inhibit infections or utilize them for medical benefit.

The main goal of the course is to teach the students in a way that they are able to understand the concepts more than memorize details. It should strengthen their critical thinking and enable them to integrate these concepts with others from different scientific disciplines.

5. Specific objectives

During this course, the specific objectives within each lecture or practical session will be provided to the students.

6. Teaching methodology

A main aim of the course is to spark the student's interest and curiosity in Virology and related disciplines and to promote their active participation during the lectures

The proposed teaching activities are as follows:

6.1 Lectures

Graphic support will be used in the lectures (Powerpoint slides). All presentations will be uploaded in "Aula Global", so that the students have access to them and can prepare the topics before the lectures.

To promote the students participation during the lectures, some of the following activities will be used:
(i) short questions that address basic issues of the topic just learned, or questions about social or scientific impacts.
(ii) Short presentations about Virology news published in normal media or in specialised journals.

6.2 Seminars

Some important topics in Virology will be given within seminars. The students will actively participate. Topics will be chosen from articles published in relevant journals and students will present the data to be discussed.

6.3 Practical work

Practical work will complement some of the topics learned in the theoretical classes. Besides the mere learning of how to work in a Virology laboratory, the experimental results and their applications will be discussed to promote the understanding of the whole experimental set-up.

6.4 Evaluation

The unified methods of evaluation that are already established in the educational system of the UPF will be applied. In addition, we will include continuous evaluation.
The different evaluation methods will include:

(i) Continuous evaluation: the participation of students in the practical work and the seminars will be evaluated.

(iii) Final evaluation: A test will be performed at the end of the course that will include short assay questions.

To pass the course, students must (i) participate in the seminars and practical activities and have to get at least 5 points from the 10 possible points of the whole course; (ii) obtain at least 40% within the final evaluation excluding practical work questions.

Final evaluation (including practical work): 6 points (+ 2 points)
Seminars: 2 points

6.5 Course retake

Students not passing the course evaluation will have another opportunity in July with the exam retake, following the same methodology described for the final evaluation (section 6.4).
In no case students can retake the continuous evaluation established during the course (participation in practical course and seminars). The results of this evaluation will be maintained during the whole course.

6.6 Final considerations

All students will have to read scientific articles and make an oral presentation within the seminars or the practical part of the course. Respective PowerPoint slides can be prepared within small groups of students.

7. Bibliography

- "Principles of Virology" Flint S.J., Enquist L.W., Racaniello V.R., Skalka A.M. 2008, 3rd edition, ASM Press.
- "Fields Virology" David M. Knipe, PhD, Peter M. Howley, MD, Diane E Griffin MD, PhD, Robert A Lamb, PhD, ScD, Malcolm A Martin MD, Bernard Roizman ScD, and Stephen E Straus, MD. 2007, 5th edition, Lippincott Williams & Wilkins.
- "Basic Virology" Edward K. Wagner, Martínez J. Hewlett, David C. Bloom, David Camerini. 2007, 3rd edition, Wiley-Blackwell.
- "Introduction to Modern Virology" N.J. Dimmock, A.J. Easton, K.N. Leppard. 2007, 6th edition, Wiley-Blackwell.
- "Janeway's Immunobiology" K. Murphy, P. Travers, M. Walport. 2011, 8th edition, Garland Science.
- "Understanding viruses" Teri Shors. 2nd ed. Burlington: Jones & Bartlett Learning, cop. 2013

8. Course program

Theoretical credits (20 hrs)

I. Virus-cell interactions

Viruses depend on cells to amplify. Thus, viruses can exist only when more particles leave the infected cell than get in. The lectures will cover the main mechanisms of how the different viruses perform this task.

II. Virus-host interactions

Human viruses need to overcome human immune defences and spread with sufficient efficiency between individuals. The lectures will address the main outcomes of infections, will discuss the tricks that viruses use to overcome immune restriction, present ways how to stop virus spread and give examples of beneficial viral effects.

Seminars (8 hrs)

Interesting topics in Virology will be selected from the literature. Students will give presentations that will be discussed within the whole course.

Practical work (16 hrs)

The practical work will cover demonstrations, experiments and theoretical aspects of virus effects on cells and organisms including viral cytopathic effects, virus diagnosis and virus-induced immune cell proliferation.

In general, viruses are restricted to infect certain cell types. This is due to specific interactions between viral proteins with cellular receptors. When a cell then fully supports viral growth, cytopathic effects (CPEs) are commonly observed. A number of CPEs for different viruses will be demonstrated and discussed.

The diagnosis of a viral infection is an important part of infectious disease management. Different tests will be carried out, and results and implications will be discussed.

Upon a virus infection of a host, cells of the adaptive immune response are stimulated and start to proliferate. Via fluorescence-staining of cells with CFSE and subsequent analysis of the label distribution between the different cell generation, basic features of proliferating immune cell populations can be analysed. Respective experiments will be performed in small groups depending on the total number of participants.