



Project no. 043338

Project acronym: EMERGENCE

Project title: A foundation for Synthetic Biology in Europe

Instrument: NEST Pathfinder

Thematic Priority: Synthetic Biology

Deliverable 2.4:
“Master studies implemented at the leading and the collaborating schools”

Due date of deliverable: Month 34

Actual submission date: Month 34

Start date of project: 1.12.2006

Duration: 36 months

Organisation name of lead contractor for this deliverable: Ecole Polytechnique

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Deliverable D2.4.: Master studies implemented at the leading and the collaborating schools
Responsible : Alfonso Jaramillo (EP & Université d'Evry Val d'Essonne)

EP has worked towards the establishment of a European master in Systems and Synthetic Biology for the work package 2 "Attracting talent to synthetic Biology in Europe".

EUROPEAN MASTER IN SYSTEMS AND SYNTHETIC BIOLOGY

www.mssb.fr

Aims of mSSB

The vigorous development of Systems and Synthetic Biology constitutes a huge challenge that must be met both from the research and education perspectives. mSSB represents the first step towards nurturing a new brand of researchers and engineers to face up to the challenge.

The aim of mSSB is to provide students from the Life Sciences, Mathematics, Engineering, Chemistry, Physical and Computer Sciences a mean to fruitfully engage in collaborative work across disciplinary boundaries, with applications in Systems and Synthetic Biology. Students undertaking the course will gain hands-on experience in experimental Biology, modeling and designing. They will also enhance transversal capacities including planning a project, giving a seminar, writing and defending a scientific report, interacting with a community, perceiving the industrial, economical and ethical issues associated with these developing fields.

Added values of mSSB

- A+ appreciation by AERES (French quality assurance evaluation agency)
- The first Master 2 in France teaching Synthetic Biology.
- Partnership with École Centrale Paris, AgroParis Tech, Telecom SudParis

- International panel of world-class research training laboratories, including 7 hosting labs in Europe (Spain, United-Kingdom, Germany, Austria, Denmark)
- Local scientific environment:
 - Paris region, the first European R&D concentration;
 - Genopole® of Evry, the leading French Biopark, with 20 academic laboratories and 69 biotech companies;
 - Excellent research facilities offered on-site (iSSB)

- Limited number of stipends offered to foreign students.
- First row seat in the international Genetically Engineered Machine (iGEM) competition (organized by MIT, USA).

Recruitment

Deadline for application: June 11th 2010.

27 candidates so far (international recruitment), around 12 are expected to be retained.

Program description:

Semester 3 comprises an optional upgrade module, three required modules and three elective modules (Table below) for a total of 30 European credits (ECTS). The three Teaching Units from upgrade module relate to either Biology (for non-biologist students), or Informatics and Mathematics (for biologist students) and they do not give right to European credits. The programme is enriched by a seminar series given by international speakers.

Optional upgrade module:

Module		Hours	ECTS
UE0 Upgrade	- Introduction to genomic Biology	34	0
	- Introduction to statistical machine learning for inference of biological networks	17	
	- Introduction to Mathematics applied to Biology	17	

Three required modules:

Module		Hours	ECTS
UE1 Foreign language	- Language 1 - Language 2	50	3
UE2 Integrative Biology	- Integrative and spatial view of cellular machinery: from biology to modelling - Integrative modelling in Physiology	40	5
UE8 Synthetic Biology	- Synthetic Biology for biosynthetic Chemistry - Designing, construction and characterization of biological parts and devices - Practical work on biological device engineering - Modelling and engineering of molecular interaction networks	80 including 42 h of practical work	7

Three elective modules among five:

Module		Hours	ECTS
UE3 Data integration and bio-engineering	• Systems Biology and Bio-engineering • Production and interpretation of «-omics» data - Practical work on complex systems modelling: from data integration to predictions/falsifications	40 including practical work	5
UE4 Mathematics applied to Systems Biology	- Statistical analysis of biological sequences and expression data - Statistical machine learning for inference of biological networks	40	5
UE5 Formal languages for modelling and simulation in integrative Biology	- Languages for modelling and simulation of biological systems - Formalisms for engineering of biological systems and networks	40	5
UE6 Dynamic models of biological regulatory networks	- Symbolic approaches for genetic regulatory networks - Test applied to biological objects	40	5

UE7 Molecular modelling and design	- Soft Matter for Synthetic Biology - Molecular modelling: interactions and computational engineering of proteins	40	5
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Subject to minor modifications

Seminar series given by international speakers.

The list of speakers, from the academy and from the industry, is established by the students after discussion with some teachers. It is then approved by the mSSB pedagogic team.

Semester 4

A 6-months research training takes place in one of the cutting-edge academic laboratories or biotechnology companies located on site or abroad (Europe, US), for a total of 30 ECTS: 21 ECTS from mid-February to June (before exams) ; and 9 ECTS in July and August, either by continuing research work in the training lab, or by preparing at Genopole® the **iGEM competition** to take place on the following November.

Module responsibilities:

			Matières (UE)	Responsable(s)
Obligatoires	UE0	Remise à niveau	Introduction à la Biologie génomique	François Képès
			Introduction à l'apprentissage automatique pour la biologie	Mohamed Elati
			Introduction aux Mathématiques pour la Biologie	Bernard Prum
	UE1	Langues vivantes	Langue vivante 1	
			Langue vivante 2	
	UE2	Biologie Intégrative	Vue intégrée et spatiale de la machinerie cellulaire : de la biologie vers la modélisation	Sébastien Aubourg
			Modélisation intégrée en Physiologie	Randy Thomas
	UE8	Biologie synthétique	Biologie Synthétique pour la Chimie biosynthétique	Jean Weissenbach
			Conception, construction et caractérisation de parties et de dispositifs biologiques	Alfonso Jaramillo
			Pratique du génie de dispositifs biologiques	Pacale Dupuis Williams
			Modélisation et ingénierie des réseaux d'interactions moléculaires	Jean-Loup Faulon
Optionnelles	UE3	Intégration de données et Bio-ingénierie	Biologie des systèmes, intégration de données	Claude Gaillardin, Ivan Mijakovic, Vicent Fromion
			Bio-ingénierie	Claude Gaillardin, Ivan Mijakovic, Vicent Fromion
	UE4	Mathématiques pour la Biologie Systémique	Analyse statistique de séquences biologiques et données d'expression	Bernard Prum, Christophe Ambroise
			Apprentissage statistique pour l'inférence de réseaux biologiques	Florance D'Alché-Buc
	UE5	Modèles et langages de simulation pour la Biologie Systémique	Approche langage pour la modélisation et la simulation de systèmes biologiques	Jean-Louis Gaviotto
			Formalismes pour l'ingénierie des systèmes et des réseaux biologiques	Franck Delaplace, Hanna Kludel
	UE6	Modèles dynamiques discrets de réseaux de régulation biologiques	Approches symboliques des réseaux de régulation génétique	Marc Aiquier
Test appliqué aux objets biologiques			Ana Cavalli	
UE7	Modélisation et design moléculaire	Matière molle pour la Biologie Synthétique	Philippe Guégan	
		Modélisation moléculaire : interactions et ingénierie computationnelle des protéines	Tap Ha-Duong, Nathalie Basdevant	