

**FUCE**

European Federation of Catholic Universities  
Fédération des universités catholiques Européennes  
Federación de universidades católicas de Europa



# The teaching of ethics of sciences an asset for Catholic universities

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Higher School of Ethics of Sciences (Catholic University of Toulouse)

Ethics evaluation platform (consortium Toulouse White Biotechnology)

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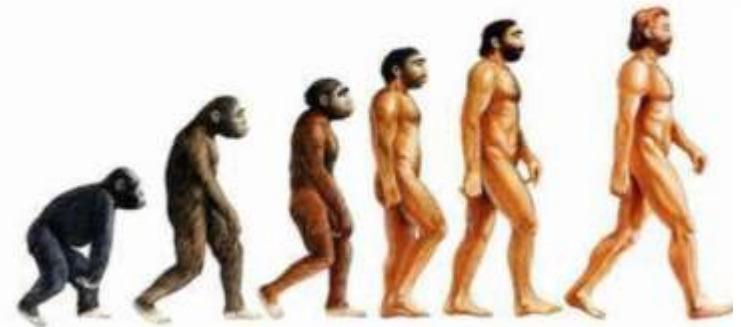
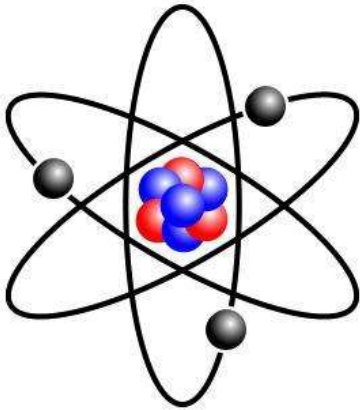
Université catholique de Lyon, 16 mai 2014

- 1 - Science: between mystery and enigma
- 2 - Ethics of Science in the Catholic universities
- 3 - An asset for Catholic universities

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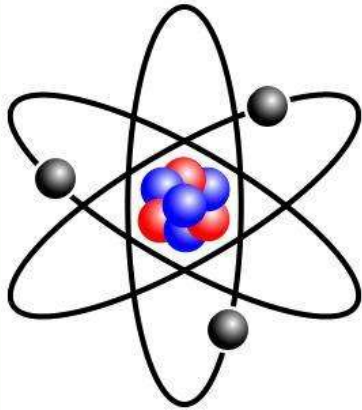
matter

life

humanity



?



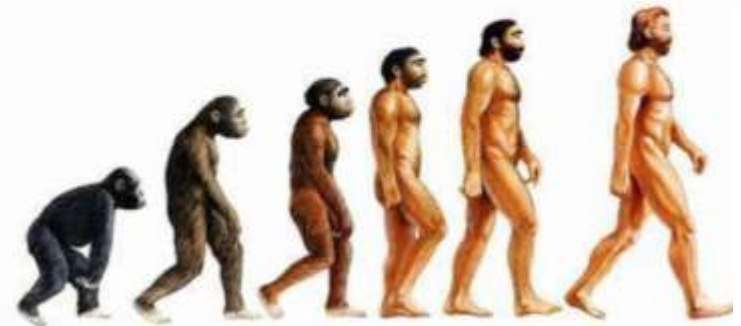
matter

?



life

?



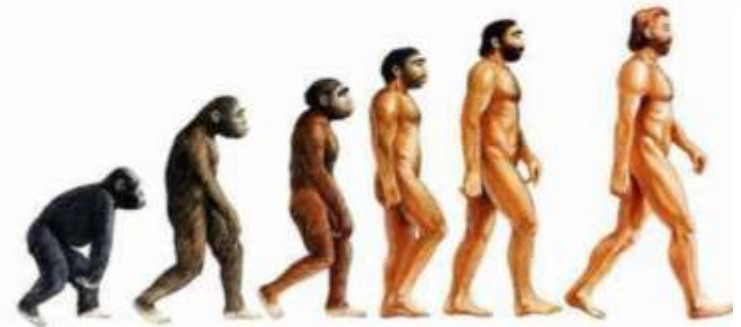
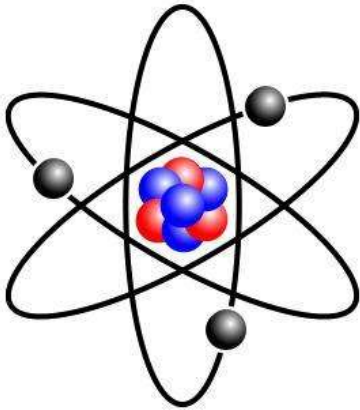
humanity

Erwin Schrödinger:  
*What is Life?* (1944)

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?

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matter

life

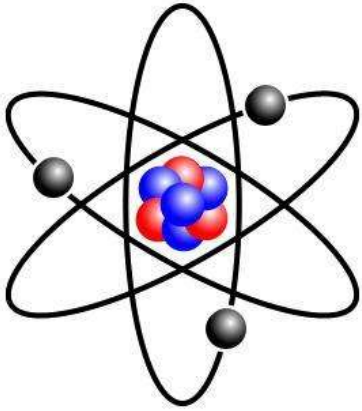
humanity

## Nano-biotechnologies

NBIC: Nano-Bio-Info-Cognitif

**BANG : Bits, Atomes, Neuron, Gene**

?



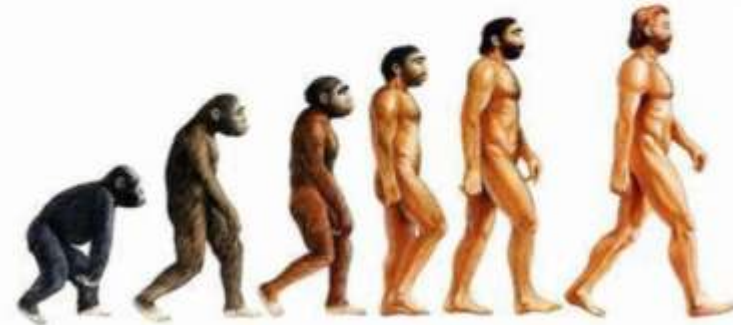
matter

?



life

?



humanity

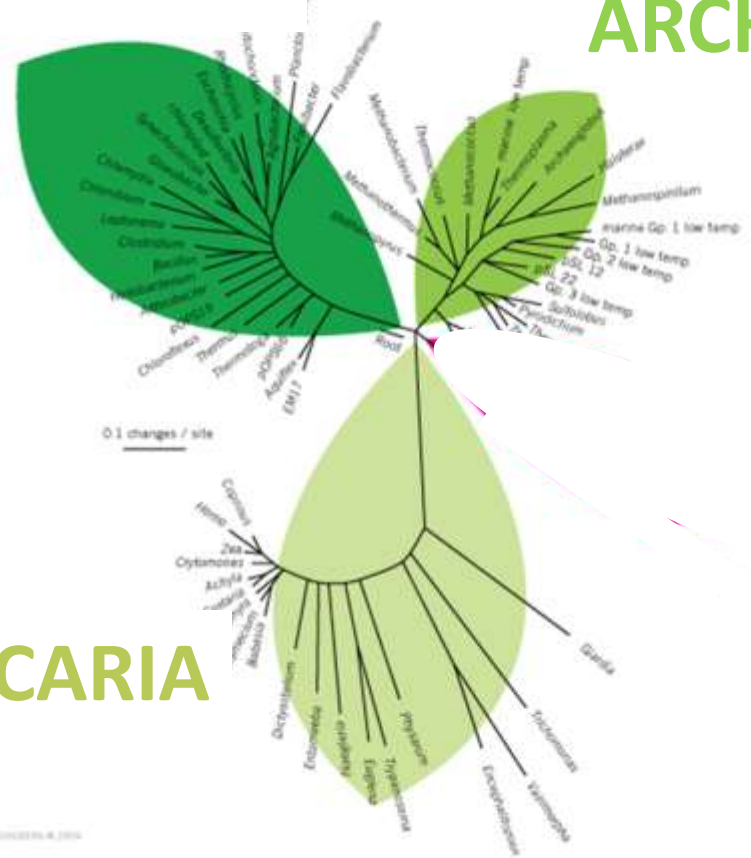
Bioengineering  
Synthetic biology



# BACTERIA

# ARCHAEA

# EUCARIA

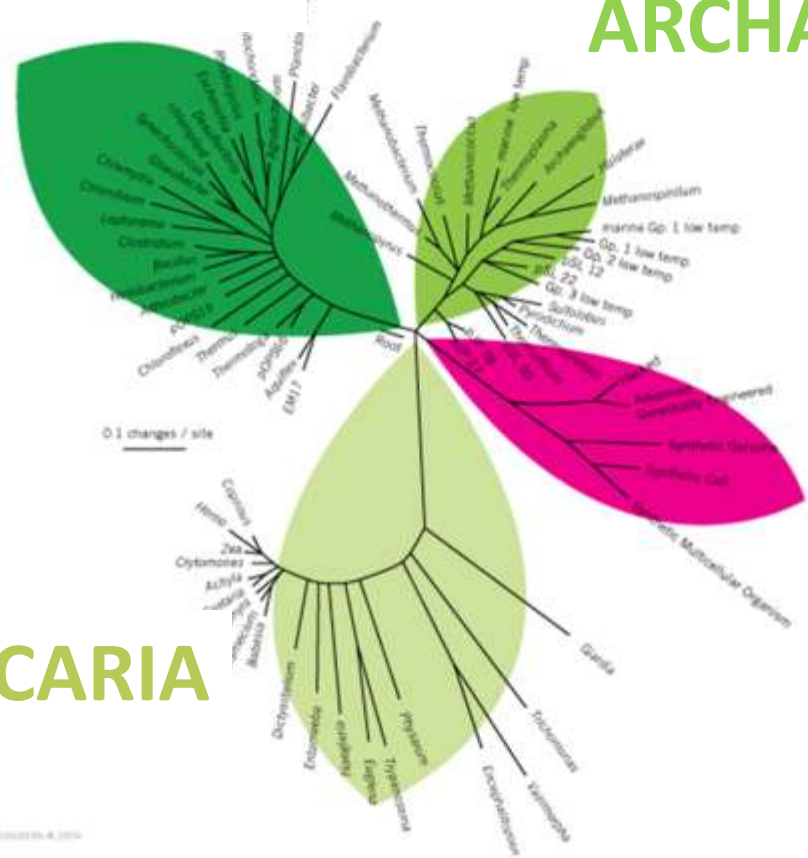


© 2004 Nature Publishing Group



# BACTERIA

# ARCHAEA



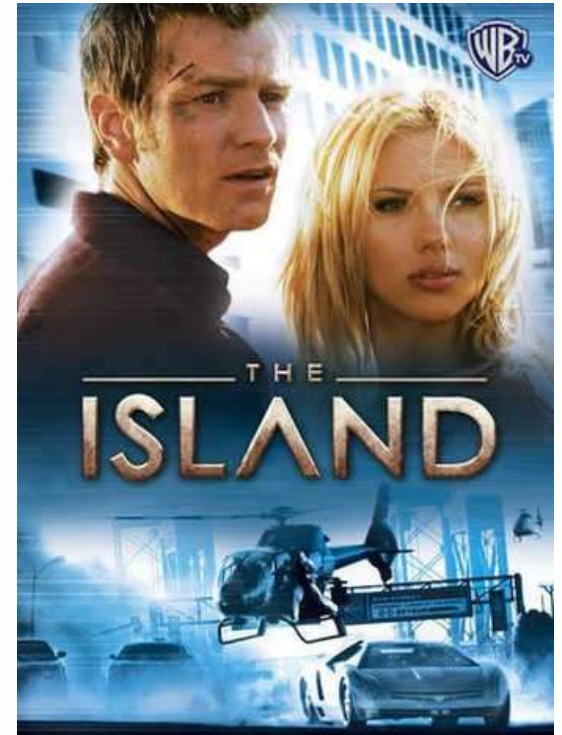
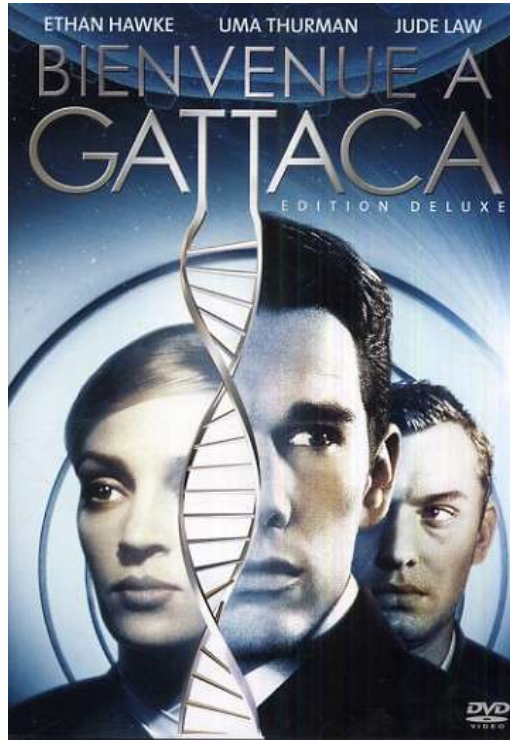
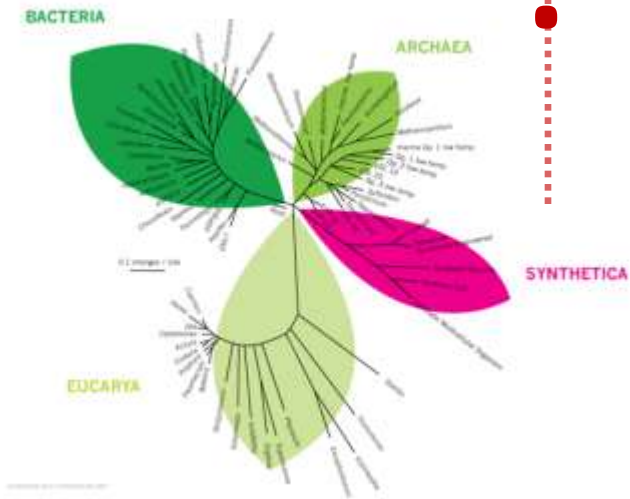
# EUCARIA

# SYNTHETICA



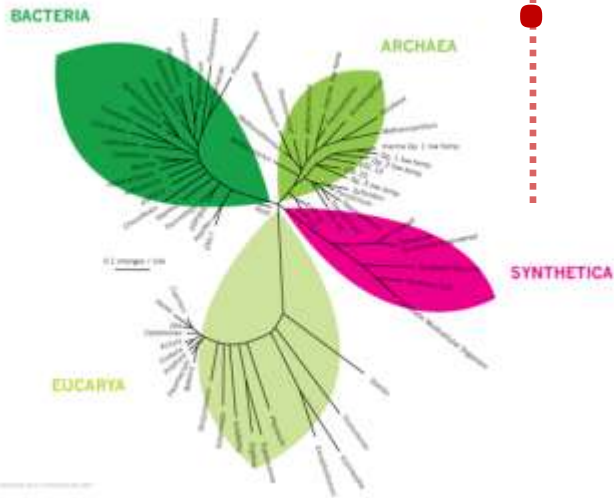
*Mycoplasma laboratorium*

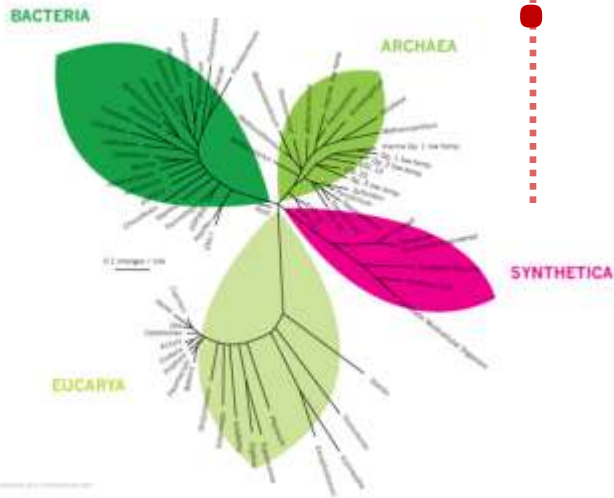






# Fantasy and/or relality?





# Fabriquer le vivant ?

Miguel Benasayag

Pierre-Henri Gouyon

ce que nous apprennent  
les sciences de la vie  
pour penser  
les défis de notre époque

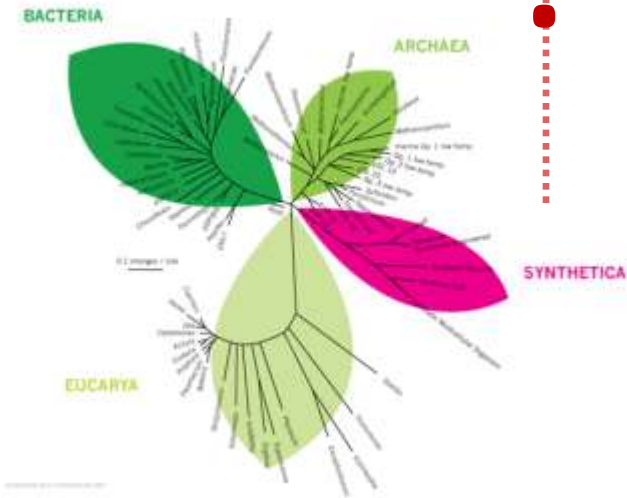
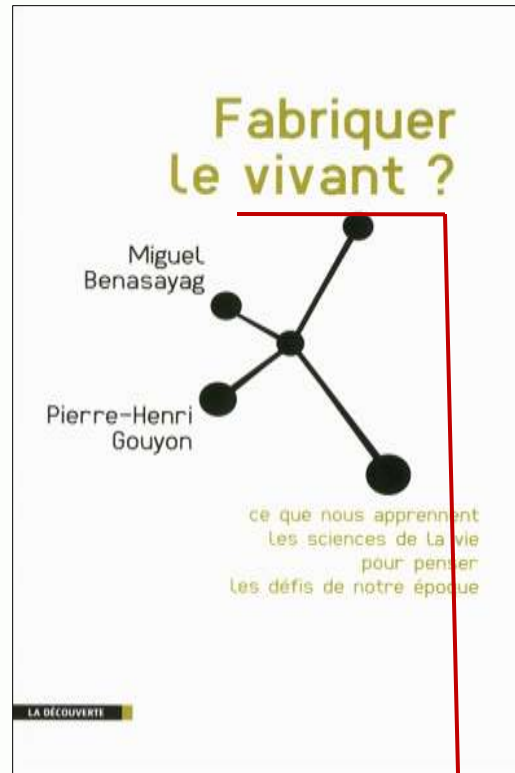
LA DÉCOUVERTE

SCIENCE OUVERTE  
Seuil

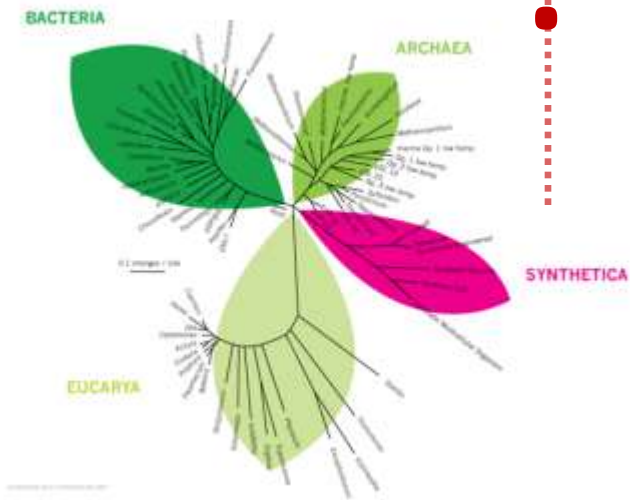
BERNADETTE BENSAUDE-VINCENT  
DOROTHÉE BENOIT-BROWAEYS

# Fabriquer la vie

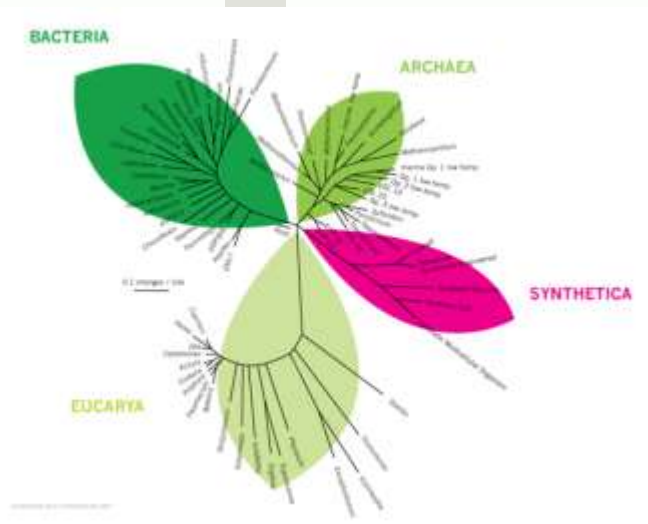
Où va la biologie de synthèse ?



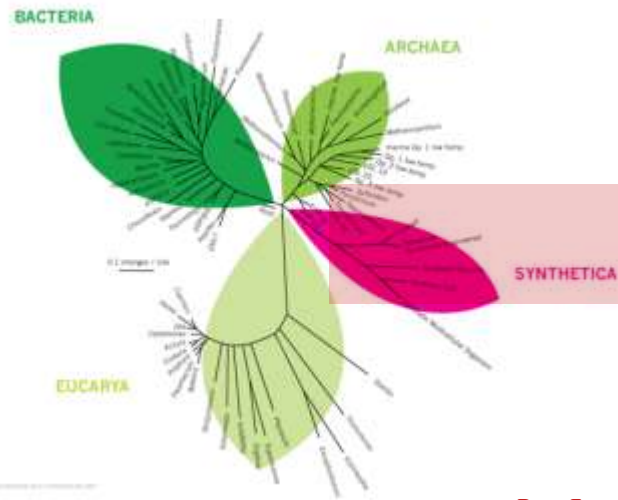
Life and living:  
concepts to be clarified...



# Current scientific advances in bioengineering



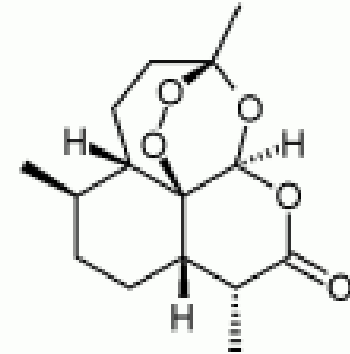
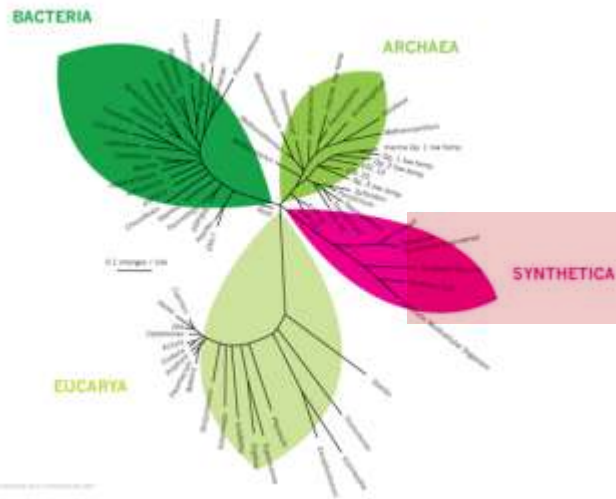
# Bioengineering (1)



**BIOFUEL**

Modified bacteria  
associated to  
"micro-factories"

# Bioengineering (2)



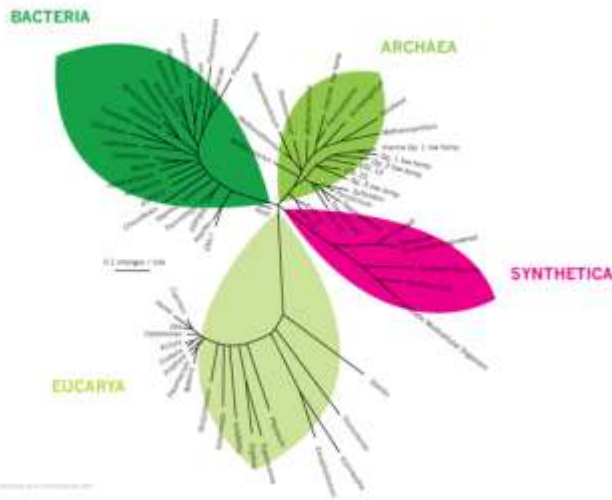
**ARTEMISININ**

**Lower production costs**

Dae-Kyun Ro *et al.*, Production of the antimalarial drug precursor artemisinic acid in engineered yeast, *Nature* 440, 940-943.



# Bioengineering (3)



## Creation of life?

### HOW TO MAKE ARTIFICIAL LIFE

- 1 Entire DNA of *Mycoplasma mycoides*, a bug that usually infects goats, is decoded.
- 2 Researchers buy fragments of DNA from a mail order catalogue. Each of the four bottles of chemicals contains a section of the code.
- 3 The fragments are put into yeast, which 'stitches' them together, gradually building a synthetic copy of the original DNA.
- 4 The artificial DNA is put into a recipient bacterium, which then grows and divides, creating two daughter cells, one with the artificial DNA and one with the natural DNA.
- 5 Antibiotics in the petri dish kill the bacterium with the natural DNA, leaving the one with the synthetic DNA to multiply.
- 6 Within just a few hours, all traces of the recipient bug are wiped out and bugs with artificial DNA thrive. New life has been created.
- 7 Possible uses are bugs capable of producing clean fuels and sucking carbon dioxide out of the atmosphere. Also microbes capable of mopping up oil slicks (above) or generating drugs, including the flu vaccine.

Maverick: Dr Craig Venter

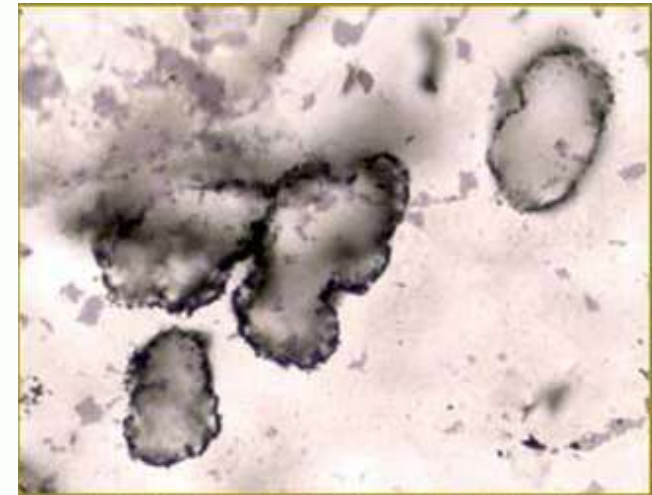
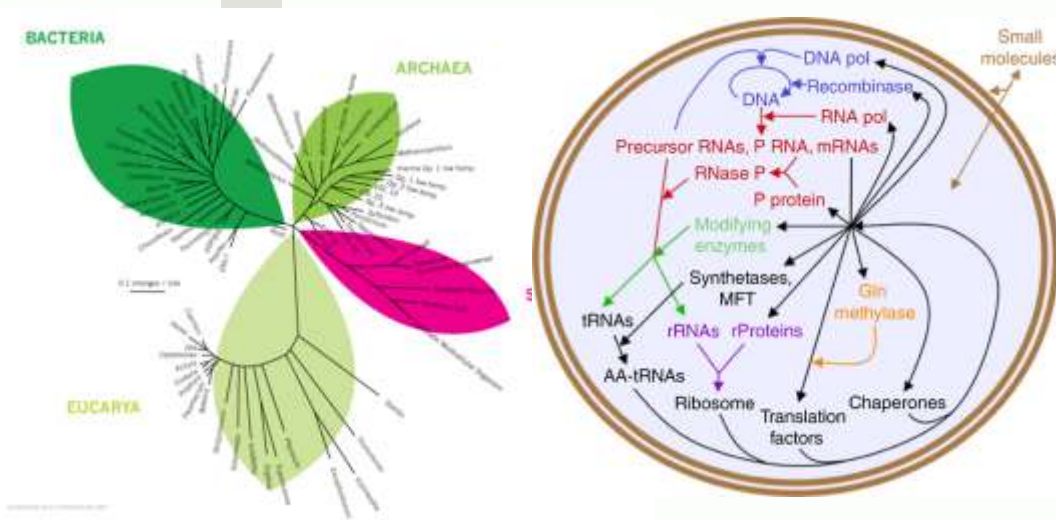
Artificial DNA Natural DNA

Graphic by John Lawson

Gibson *et al.*, **Creation** of a Bacterial Cell Controlled by a Chemically Synthesized Genome, *Science* 2 July 2010: Vol. 329 no. 5987 pp. 52-56.

# Bioengineering (4)

Pseudo-living assemblages (113 proteins, 38 RNA, ATP) system able to replicate!



Organismes unicellulaires (Australie)  
Age: 3,4 milliards d'années

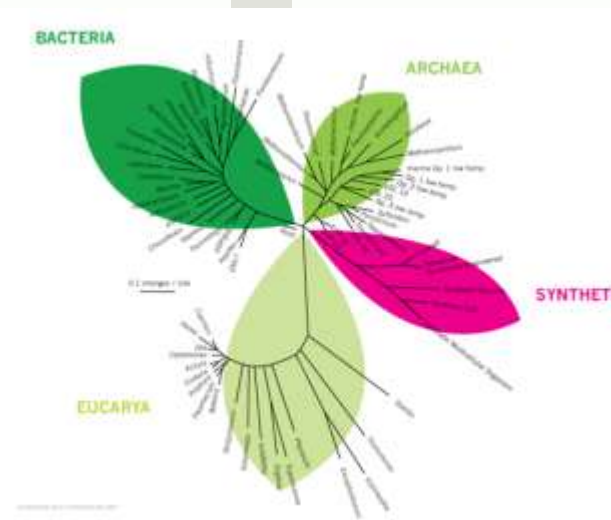
## Creation of life?

C. Forster, George M. Church, Towards synthesis of a minimal cell. **Molecular System Biology**, vol. 2, Issue 1, 2006

Wasey, D. et al. (2011) Microfossils of sulphur-metabolizing cells in 3.4-billion-year-old rocks of Western Australia **Nature Geoscience** Volume: 4, Pages: 698–702

# Bioengineering (5)

## 5-chloro-uracil



Marlière *et al.* (2011),  
**Angewandte Chemie** vol.  
50, Issue 31, pages 7109–  
7114, July 25, 2011

## Xenobiology development

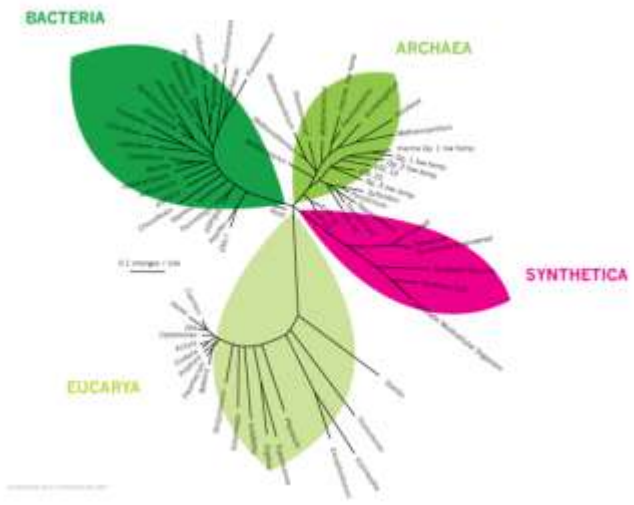


# CURRENT QUESTIONS (1)

➤ Nano-biotechnology and neuro-technologies: new societal insights? about living, life and humanity

➤ New thinking about the "natural-artificial" relationship

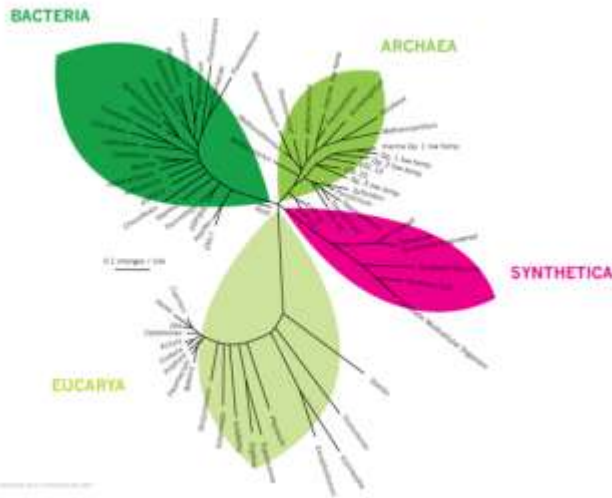
Synthetic biology and its impact on the acceptance or rejection of new technologies of living?





## CURRENT QUESTIONS (2)

- How far is life manipulable?
- How to use new artificial living while maintaining biosecurity and "biosecurity"?
- How far can we patent life?
- **A "liberal eugenism"?**  
(J. Habermas)

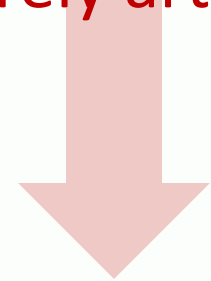




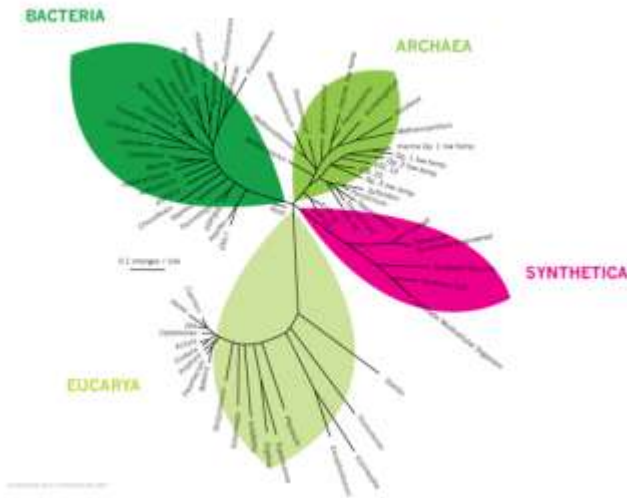
## CURRENT QUESTIONS (3)

Example 1:

Introducing into pluripotent stem cells a new program entirely artificial:



Chimerical beings  
undescribed properties in nature  
(xenobiology)





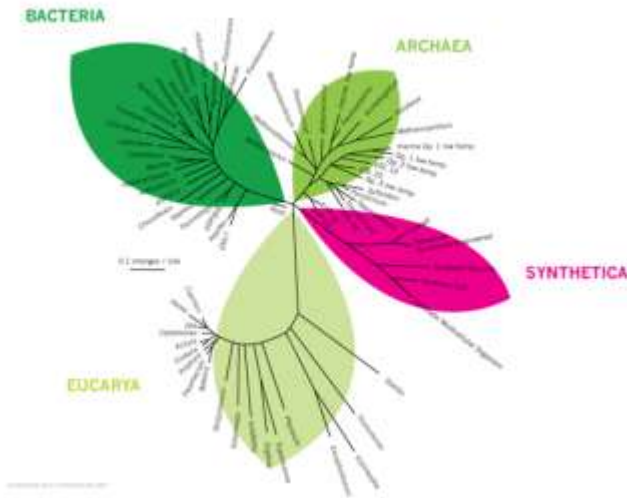
## CURRENT QUESTIONS (4)

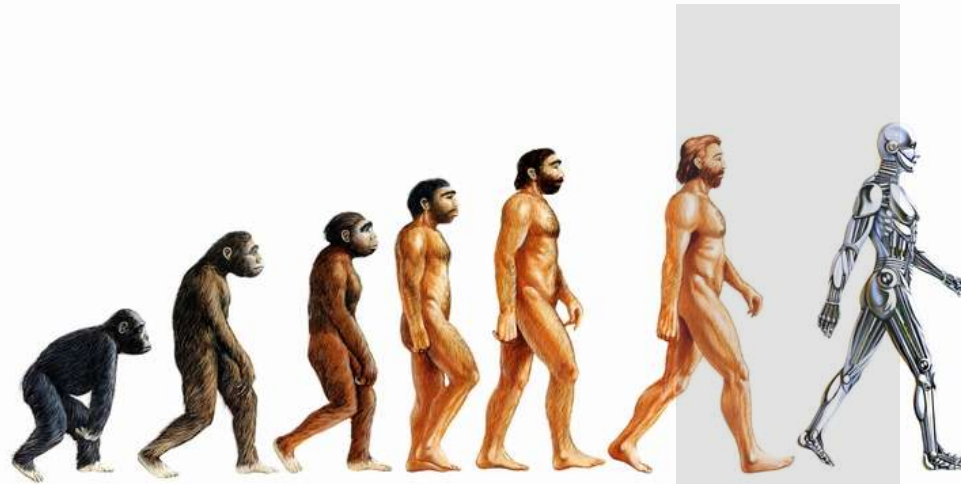
### Example 2:

The genome can not be reduced to the simple sum of its parts!

➤ How predict the emergent properties of the genome?

➤ Deconstruction of the dogma of the "selfish gene"





# Ethics of science into the catholic Universities



# Ethics of Sciences

## Toulouse Catholic University





**Toulouse Catholic  
University**

**ESES**

École Supérieure  
d'Éthique des Sciences

Higher School  
of Science Ethics

**PUBLIC DEBATES**

**TRAININGS**

**PARTNERS**



Toulouse Catholic  
University

**ESES**

École Supérieure  
d'Éthique des Sciences

**PUBLIC DEBATES**

TRAININGS

PARTNERS

- « General public » debates
- Scientific topics
- **Technoscience is questioned**



**Toulouse Catholic  
University**

**ESES**

École Supérieure  
d'Éthique des Sciences

**PUBLIC DEBATES**

**TRAININGS**

**PARTNERS**

• *ad intra*



Faculty of Philosophy

Master in ethics

Licence “European Communication”



**Toulouse Catholic  
University**

**ESES**

École Supérieure  
d'Éthique des Sciences

**PUBLIC DEBATES**

**TRAININGS**

**PARTNERS**

• *ad extra*

**Engineering  
schools**



**AGRONOMICS**



**ISAE**

Institut Supérieur de l'Aéronautique et de l'Espace

**AIRCRAFT & SPACE**



**Toulouse Catholic  
University**

**ESES**

École Supérieure  
d'Éthique des Sciences

PUBLIC DEBATES

**TRAININGS**

PARTNERS

- *ad intra*
- *ad extra*
- more than 400 students per year involved
- an increasing request
- many questions about the relationship between science and faith!



Toulouse Catholic University

# ESES

École Supérieure d'Éthique des Sciences

PUBLIC DEBATES

TRAININGS

PARTNERS

### Partenaires Industriels



### Partenaires académiques



### Partenaires investisseurs





**Toulouse Catholic  
University**

**ESES**

École Supérieure  
d'Éthique des Sciences

**PUBLIC DEBATES**

**TRAININGS**

**PARTNERS**

Ethics and sustainable development  
Committee

Competent ethical platform to support  
biotechnology research projects



**twb**  
White Biotechnology  
center of excellence





**Toulouse Catholic  
University**

**ESES**

École Supérieure  
d'Éthique des Sciences

DEBATS ETHIQUES

TRAININGS

**PARTENARIATS**

Researchers are waiting for an  
ethical reflection on their work

Implementation of appropriate  
training in ethics



**twb**  
White Biotechnology  
center of excellence

# Ethics of Sciences Lyon Catholic University...



Research Team:

**"epistemology and Ethics of Sciences"**

- **Licence “Life Sciences and Humanities”.**
- **Transdisciplinary approach**

## Innovative Training for biologists

- Humanities (philosophy, epistemology, ethics, Humanities and Social Sciences, aesthetic with a real crossing disciplines (biology, humanities) and not a simple juxtaposition.
- ***Example: "Genetics" / "Philosophy of identity"***
- Biology teachers and humanities teachers built the course together, some modules can be driven together.

## **Trainings:**

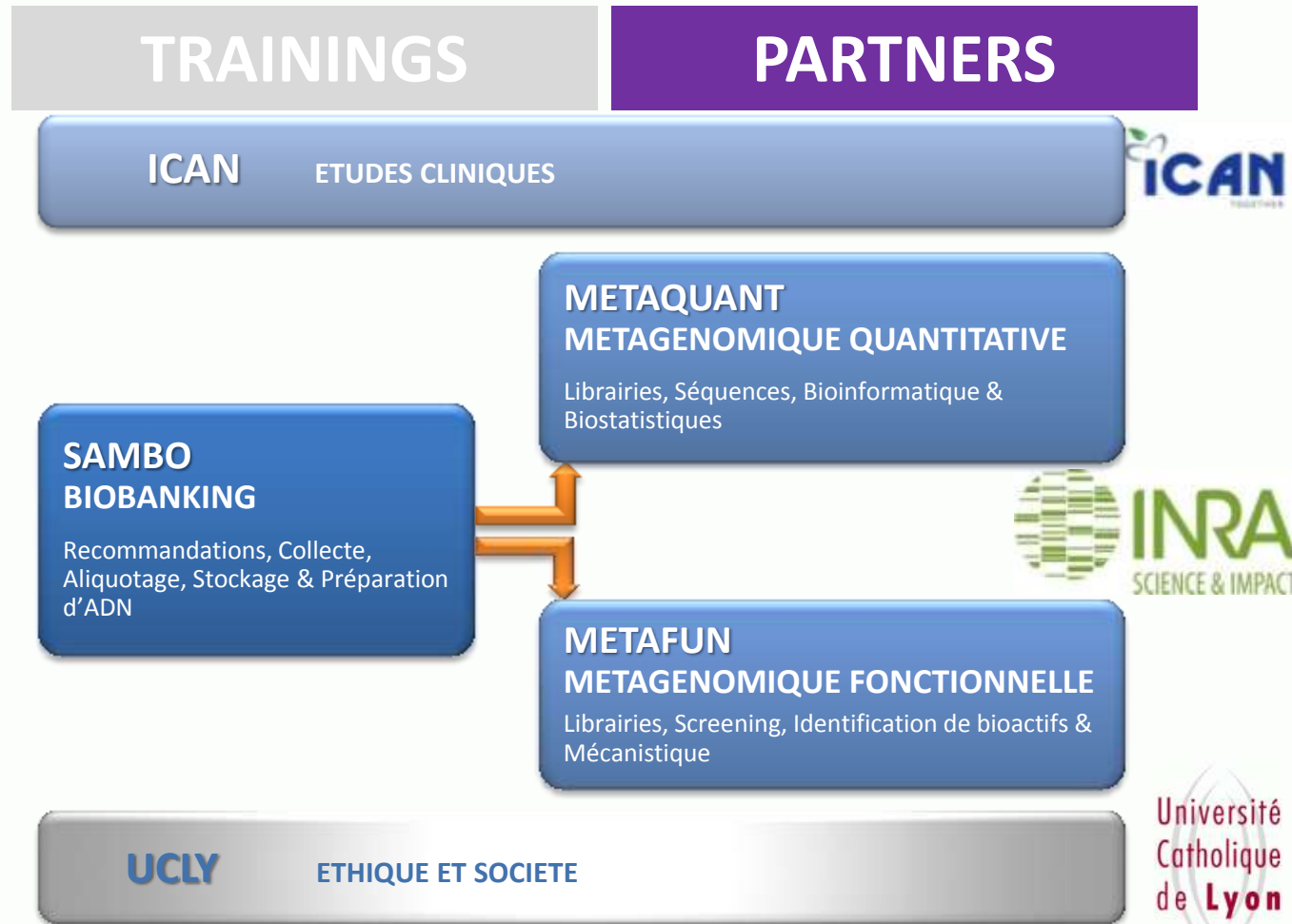
- Genetic identity and human identity
- Reproduction and Sexuality
- Evolution and Randomness
- Natural and artificial
- Ecology and Society
- Human and animal
- Health and Disease
- Bioethics
- Knowing and believing
- Labour, law and standard

## **Licence “Life Sciences and Humanities”.**

... for a pedagogy of the intersection of  
philosophy and biology!

# METAGENOPOLIS project

(financed by the French program of future investments)





## METAGENOPOLIS Project

- 10 times more bacteria than cells in our body
- genes of our intestinal bacteria:  
100 times more than the genes in our genome

## METAGENOPOLIS Project

Link with chronic diseases:

Examples:

obesity

Inflammatory bowel disease



Toulouse Catholic University

Université Catholique de Lyon



1 - Science: between mystery and enigma

2 – Ethics of Sciences in the Catholic universities

**3 - An asset for Catholic universities**

## **PUBLIC INSTITUTIONS**

universities

Higher Schools

Engineering Schools

## **PRIVATE INSTITUTIONS**

Private laboratories,  
companies

## **ETHICS COMMITTEES**



**CATHOLIC  
UNIVERSITIES**

# ETHIQUE DES TECHNOLOGIES DU VIVANT

LYON, 25-26 novembre 2013

- 50 speakers
- Many scientists that philosophers
- transdisciplinary work
- Acts being published

**For the first time in France!**

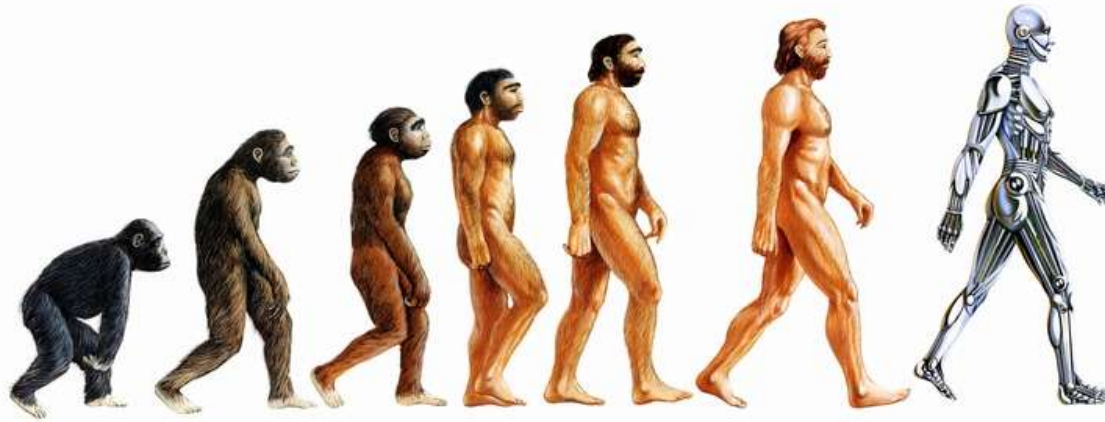
- Ethics of Sciences: essential to understand the issues of the technosciences
- Questions brought by the general public and researchers
- **Catholic universities Expertise widely recognized**
- **A real opportunity for FUCE!!**

## Different levels of research in ethics:

- ✓ Risk / benefit ratio: Biosafety and biosecurity...
- ✓ Ethical Risks: Responsibility / Caution principles
- ✓ The societal impact
- ✓ "Repaired man to enhanced man"
- ✓ The relationship with *living* and *life*
- ✓ Representations of nature and its impact on the vision of humans: the problem natural-artificial-cultural

**Cross fundamental anthropological and theological questions!**





Thank you  
for your attention!