

# Master Systems Biology

Maastricht Centre for Systems Biology  
30<sup>th</sup> of November 2019



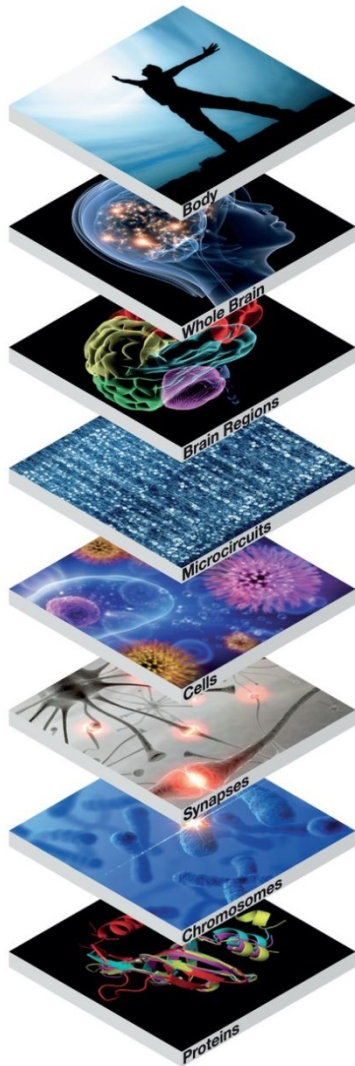
# Master Systems Biology

*Started 31 august 2015*

- 2 year, full-time master
- 120 ECTS
- At the Health Campus (Randwyck, UM)
- Fully English programme



# Systems Biology:



- Is a rapidly evolving multidisciplinary field of science
- Combines biology, computational models, and mathematics
- Aims to understand the behavior of biological systems ...
- ... and predict new behaviors

# Towards the virtual physiological human



## Mathematical modelling

- biology based
- prediction
- metabolism

**B** Mathematical formulation

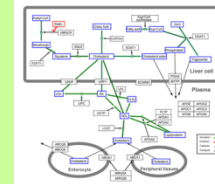
$$S = \begin{pmatrix} r_1 & r_2 & r_3 & -r_4 & 0 \\ 0 & 2 & 0 & -\theta & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix} \begin{pmatrix} m_1 \\ m_2 \\ m_3 \\ m_4 \\ m_5 \end{pmatrix}$$

Steady-state assumption  
 $S \cdot v = 0$

Constraints and objective function  
 $0 \leq v_i \leq ub_i$   
 Minimize  $v \cdot c$

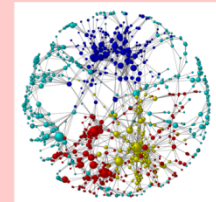
## Pathway analysis

- biology based
- easily add regulatory info



## Data-driven analysis

- correlations
- detect novel mechanisms



Organs



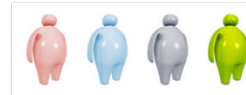
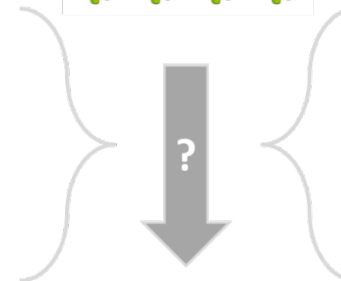
Cells



Molecules



DNA



# Why Systems Biology?

Societal



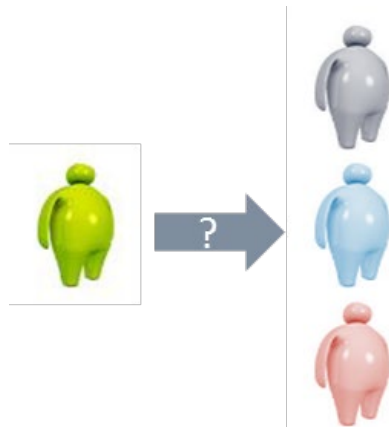
Replace animal testing



Basic research



Diagnostics



Personalized medicine



# Scientific challenges for the future:

- are multidisciplinary and international
- need teams spanning scientific disciplines to develop solutions
- require a new generation of scientists

→ **new teaching programmes**



# Need for students:

- who have a broad interest in combining biology, computer science, and mathematics
- who do not want to be limited to a fixed, highly specialized programme
- who want to learn how to think, work and communicate across disciplines



# Programme Master SB

## 1st year MSc Systems Biology (total 60 EC)

8 weeks	8 weeks	4 weeks	8 weeks	8 weeks	4 weeks
Compulsory courses	Compulsory courses	Project	Electives	Electives	Project
		student research (group)	Choose 2	Choose 2	student research (group)
2 x 6 EC	2 x 6 EC	6 EC	2 x 6 EC	2 x 6 EC	6 EC

## 2nd year MSc Systems Biology (total 60 EC)

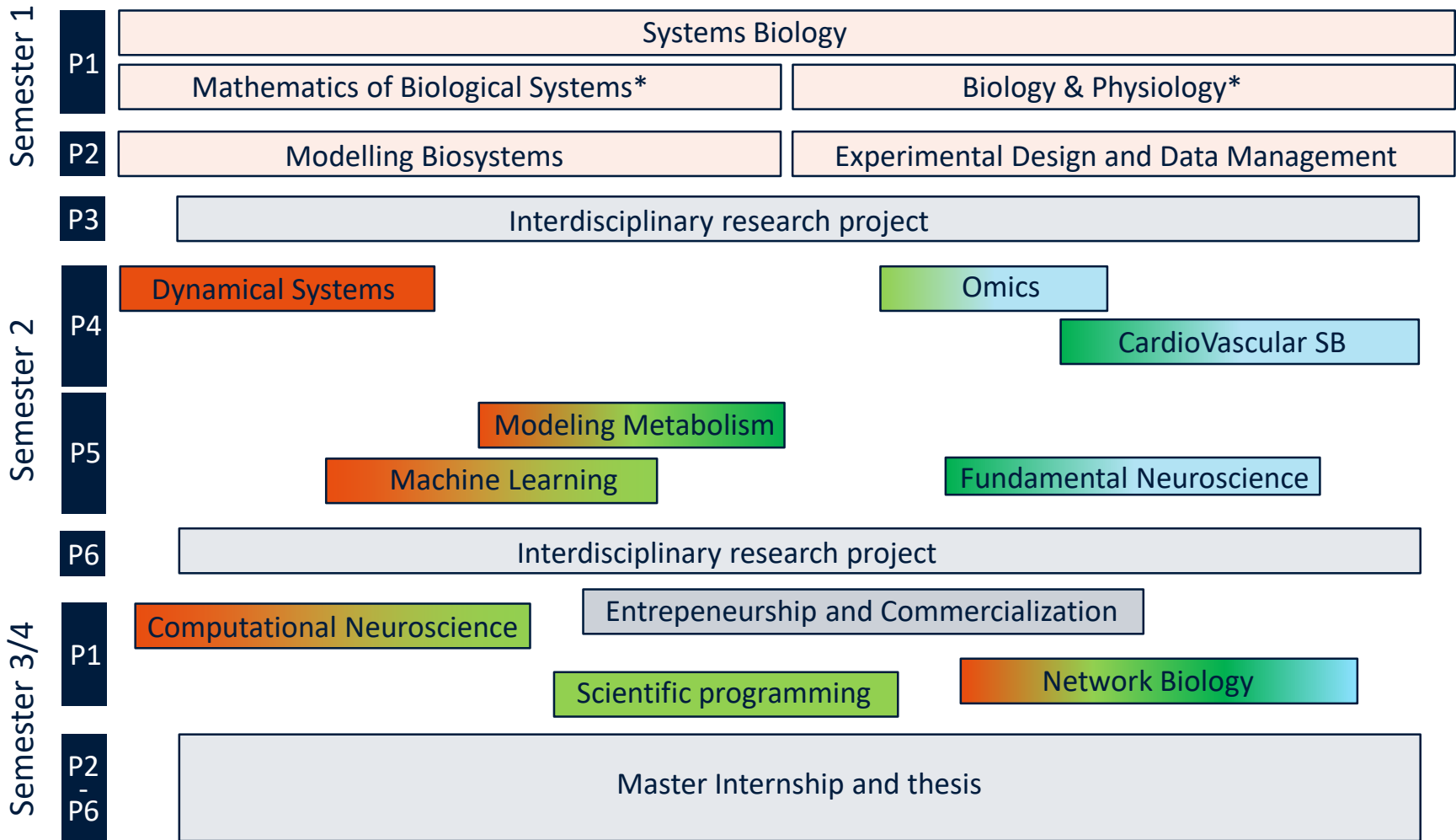
8 weeks	32 weeks
Electives	Master Thesis Research Project
Choose 2	Individual student research project
2 x 6 EC	48 EC



# Curriculum set-up:

**Multidisciplinary programme:** broad spectrum of topics spanning from mathematics to biology





# Study load:

## What does a week of study look like?

*Two courses each week (up to 20 hr contact time)*

Module	Hours/module	Total/week
2 lectures/week	2 hours/lecture	4 hours
2 tutorials/week	2 hours/tutorial	8 hours
2 practicals/week	4 hours/practical	8 hours
Self study		20 - 24 hours

# Academic Advisors



- **Every student** has an academic advisor throughout the 2 year SB Master
- Academic advisor gives **guidance and advice** regarding your **personal curriculum**
- Academic advisors are **active researchers** in the field of Systems Biology

# Teaching by active researchers



# Infrastructure and facilities



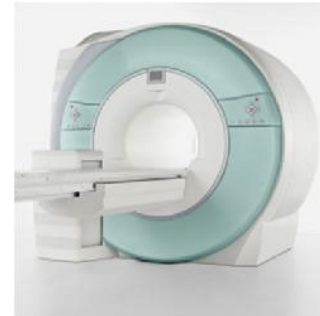
Laboratories



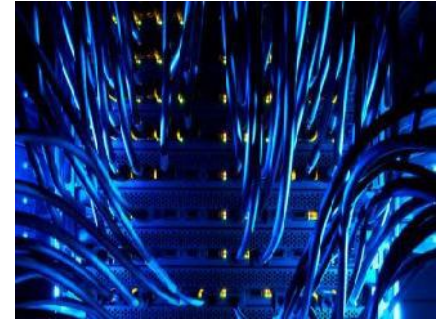
Clean rooms



Large cohorts



MRI scanners



High-performance computing facilities



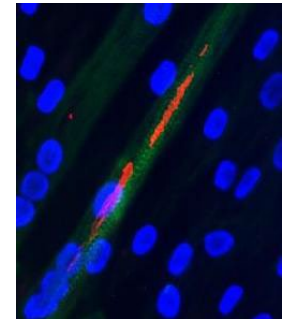
Multi-modal molecular imaging



Macro/micro/nano-biofabrication technology



Genomics & Proteomics



Cell Biology/ iPSC facilities

# Career opportunities



# Admission requirements:

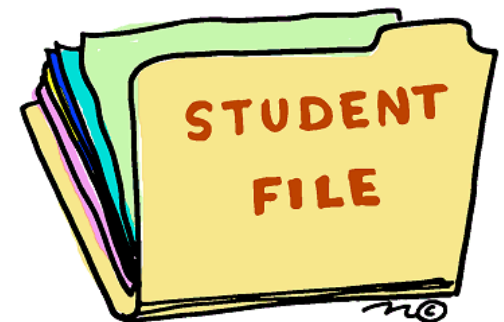
- **Bachelor diploma:** biomedical sciences, sciences (e.g., MSP), university college (e.g., UCM), mathematics, data science, neuroscience, biomedical engineering, (bio)informatics, etc.
- **Motivation** to study across disciplines
- Proficiency in the **English** language
- Required **15 ECTS in mathematics/statistics** at bachelor level
  - Can be waived based on individual background: *contact us!*

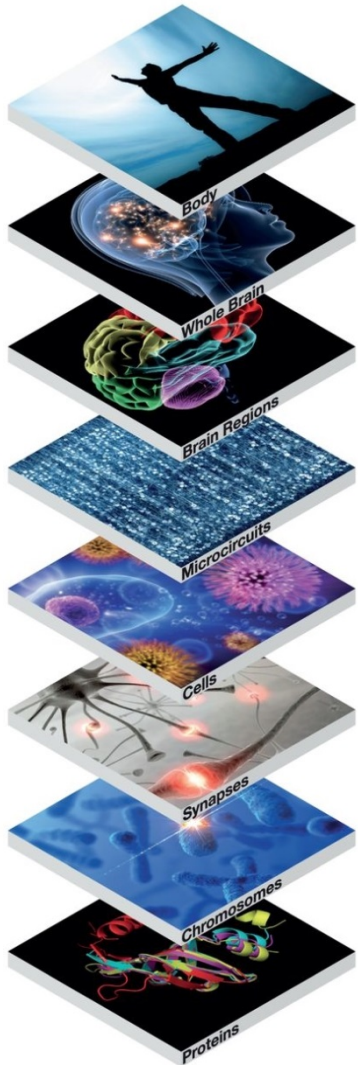




# Admission procedure:

- Send in **all documents**: bachelor diploma; transcripts or grade list; motivation letter; 2 reference letters; copy passport; english proficiency (IELTS, TOEFL, etc.)
- **Interview**: approx. 30 minutes to determine if there is a match between student and master programme
- Board of admissions makes a **decision** on admission





## Contact/Information:

**E-mail:**

[Sb-info@maastrichtuniversity.nl](mailto:Sb-info@maastrichtuniversity.nl)

**Website:**

[www.maastrichtuniversity.nl/fse/systems-biology](http://www.maastrichtuniversity.nl/fse/systems-biology)