# Applied Evolutive Genetics 2015/2016

Code: 42927
ECTS Credits: 6

| Degree | Type | Year | Semester |
|---|---|---|---|
| 4313802 Advanced Genetics | OT | 0 | 1 |

## Contact

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## Use of languages

Principal working language: english (eng)

## Teachers

Hafid Laayouni el Alaoui

## Prerequisites

Toda la biología converge en la evolución. El análisis evolutivo integra, y por lo tanto requiere, conocimientos de todas las disciplinas de la biología. Para un seguimiento adecuado de la asignatura es MUY IMPORTANTE partir de los siguientes conocimientos previos:

Comprensión de conceptos transversales de matemáticas y biometría (azar, variable aleatoria, variables discretas y variables continuas, modelo matemático, funciones de distribución, distribución de Poisson, distribución binomial, distribución multinomial, distribución chi-cuadrado, distribución normal, muestras y poblaciones, estadísticos y parámetros, medidas de tendencia central y de dispersión, medidas de relación, correlación y causalidad, inferencia estadística, error de muestreo, sesgo y dispersión, hipótesis nula, prueba de hipótesis, intervalo de confianza, nivel de significación, error experimental, diseño experimental, replicación, aproximación no paramétrica, pseudoreplicación, simulación, aproximación bayesiana), impartidos en las asignaturas de Matemáticas (1º curso) y Bioestadística (1º curso).

## Objectives and Contextualisation

As defined by the Stanford Encyclopedia of Philosophy, *Evolutionary Genetics* is the broad field of studies that result from the integration of Genetics and Darwinian evolution. The central challenge of Evolutionary Genetics is to understand how the basic evolutionary processes shape the enormous biodiversity observed in nature.

The course presents the principles of Evolutionary Genetics and discusses some major open problems, ideas and empirical results. **The course is designed to elicit your own, original questions about Evolutionary Genetics.**

## Skills

- Demonstrate responsibility in management of information and knowledge.
- Design and apply scientific methodology in resolving problems.
- Identify and propose scientific solution for problems related to genetic research at both molecular and organism levels and demonstrate an understanding of the complexity of living beings.
- Integrate genetic analysis at different levels of complexity (molecular, cell, individual, population) to coherently resolve different problems in the area of genetics.

- Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
- Students should know how to apply the knowledge they acquire and be capable of solving problems in new or little-known areas within broader contexts (or multidisciplinary contexts) related to their area of study
- Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously
- Use and manage bibliographical information and other resources related to genetics and related fields.
- Use scientific terminology to argue the results of the research and show how to communicate in spoken and written English in an international setting.

## Learning outcomes

1. Apply bibliographical information on genetic evolution to understand evolutive processes
2. Apply the methodology and knowledge acquired in solving practical problems of evolutive genomics.
3. Demonstrate advanced knowledge of evolutive genetics and its applications.
4. Demonstrate responsibility in management of information and knowledge.
5. Demonstrate up-to-date knowledge of methods of molecular analysis of genetic and genomic variability.
6. Demonstrate up-to-date knowledge of the biocomputing methodology of interest in evolutive genetics.
7. Preparation and presentation of seminars
8. Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously
9. Use scientific terminology to argue the results of the research and show how to communicate in spoken and written English in an international setting.
10. Write a report that considers the use of the methodology used in the module to resolve a specific problem
11. Write critical summaries about the taught seminars

## Content

1. *The history of Evolutionary Genetics*
2. *The origin of life*
3. *Adaptive evolution: Natural selection*
4. *Phenotypic evolution*
5. *Detecting natural selection using genome sequences I.*
6. *Detecting natural selection using genome sequences II.*
7. *Conflict and cooperation*
8. *Neutral evolution: Genetic drift*
9. *Clinal variation*
10. *Species and speciation*
11. *From Darwin to the Genome*
12. *Association studies: How to identify the genes that matter for evolution*
13. *Evolutionary potential: Can species cope with global warming?*

## Methodology

Los contenidos de la asignatura se orientan a que los estudiantes reciban una introducción general a los conceptos básicos del pensamiento y la teoría evolutiva.

Clases de teoría: El alumno adquiere los conocimientos científicos propios de la asignatura asistiendo a las clases de teoría que complementará con el estudio personal de los temas expuestos.

Exposición de trabajos: Los alumnos expondrán y discutirán diversos artículos que cubren varios aspectos relevantes de Evolución.

## Activities

| Title | Hours | ECTS | Learning outcomes |
|---|---|---|---|
| **Type: Directed** | | | |
| Preparation and presentation of seminars. Write critical summaries about the taught semenars. | 25 | 1 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 |
| Theoretical Seminars | 45 | 1.8 | |
| **Type: Autonomous** | | | |
| Biographical search | 15 | 0.6 | 1, 4, 9 |
| Study | 60 | 2.4 | 1, 2, 4, 7, 9, 11 |

## Evaluation

**Students have to write a short paper on a topic of your interest and present it to the rest of the class. A take-home final will address some questions discussed during the course.**

## Evaluation activities

| Title | Weighting | Hours | ECTS | Learning outcomes |
|---|---|---|---|---|
| Seminar presentation | 100% | 5 | 0.2 | 3, 7, 8, 11 |

## Bibliography

Basic books:

Barton, N. H., D. E. G. Briggs, J. A. Eisen, D. B. Goldstein, N. H. Patel. 2007. *Evolution*. ColdSpringHarbor Laboratory Press, New York.

Fontdevila, A. 2011. *The Dynamic Genome*. *A Darwinian Approach*. OxfordUniv. Press, Oxford.

Futuyma, D. J. 1998. *Evolutionary Biology*, 3rd ed. Sinauer Associates, Sunderland, Massachusetts.