



POLITÉCNICA



E.T.S. DE INGENIERÍA AGRONÓMICA,  
ALIMENTARIA Y DE BIOSISTEMAS

### **Título de las prácticas/ Title of the practical**

Predicting the evolution of spontaneous multi-drug resistance in bacteria: a modelling approach.

### **Descripción de las funciones del alumno / Description of student's tasks**

Antibiotic resistance is one of the foremost societal challenges of our time, accounting every year for 25,000 deaths and >€1.5 billion in the EU alone (Kraker 2011, *PLoS Medicine*). Consequently, much research effort is being poured into finding ways to predict the evolutionary routes that bacterial populations may follow to escape the action of antibiotics (Sommer 2017, *Nature Rev Microbiol*). An important insight gained over the last decade is that the interaction among different mutations (that is, epistasis) is a key factor to consider in this conversation: it may accelerate multi-drug resistance evolution if interactions are synergistic, or slow it down if antagonistic (Trindade 2009, *PLoS Genetics*). However, knowledge of the epistatic interactions among resistance mutations alone may not suffice to be able to predict the most probable evolutionary routes. Previous work from the host lab has shown that historical contingency can play an outsized role in controlling the degree of (un)predictability (Couce 2016, *Genetics*), at least in the case of a single drug treatment. The candidate will develop a computer simulation model to expand these analyses to the scenario of multiple drug treatments, including key realistic features such as complex epistatic interactions, variation in mutation rate and fitness cost of each mutation.

### **Requisitos / Requirements**

Computational Biology Master student with basic bioinformatics skills (alignment software, R, Python...), motivated and curious about exploring fundamental questions in evolutionary genetics. Modelling experience in R will be considered a plus, although if needed training will be provided by the host. Good command of scientific English, or good disposition to develop your language skills.

### **Proyecto formativo / Training program**

EXTERNAL PRACTICAL module. The fundamental objective of the External



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Practices is to teach the student to apply in the real world the knowledge that he has previously acquired in a group work environment that reproduces in a realistic way the things that can be found in his future place of work. The student can become familiar with the working world (schedules, responsibility, attitude, organization, etc.), and with the work methodology appropriate to the professional reality, contrasting and applying the academic knowledge acquired.

***Actividades a desarrollar en la práctica académica / Activities to carry out during the academic practical***

You will join a multidisciplinary team with highly motivated, expert mentors that combine experiments with computer analyses to understand fundamental principles in evolutionary genetics and genomics. Taking advantage of this expertise, you will be expected to:

- i) Acquire a critical understanding of the literature on antibiotic resistance and on predicting evolution.
- ii) Build a working knowledge of computer modelling to explore open questions in evolutionary genetics.
- iii) Develop your critical thinking, creativity and scientific communication skills during lab seminars and one-on-one meetings with the Principal Investigator.

<b>Nº de plazas:</b>	<b>1</b>
<b>¿El alumno tendrá trato habitual con menores?</b>	<b>No</b>
<b>Fecha de inicio:</b>	<b>01/02/2021</b>
<b>Fecha de fin:</b>	<b>30/06/2021</b>
<b>Horas semanales:</b>	<b>25</b>



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<b>Horario jornada laboral:</b>	<b>Flexible</b>
<b>Importe Ayuda/Bolsa de estudio:</b>	<b>€/mes</b>
<b>Tutor académico:</b> Email:	<b>Jesús Israel Pagán Muñoz</b> <b>jesusisrael.pagan@upm.es</b>
<b>Departamento tutor académico:</b>	<b>Biotecnología - Biología Vegetal</b>
<b>Tutor empresa:</b>	<b>Alejandro Couce</b>
<b>Email tutor empresa:</b>	<b>a.couce@upm.es</b>
<b>Departamento tutor empresa:</b>	<b>CBGP</b>
<b>Ubicación de la estancia de las practicas</b>	<b>Campus de Montegancedo - UPM</b>
<b>ENTIDAD COLABORADORA:</b>	<b>UPM</b>
<b>A cumplimentar por Oficina Prácticas ETSIAAB: Créditos a reconocer (Nº ECTS):</b>	

**Enviar por email a: OFICINA DE PRÁCTICAS ACADÉMICAS EXTERNAS - ETSIAAB**

secretaria.pei.etsiaab@upm.es - Secretarias: Visitación Pérez / Susana Pardo -  
Tfno: 913363686)