



Master on Integrative Synthetic Biology

Engineering Molecular and Cellular Systems

2nd Edition. 2022-2024

Semester 1 (10/2022 – 02/2023)

M1. FUNDAMENTALS (25 ECTS)

M1a. Basic principles & research topics (15 ECTS): ASSEMBLY & SYNTHESIS, BIOFACTORIES

M1b. TOOLS (10 ECTS)

- 3 days of classes per week (Tues, Wed, Thu): up to 3 classes / 1 h (morning; 10:00, 11:15, 12:30) + afternoon sessions (optional)
- Mon and Fri reserved for tutorials, journal clubs, **FRONTIERS** activities of the semester

M2. FRONTIERS I (2-3 seminars & 1-2 workshops)

FUNDAMENTALS 0 (03-07/10/2022)

INTRODUCTORY SESSIONS: Essentials of SynBio and related disciplines

Coordination: MISB team

FUNDAMENTALS 1 (10/10/2022 – 30/11/2022)

Engineering molecular systems (bottom-up approaches)

ASSEMBLY & SYNTHESIS (I) + TOOLS (I)

Coordination: ASSEMBLY & SYNTHESIS (I) – R Pérez, S Martín-Santamaría & G Rivas (CIB). TOOLS (I): B Monterroso, S Zorrilla & G Rivas (CIB)

FUNDAMENTALS 2 (***/12/2021 – ***/01/2023)

Engineering cellular systems (top-down approaches)

ASSEMBLY & SYNTHESIS (II) + TOOLS (II)

Coordination: R Giraldo & J Nogales (CNB); J Buceta & J Peretó (I₂SysBio)

EXAM F1 (***/12/2022)

FUNDAMENTALS 3 (***/01/2023 – ***/02/2023):

BIOFACTORIES + TOOLS (III)

Coordination: BIOFACTORIES - J Barriuso (CIB) & J Nogales (CNB). TOOLS (III) J Nogales (CNB); I Otero & J Buceta (I₂SysBio)

EXAM F2+F3 (***/02/2023)

Semester 2 (03/2023 – 06/2023)

M2. FRONTIERS I (5-6 seminars & 2-3 workshops) – engineering synthetic and natural systems

M3. EXTENSION I

M4 LAB ROTATIONS I

04-08/10/2022 FUNDAMENTALS 0 – Welcoming and Introductory Lectures		
Day	Lectures / Activities (Teachers)	Room
03/10	11:00 – 13:00: Welcoming. Introduction to the MISB + practical aspects / questions (MISB team)	CIB Lecture Hall (LH) (*) on-line
04/10	SYNTHETIC BIOLOGY AND ORIGINS OF LIFE 10:00 – 11:00. Synthetic Biology – a diversity of approaches (Germán Rivas, CIB) 11:30 – 12:30. Synthetic Biology – story of a yearning (Juli Peretó, I2SysBio) 13:00 – 14:00 Lunch (students and teachers) 15:00 – 15:45. The chemical origins of life: metabolism (Juli Peretó, I2SysBio) 15:45 – 16:30. The RNA world (Susanna Manrubia, CNB) 16:30 – 17:15. Protocell: what is in a name (Kepa Ruiz-Mirazo, Biofisika)	CIB (LH) (*) on-line (*) on-line
06/10	CHEMISTRY FOR SYNTHETIC BIOLOGY: BASICS (Sonsoles Martín-Santamaría & Ruth Pérez, CIB) 10:00-11:00. The chemistry of functional groups in molecules of biological interest. 11:30-12:30. Conformation and tautomerism. Role in molecular recognition and biological function. Case studies. BREAK 15:00-16:30 Chirality. Stereoisomerism. Shape. Case studies.	CIB (LH) (*) on-line
07/10	MATH FOR SYNTHETIC BIOLOGY: BASICS (Javier Buceta, I2SysBio) 10:00-11:00. Math Basics 1 11:30-12:30. Math Basics 2 BREAK 15:00-16:30. Math Basics 3	(*) on-line
08/10	MISB2 OPENING LECTURE Prof. Tom Ellis (Imperial College London) 10:00 - 11:00. Future challenges of synthetic biology 11:00 – 11:45. Colloquium with students (coordinators: Víctor de Lorenzo & Rafael Giraldo, CNB; Germán Rivas, CIB)	CNB (LH) (**) on-line

(*)

<https://rediris.zoom.us/j/86174007478>

ID: 861 7400 7478

Code: 929694

(**) TBA

FUNDAMENTALS 1

Engineering molecular systems (bottom-up approaches)

ASSEMBLY & SYNTHESIS (I) + TOOLS (I)

ASSEMBLY AND SYNTHESIS (I) *Proto-cellular systems and origins of life. The macromolecules of life and their interactions. Cellular machines driving essential processes: information processing (replication, transcription, translation); self-organization (growth, division, mobility, transport). Bottom-up SynBio – biochemical reconstitution; self-organization; minimal systems and synthetic life.*

TOOLS (I) *Integrated structural biology and molecular biophysics (NMR, XRC, EM); molecular interactions (AUC, fluorescence-based tools). Advanced imaging tools. Computational structural and chemical biology. Protein biotechnology – protein engineering and production. Cell-free systems for biomolecular production and functional assays. Compartments: generation and control using microfluidics. Molecular systems chemistry and engineering*

10/10/2022 – 30/11/2022		
FUNDAMENTALS 1 (engineering molecular systems – bottom-up approaches)		
ASSEMBLY & SYNTHESIS (I) + TOOLS (I) + FRONTIERS I		
Day	Lectures / Activities (<i>Teachers</i>)	Room
	Lectures ASSEMBLY & SYNTHESIS I (in black) Lectures TOOLS 1 (in blue)	
11/10/22	10:00 – 10:30. Introduction to FUNDAMENTALS 1 (<i>Germán Rivas, CIB</i>) • MOLECULES OF LIFE AND THEIR INTERACTIONS 10:45 – 11:45. Macromolecules and small molecules. Molecular recognition (<i>Sonsoles Martín-Santamaría, CIB</i>) 12:00 – 13:00. Non-covalent interactions (<i>SMS, CIB</i>) 15:00 – 16:00. Basis of the Chemical Biology (<i>Ruth Pérez, CIB</i>)	CIB
12/10/22	HOLIDAY	
13/10/22	10:00 – 11:30. Biochemistry (molecular interactions) in the test tube and the living cell: implications for synthetic biology research (<i>Germán Rivas - CIB</i>) 12:00 – 13:30. Lipids and membranes – essential concepts & assembly (<i>Iván López-Montero – UCM</i>)	CIB
14/10/22		
17/10/22		
18/10/22	10:00 – 11:00. Carbohydrates: molecular recognition (<i>Javier Cañada – CIB</i>) 11:15 – 12:15. Nucleic acids: natural and synthetic (<i>Carlos González – IQFR</i>) 12:30 – 13:00. Journal club: tutorial (<i>Germán Rivas – CIB</i>) 15:00 – 16:00. Bottom-up biology: a biophysical approach (<i>Iván López-Montero – UCM</i>)	CIB

19/10/22	<ul style="list-style-type: none"> ESSENTIAL CELLULAR PROCESSES <p>10:00-11:00. Information processing: replication (<i>TBA</i>) 11:15-12:15. Information processing: transcription (<i>Carlos Fdez-Tornero, CIB</i>) 12:30-13:30. Information processing: translation (<i>Mikel Valle, BioGune</i>)</p>	CIB
20/10/22	<p>10:00 – 12:00. Protein folding and assembly (<i>Douglas Laurents, IQFR</i>) 12:30 – 13:30. Protein modifications (<i>Dolores Pérez-Sala, CIB</i>)</p>	CIB
21/10/22		
24/10/22		
25/10/22	<p>10:00 - 11:00. Organization: cytoskeleton / cell division (<i>Germán Rivas, CIB</i>) 11:30 – 13:00. Organization: cytoskeleton / Intracellular traffic (<i>Miguel Á. Peñalva, CIB</i>)</p> <p>15:00 – 16:00. Organization: signaling and cell adhesion (<i>Daniel Lietha, CIB</i>)</p>	CIB
26/10/22	(Journal Club preparation)	
27/10/22	10:00 – 13:00. JOURNAL CLUB 0	CIB
28/10/22	<p>FRONTIERS SEMINAR <i>Bert Poolman (Univ. Groningen)</i> 12:00 - 13:00. TBA 13:00 – 13:45. Colloquium with students</p>	CIB
31/10/22		
01/11/22	HOLIDAY	
02/11/22	<ul style="list-style-type: none"> INTEGRATED STRUCTURAL BIOLOGY <p>10:00 – 11:00. Introductory remarks (<i>Carlos Fdez. Tornero, CIB</i>)</p>	CIB
03/11/22	<p>- INTEGRATED STRUCTURAL BIOLOGY: X-Ray crystallography tools <i>Coord: Cristina Vega (CIB); Armando Albert & Juan A Hermoso (IQFR)</i></p> <p>10:00-10:45. Fundamentals of X-ray Crystallography: from molecules to crystals and beyond (<i>Juan A Hermoso, IQFR</i>) 11:00-11:30. Membrane Maintenance at Contact Sites (<i>Armando Albert, IQFR</i>) 12:00 12:30. Glyco-Synthetic Biology (<i>Julia Sanz, IQFR</i>) 12:30 13:00. Conformational Versatility in Protein Complexes (<i>Cristina Vega, CIB</i>)</p> <p>14:30-16:30. Practical session: Crystallization, data collection and structure solution (<i>Lourdes Infantes & Beatriz González, IQFR</i>)</p>	IQFR
04/11/22		

07/11/22		
08/11/22		
09/11/22	HOLIDAY	
10/11/22	<p>- INTEGRATED STRUCTURAL BIOLOGY: Electron microscopy tools <i>Coord: Ernesto Arias & Carlos F Tornero (CIB)</i></p> <p>10:00 - 11:00. EM – fundamentals (<i>Ernesto Arias, CIB</i>) 11:15 – 12:15. EM – reconstructing cellular machines (1) (<i>CF Tornero, CIB</i>) 12:30 - 13:30. EM – practical workshop (<i>F Escolar & R Núñez, CIB</i>)</p> <p>15:30 - 16:30. EM – reconstructing cellular machines (2) (<i>J Conesa, CNB</i>) 16:30 - 17:00. EM – practical workshop (<i>J Conesa, CNB</i>)</p>	<p>CIB</p> <p>CNB</p>
11/11/22		
14/11/22		
15/11/22	<ul style="list-style-type: none"> MOLECULAR INTERACTIONS <p>- MOLECULAR INTERACTIONS: Computational tools. <i>Sonsoles Martín-Santamaría, CIB</i></p> <p>10:00-11:00. Fundamentals 11:15-12:15. Applications 12:30-13:30. Practical cases</p>	CIB
16/11/22	<p>- MOLECULAR INTERACTIONS: Biophysical tools.</p> <p>10:00-11:00. Analytical ultracentrifugation, light scattering (<i>JR Luque, C Alfonso, CIB</i>) 11:15-12:15. Fluorescence spectroscopy (<i>S Zorrilla, CIB</i>) 12:30 – 13:30. Calorimetry (ITC), circular dichroism (<i>B Monterroso, CIB</i>)</p> <p>15:00 – 16:30. Molecular interactions - practical workshop (<i>JR Luque & C Alfonso, CIB</i>)</p>	CIB
17/11/22	<ul style="list-style-type: none"> CHEMICAL BIOLOGY <p>10:00 – 12:00. Chemical biology tools – chemical systems and probes (<i>R. Pérez CIB</i>)</p>	CIB
18/11/22	<p>FRONTIERS SEMINAR <i>Evan Spruijt (Univ. Radboud, Nijmegen, NL)</i></p> <p>12:00 - 13:00. TBA 13:00 – 13:45. Colloquium with students</p>	
21/11/22	<p>FRONTIERS SEMINAR <i>Joachim Spatz (MPI-Mol.Medicine – Heidelberg)</i></p> <p>12:00 - 13:00. TBA</p>	

	13:00 – 13:45. Colloquium with students	
22/11/22	<ul style="list-style-type: none"> IMAGING - IMAGING (1) 10:00-12:00. Confocal and multi-D microscopy (MA Peñalva, CIB)	CIB
23/11/22	<ul style="list-style-type: none"> PROTEIN PRODUCTION SESSION <i>Coord: C Vega (CIB), A Albert (IQFR)</i> 10:00-10:45. Fundamentals of protein production tools (C Vega, CIB) 11:00-11:45: Membrane protein production (D Lietha, CIB) 11:45-12:30: Antibody production in cell-free systems (FJ Fernández, Abvance) 15:00-15:45: Cell-free expression systems (C Fernández, I2SysBio)	CIB
24/11/22	<ul style="list-style-type: none"> MICROFLUIDICS in Synthetic Biology 10:00 – 11:00. Fundamentals in microfluidics design (J Buceta, I2SysBio) 11:15 – 12:15. Microdroplets in microfluidics (B Monterroso, CIB) 12:30-13:30. Microfluidics – Practical sesión (B Monterroso & S Zorrilla, CIB)	On-line CIB CIB
25/11/22		
28/11/22		
29/11/22	- IMAGING (2) 10:00 – 12:00: Single-molecule and super-resolution tools (M Nollmann, CBS Montpellier)	On-line
30/11/22	- INTEGRATED STRUCTURAL BIOLOGY: NMR tools <i>Coord: F Blanco & J Cañada (CIB); J Oroz & C González (IQFR)</i> 10:00 - 11:00. NMR – fundamentals (F Blanco, CIB) 11:15 - 12:15. NMR - Nucleic acids (C González, IQFR) 12:30 - 13:30. NMR – Proteins (J Oroz, IQFR) 15:30 - 16:30. NMR – practical session (FJ Cañada, CIB)	Morning IQFR Afternoon CIB

FUNDAMENTALS 2 (***/12/2021 – ***/01/2023)

Engineering cellular systems (top-down approaches)
 ASSEMBLY & SYNTHESIS (II) + TOOLS (II)

FUNDAMENTALS 3 (***/01/2023 – ***/02/2023):




BIOFACTORIES + TOOLS (III)




Master on Integrative Synthetic Biology

Engineering Molecular and Cellular Systems 2nd Edition. 2022-2024

01/12/22 – 19/12/22		
FUNDAMENTALS 2 (Engineering cellular systems – top-down approaches)		
ASSEMBLY & SYNTHESIS (II) + TOOLS (II) + FRONTIERS		
Day	Lectures / Activities (Teachers)	Room
	Lectures ASSEMBLY & SYNTHESIS or BIOFACTORIES (in black) Lectures TOOLS (in blue)	
01/12/22	10:00-11:00 Revisiting basic calculus tools: Introduction to ODEs (protein expression model) 11:15-12:15. Analysis of Nonlinear ODEs (and implications in biological function): phase space analysis and bifurcations (I) 12:30-13:30. Analysis of Nonlinear ODEs (and implications in biological function): phase space analysis and bifurcations (II) (<i>J Buceta, I₂SysBio</i>)	On-line (*)
02/12/22	10:00 - 11:00. Bacteria boost the immune system against cancer (<i>E Veiga, CNB</i>) 11:15 - 12:15. Amyloids as constructive parts in SynBio (<i>R Giraldo, CNB</i>) 12:30 - 13:30. New tools to study plasmid-mediated antimicrobial resistance (<i>A San Millán, CNB</i>)	CNB
05/12/22	No classes	
06/12/22	HOLIDAY	
07/12/22	No classes	
08/12/22	HOLIDAY	
09/12/22	No classes	
12/12/22	11:00-13:00. EXAM F1 (Assembly & Synthesis I)	CIB
13/12/22	10:00 - 11:00. An introduction to Biomolecular Networks in Synbio (I): from gene-regulatory networks to metabolic pathways. Introduction to Biocircuits (<i>I Otero-Muras</i>) 11:15 - 12:15. An introduction to Biomolecular Networks in Synbio (II): from the reaction graph to dynamics (<i>J Buceta</i>) 12:30 – 13:30. FRONTIERS. Optimization in Systems and Synthetic Biology (<i>JR Banga, Computational Biology Lab, MBG-CSIC, Pontevedra</i>)	On-line (I ₂ SysBio) (*) On-line (**)
14/12/22	10:00 - 11:00. Introduction to Metabolic Network Analysis (<i>P Carbonell, I₂SysBio</i>) 11:15 - 12:15. Standards in synthetic biology (<i>M Porcar, I₂SysBio</i>) 12:30 - 13:30. Clocks and rules in life in the context of SynBio (<i>S Ares, CNB</i>)	On-line (*)
15/12/22	10:00 - 11:00. Optogenetics (<i>R Giraldo, CNB</i>) 11:15 - 12:15. Assembling structured microbial ecosystems (<i>E Martínez, CNB</i>) 12:30 - 13:30. Introduction to plant synthetic biology and its biotechnological applications (<i>E González, CNB</i>) 15:00 – 16:00. The SEVA project as a standardization approach (<i>E Martínez, CNB</i>) 16:00 – 17:00. Large-scale and high-throughput genome editing (<i>T Aparicio, CNB</i>)	CNB

16/12/22	<p>10:00 - 11:00. Therapeutic bacteria: from probiotics to synthetic biology (LA Fernández, CNB)</p> <p>12:00 – 13:00. FRONTIERS. Daring the limits of chemistry in living cells by engineering synthetic metabolism for biofluorination (<i>P Nickel, Novo-Nordisk</i>)</p>	<p>On-line  (*)</p> <p>CIB (on-site)</p>
19/12/22	<p>10:00 - 11:00. Analysis of biological networks: a complex-network approach (<i>F Pazos, CNB</i>)</p> <p>11:15 - 12:15 Bottom-up assembly of microbial ecosystem from metagenome data (<i>J Tamames, CNB</i>)</p> <p>12:30 – 13:30. Sequence-based assignment of protein functional sites (<i>F Pazos</i>)</p>	<p>On-line  (*)</p>
20/12/22	<p>10:00 – 11:00. Making Biological Switches (<i>I Otero-Muras, I₂SysBio</i>)</p>	<p>On-line  (*)</p>
22/12/22 08/01/23	<p>HOLIDAY BREAK</p>	
09/01/23	<p>11:00 – 13:00. EXAM F1 (Tools)</p>	<p>CIB</p>
10/01/23 17/02/23	<p>FUNDAMENTALS 3 In mid-December, we will announce the F3 program/calendar</p>	<p>CIB I₂SysBio (online) CNB ICP</p>

 Similar protocol as for the on-line classes of F1. Otherwise, shortly, we will announce the alternative link to attend them.

 Similar protocol as for the on-line FRONTIERS seminars. Shortly, we will announce the link to attend it.



Master on Integrative Synthetic Biology

Engineering Molecular and Cellular Systems

2nd Edition. 2022-2024 Version **17/01/2023**

Semester 1 (10/2022 – 02/2023)

FUNDAMENTALS 3 (11/01/2023 – 20/02/2023):

BIOFACTORIES + **TOOLS (III)**

Coordination: BIOFACTORIES - J Barriuso (CIB) & J Nogales (CNB). TOOLS (III) J Nogales (CNB); I Otero & J Buceta (I₂SysBio)

EXAM F2+F3 (22/02/2023)

ENZYMES ENGINEERING FOR BIOTRANSFORMATIONS

- Enzyme biocatalysis for green chemistry: biotransformations mediated by microbial hydrolases
- Genome mining and rational design of new biocatalysts for lignocellulose biorefineries
- Design of tailor-made biocatalysts by enzyme directed evolution
- The revolution of directed evolution
- [Directed Evolution of Proteins in vivo](#)

INDUSTRIAL BIOTECHNOLOGY

- Metabolic engineering of food-producing yeasts
- Systems metabolic engineering for bacterial biodegradation/bioconversion of aromatic compounds
- Carbon dioxide and hydrogen as feedstock for bacteria
- Biotechnology with metals: new challenges
- Nanotechnological tools: Dendrimeric and magnetic nanoparticles
- [High-throughput pathway assembly and optimization](#)
- [Genome-Scale Metabolic Modeling](#)

POLYMERS BIOTECHNOLOGY

- Domesticating bacteria for tailored bioplastic production
- Engineering microbial cell factories by adaptive laboratory evolution
- Synthetic genomes and their evolution

SYNTHETIC DISTRIBUTED BIOCATALYSIS

- Biofactories based on synthetic bacterial compartmentalization
- Synthetic communities-based biofactories
- Microbial cell to cell communication in biotechnology

IN SILICO SYN BIO

- [Bacterial computing](#)
- [Biocircuits & functional motifs](#)
- [Synthetic Biocircuit Design](#)
- [Challenges in synbio design](#)
- [Metabolic engineering design](#)
- [Other related topics](#)

F3 – BIOFACTORIES + TOOLS (III)		
JANUARY 2023		
Day	Lectures / Activities (Teachers)	Room
09/01/23		
10/01/23	EXAM F1 (TOOLS)	10:00 - CIB
11/01/23	10:00-11:00: Biocircuits & functional motifs (1): introduction, parts, systems and devices (<i>I. Otero, I2SysBio</i>) 11:15-12:15: Biocircuits & functional motifs (2): feedforward Loops (<i>J. Buceta I2SysBio</i>)	ON-LINE
12/01/23	10:00-11:00: Synthetic Biocircuit Design (<i>I. Otero, I2SysBio</i>) 11:15-12:15: TBA 12:30-13:30: TBA	ON-LINE
13/01/23		
16/01/23		
17/01/23	10:00-11:00: Enzyme biocatalysis for green chemistry: biotransformations mediated by microbial hydrolases (<i>A Prieto, CIB</i>) 11:15-12:15: Genome mining and rational design of new biocatalysts for lignocellulose biorefineries (<i>FJ Ruiz-Dueñas, CIB</i>)	CIB CIB
18/01/23	10:00-11:00: Design of tailor-made biocatalysts by enzyme directed evolution (<i>S Camarero, CIB</i>) 11:15-12:15: Biocircuit Control Optimization (<i>I. Otero, I2SysBio</i>) 12:30-13:30: Open challenges in biocircuit design (<i>I. Otero, I2SysBio</i>)	CIB ON-LINE ON-LINE
19/01/23	10:00-11:00: Examples of de novo RNA sequences with targeted function (riboregulators, de novo ribozymes, etc) (<i>A. Jaramillo, I2SysBio</i>) 11:15-12:15: Queueing: proteases and degradation as a tool in synthetic biology (<i>A. Urchueguia, J. Buceta, I2SysBio</i>) 12:30-13:30: Bacterial computing (1) (<i>A. Goñi, UPM</i>)	ON-LINE ON-LINE ON-LINE
20/01/23		
23/01/23		
24/01/23	10:00-11:00: Metabolic engineering of food-producing yeasts (<i>A Aranda, I2SysBio</i>) 11:15-12:15: Computational and experimental design of de novo RNA sequences with targeted function (<i>A. Jaramillo, I2SysBio</i>) 12:30-13:30: Bacterial computing (2) (<i>A. Goñi, UPM</i>)	ON-LINE ON-LINE ON-LINE
25/01/23	10:00-11:00: Carbon dioxide and hydrogen as feedstock for bacteria (<i>G Durante, CIB</i>) 11:15-12:15: Biotechnology with metals: new challenges (<i>M Carmona, CIB</i>) 12:30-13:30: Systems metabolic engineering for bacterial biodegradation/bioconversion of aromatic compounds (<i>E Díaz CIB</i>)	CIB CIB CIB
26/01/23	10:00-11:00: De novo virus design (<i>A. Jaramillo, I2SysBio</i>) 11:15-12:15: Bacterial computing (3) (<i>A. Goñi, UPM</i>)	ON-LINE ON-LINE
27/01/23		
30/01/23		

31/01/23	10:00-11:00: Nanotechnological tools: Dendrimeric and magnetic nanoparticles (<i>J Sanz, CIB</i>) 11:15-12:15: Domesticating bacteria for tailored bioplastic production (<i>Auxi Prieto, CIB</i>) 12:30-13:30: Engineering microbial cell factories by adaptive laboratory evolution (<i>Isabel Pardo, CIB</i>) 16:00-18:00: Taller CIB sobre Acoso Sexual y por Razón de Sexo	CIB CIB CIB CIB
FEBRUARY 2023		
01/02/23	10:00-11:00: Challenges in synbio design (II): The role of molecular noise (<i>J. Buceta, I2SysBio</i>) 11:15-12:15: Computational Protein Design (<i>P. Carbonell, I2SysBio</i>) 12:30-13:30: Metabolic Pathway Design (<i>P. Carbonell, I2SysBio</i>)	ON-LINE ON-LINE ON-LINE
02/02/23	10:00-13:30: TBA	
03/02/23		
06/02/23	10:00-11:00: Directed Evolution of Proteins (<i>B. Alvarez, CNB</i>) 11:15-12:15: High-throughput pathway assembly and optimization (<i>B Blazquez, CNB</i>) 12:30-13:30: Genome-Scale Metabolic Modeling (<i>J Nogales, CNB</i>)	CNB CNB CNB
07/02/23	10:00-11:00: Synthetic communities-based biofactories (<i>J Nogales, CNB</i>) 11:15-12:15: Biofactories based on synthetic bacterial compartmentalization (<i>D López, CNB</i>) 12:30-13:30:	CNB CNB
08/02/23	10:00-11:00: Synthetic genomes and their evolution (<i>E García, ICP</i>) 11:15-12:15: The revolution of directed evolution (<i>M Alcalde, ICP</i>) 12:30-13:30: Visita EvoEnzyme (Parque científico UAM)	ICP ICP UAM
09/02/23	10:00-11:00: Microbial cell to cell communication in biotechnology (<i>J Barriuso, CIB</i>) 11:15-13:30: TBA	CIB
10/02/23		
13/02/23		
14/02/23	10:00-13:30: TBA	
15/02/23	10:00-13:30: TBA	
16/02/23	10:00-13:30: TBA	
17/02/23	12:00-13:00: <i>Frontiers</i> "Immunology of Ebola virus disease" César Muñoz-Fontela, Bernhard-Noch-Institute for Tropical Medicine (WHO Collaborating Center)	CIB
20/02/23		
21/02/23		
22/02/23	EXAM F2-F3	
23/02/23		

24/02/23		
27/02/23		
28/02/23	CIERRE ACTAS PRIMER CUATRIMESTRE	

TBA: actividades F3 (clases, tutorías, journal club) pendientes de definir; en caso contrario, hora libre.

CLASE: pendiente de confirmar la fecha

ONLINE

<https://rediris.zoom.us/j/86174007478>

ID: 861 7400 7478

Code: 929694