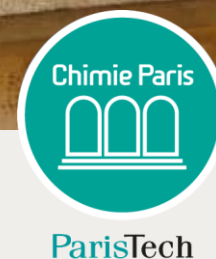


ECOLE
NATIONALE SUPERIEURE
DE CHIMIE



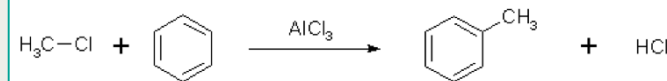
Chimie ParisTech – Université PSL

Fostering talents for tomorrow's chemistry

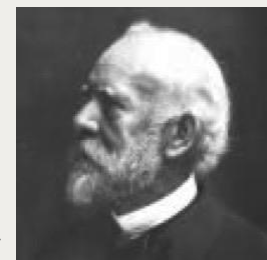
Chimie ParisTech general presentation

19/02/2020

1896: Founded by Charles Friedel



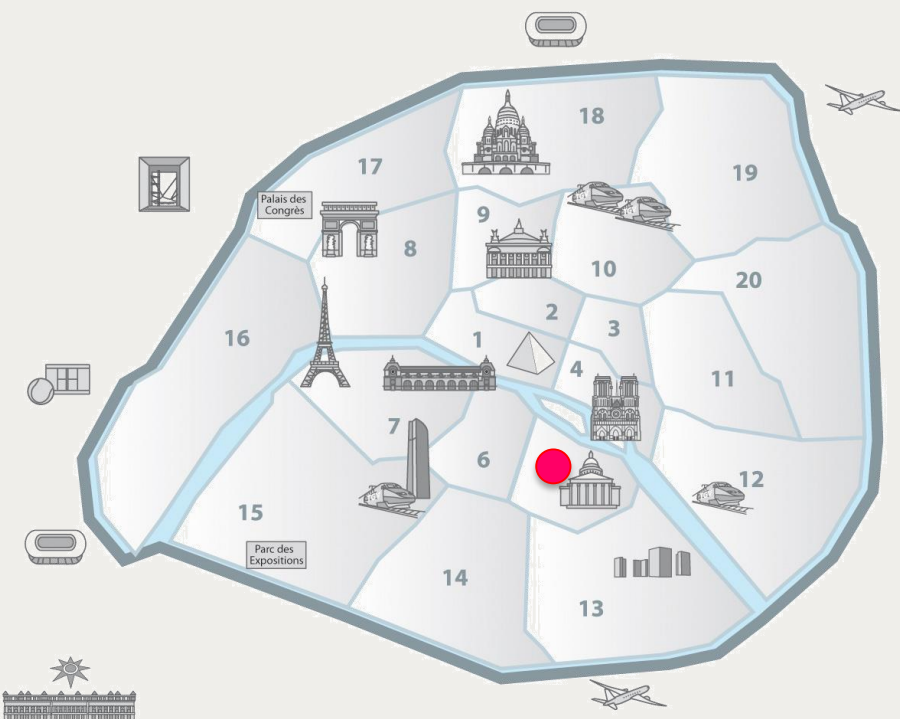
« Young chemists devoted to industrial careers should have a scientific back-ground as solid as that of those embracing purely academic ones »



- 1899-1907: Directed by Henri Moissan (Nobel Prize winner 1906)
- 1916: First woman embracing engineer career in France
- 1904: Eugène Schueller, founder of L'ORÉAL



Chemistry at the heart of Paris



Paris and its region



- 816 000 businesses
- 1/3 of the foreign businesses in France
- 1st European center for Fortune 500 multinational companies
 - 1st European center for professional meetings
 - 30% of France's Gross Domestic Product (GDP)
- Paris among World's Best Student City (QS)
 - 17 Universities, 40 Graduate Schools of Engineering
 - > 70 000 foreign students (20% of the students of the area)
- 1st European region in R&D
 - 40% of national investment in research and development
 - 95 500 researchers

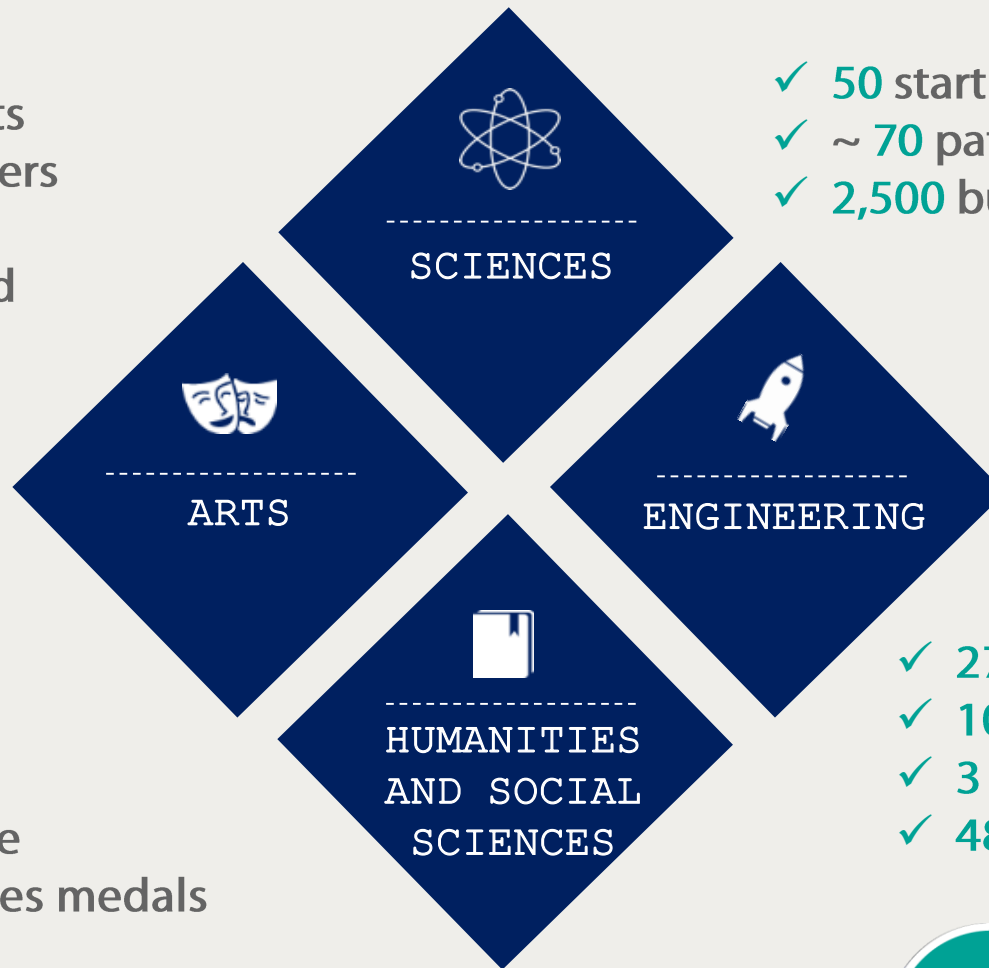
Chimie ParisTech belongs to a world class University



- ✓ 4th University younger than 50-year-old (QS, THE)
- ✓ Ranked in the top 50 worldwide (QS, THE)
- ✓ 1st University among Millennials (THE)

University PSL in a nutshell

- ✓ 17,000 students
- ✓ 4,500 researchers
- ✓ 181 labs
- ✓ 91 libraries and museums



- ✓ 50 startups founded
- ✓ ~ 70 patents/year
- ✓ 2,500 business partnerships

150 ERC
since 2011

- ✓ 50 César prize
- ✓ 79 Molière prize
- ✓ 2 Olympic games medals

- ✓ 27 Nobel
- ✓ 10 Fields Medal
- ✓ 3 Abel prize
- ✓ 48 CNRS Gold medal



ParisTech – Alliance of graduates schools in engineering



12 000
students



1 500
doctoral candidates



56 teaching and
research chairs



1 500
professors



120
partner companies



90 000
Alumni

- An exceptional union enabling a unique transdisciplinarity network
- Each School is ranked #1 at the national level in its specific domain

Shared-values

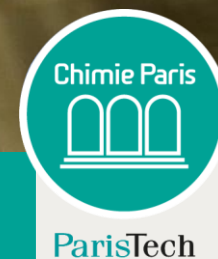
- **Excellence** based on the model of French “Grandes Écoles”
- **Openness** as a driver for growth: international openness, social diversity, openness to new pedagogical methods
- The quest for **innovation**, key to future successes for our Schools

Our Vision



Provide **basics & fundamentals** courses in all fields of chemistry **illustrated by a cutting-edge research**

KEY FIGURES

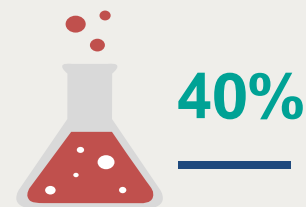


Training

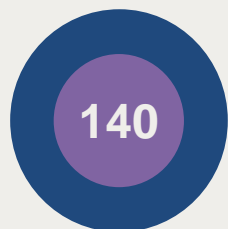
Highly selected
students
(50% of women)



1 Prof for
3 students



Practical
training



Researchers and
Professors &
Associate Professors

20%



Business, management
and human skills

20%

international
students



abroad



12 months



Mandatory
internship



Research



Research & Development

Chairs
With Eco-Systèmes



1



► 50% of PhD funded
by **companies**

2 **Labcom**
(joint lab with
SMEs)

>40

► Research
contracts
per year

Innovation & Start-Ups

Chimie Paris Innov our incubator *cofunded by the European Union*

➤ 6 start-ups since 2018



Plasma catalysis technology
for methanation of CO₂

European patent [EP15202925.2] 2015

Paris FLOW Tech a new technological platform for green and sustainable continuous flow chemistry (from summer 2020)



Zinc-Air

Cheap and Safe Batteries
for Electrical Vehicles
& Stationary Electricity Storage

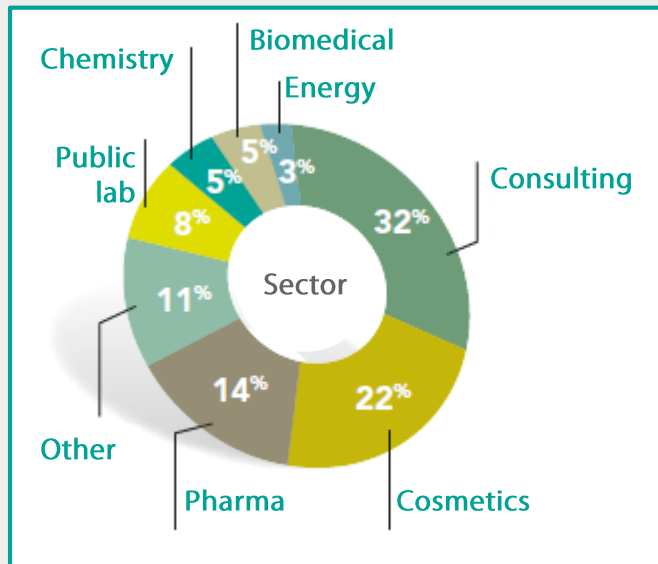
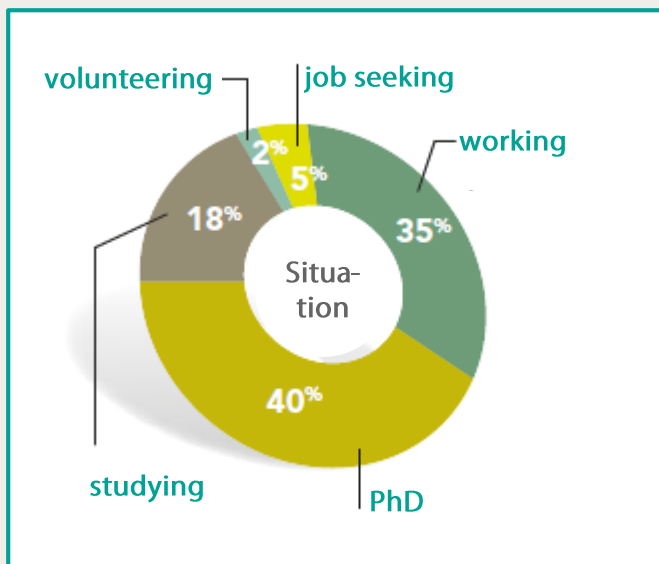


Augmented Wood, and next
generation of Human-to-
Machine Interfaces

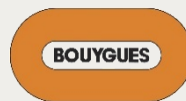


Employability of our Engineers

+ 90 % of the students get a job or PhD before the graduation ceremony



Class 2018 (110 students)



RESEARCH

A world class research
made to tackle global
societal challenges

Our 3 research joint laboratories with CNRS

Chimie Paris
Research
Institute
**Materials &
Energies**



Institute of
Chemistry
for
**Life Sciences &
Health**



Ile-de-France
Institute
for **photovoltaic**



Energy



Environment



Materials



Health



Our main research areas

Chemistry for Materials & Energies

- Materials Sciences
- Thin Films and Surfaces
- Chemical Engineering
- Organometallic Chemistry
- Polymerization Catalysis
- Energy
- Microsystems
- Heritage materials
- Nano materials & structures
- Modelisation

Chemistry for Life Sciences & Health

- Analytical physico-chemistry :
(electrochemistry, separative
methods & coupling of
detection techniques)
- Miniaturization
- Imagery
- Organic synthesis and methods for
imaging and screening
- Modeling & theoretical Chemistry
- Inorganic Biological Chemistry,
Medicinal Inorganic Chemistry,
Medicinal Organometallic Chemistry
- Catalysis, Synthesis of Biomolecules
and Sustainable Development

Energy



Environment



Materials



Health



Energy

Photovoltaic

Electrochemical Storage

Hydrogen Technology

Nanomaterials for Solar Cells

Chemistry for Health

Micro Flow & Diagnosis

Medicinal Chemistry

Structural Metallurgy

Optics & Optoelectronics

Physical Chemistry of Surfaces

Materials

Polymers & Catalysis

Ancient & Heritage materials

Chemical Engineering

Plasma Processes

Theoretical chemistry

Energy

Environment

Materials

Health



Selected examples of our research

- ✓ Imaging and characterization
- ✓ Nano and smart materials
- ✓ Catalysis
- ✓ Chemical Engineering and flow chemistry
- ✓ Modeling and simulation

Energy



Environment



Materials



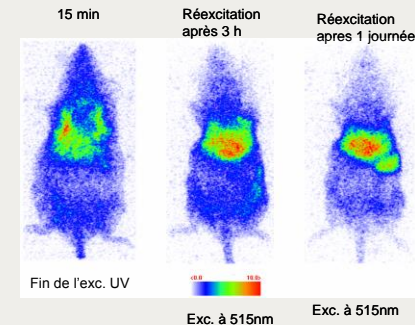
Health



Imaging and characterization

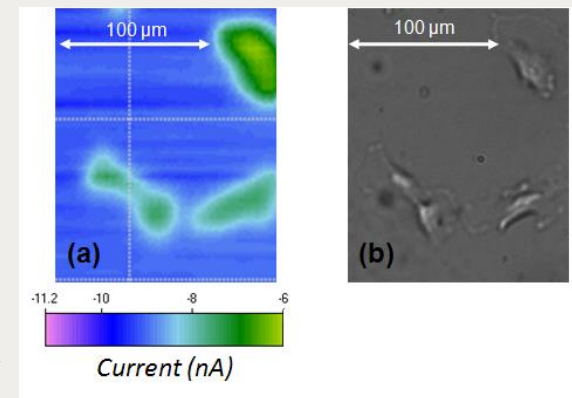
Design of new materials for Imaging and Biophotonic:

Focus on materials design, optical spectroscopy and mechanisms: Oxides and fluorides based nanomaterials used as nanosensors for thermal imaging at nanoscale, cell imaging and in-vivo bio-imaging.



Development of new bio imaging techniques

Methodological development of bimodal and multi-parametric imaging in MRI and optical contrast agents



Electrochemical microscopy for 3D Morphology and cartography of real time reactivity of biological systems

Characterization and imaging

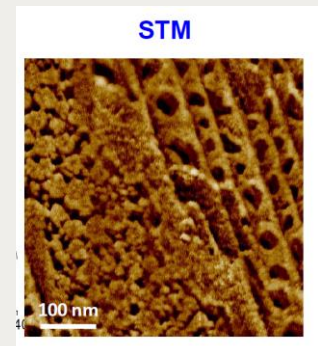
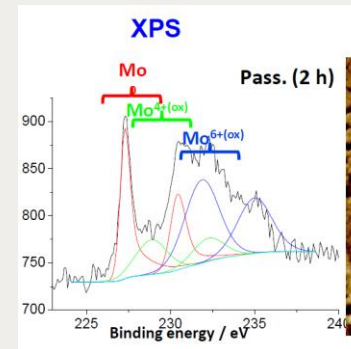
Characterization of surfaces

Surface spectroscopies and microscopies :
X-Ray photoelectron spectroscopy (XPS),
time-of-flight secondary ion mass spectrometry (ToF-SIMS), scanning probe microscopes (STM, AFM).



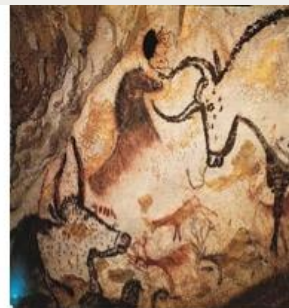
Structural Metallurgy

Investigation of microstructures/mechanical properties relationships using advanced characterization methods (“in situ” mechanical testing, EBSD, TEM, high energy synchrotron X- rays diffraction)



Ancient & Heritage materials

- Authentication and conservation of cultural heritage artifacts



Analytical techniques

Ion Beam

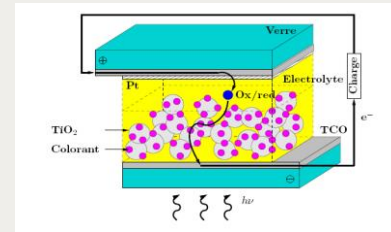
Analysis, X-Ray Fluorescence, Electron Magnetic Resonance, SEM-FEG-EDS, X-Ray Diffraction & Structure Analysis, Raman & UV/Vis/IR Spectroscopy, multi-spectral imaging, BET Surface Desorption



Nano & smart materials

Nanostructured Materials for photovoltaics & optoelectronics

Hybrid solar cells (perovskite/dye sensitized/Quantum Dot)



Crystals and Quantum State Dynamics: Control of non-classical optical & spin states in rare earth doped single crystals & nanoscale systems.



Laser and Nonlinear Optical Materials: Design & synthesis of new inorganic materials for photonics in the fields of lasers.

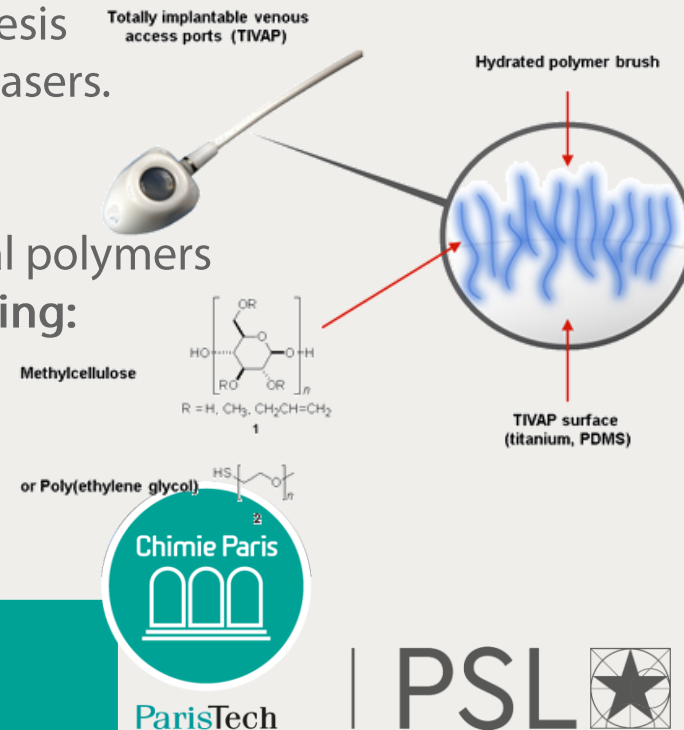
Smart Polymers

Self-assemblies: amphiphilic copolymers & liquid crystal polymers

Polymer nanoparticles for drug delivery and bioimaging:

fluorescent self-assemblies with aggregation induced emission

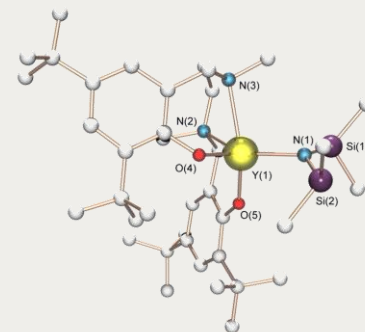
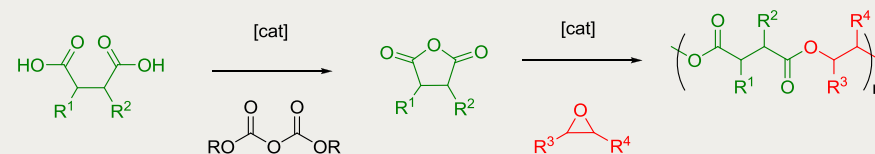
Nanoparticles for Biomedical diagnostic & therapy



Catalysis

Monomers from renewable sources and **renewable monomers**

Organometallic catalysts for **stereoselective polymerisation**

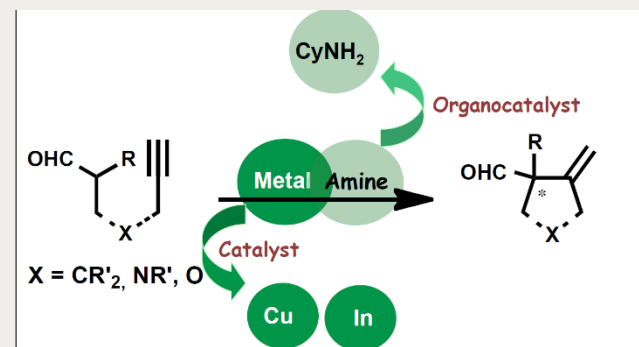


Control and synthesis of polymer based nano-objects

Catalysts for tandem catalysis

Catalysis & Metal-Organocatalysis

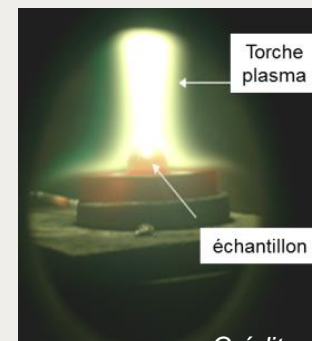
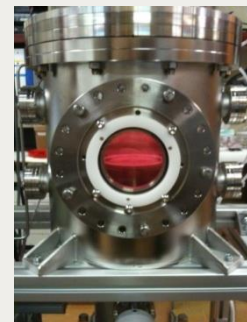
step and atom-economical processes; solventless reactions, chemistry in water; Fe, Ru, Rh, Pt, Cu, In, Pd-catalyzed reactions for C-H, C-C & C-N bond formation; asymmetric reduction



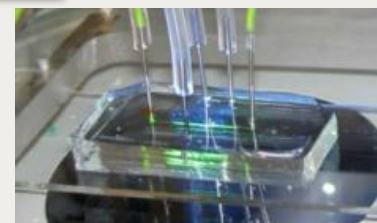
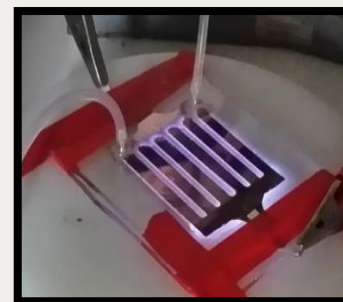
Total Synthesis of Biomolecules

Chemical engineering and flow chemistry

- Deposition of coatings by innovative plasmas Processes
- Plasma Processes for depollution & recycling
- CO₂ methanisation by plasma assisted catalyst
- Flow chemistry for Functionalisation and Synthesis of molecules and polymers



Crédit:
2PM-IRCP



Modeling and theory

Development of new methods (electronic structure, environment): DFT approaches, embedding models, solvent models; Implementation in largely distributed codes

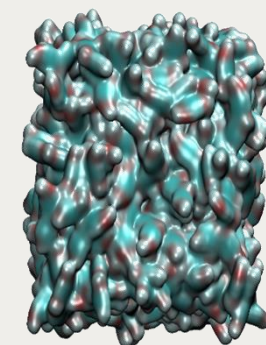
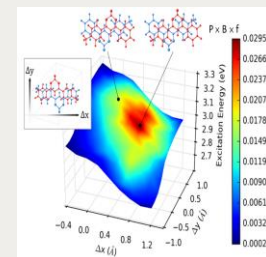
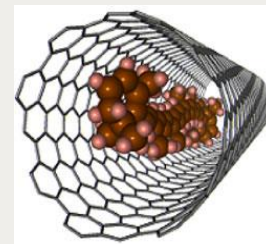
Modelling and design molecule based devices: photovoltaics, AIE, light activated devices

Properties of biologically relevant molecules: Photo Dynamic Therapy, 2 Photons Absorption, DNA intercalators...

Modeling of surfaces and materials : reactivity, properties

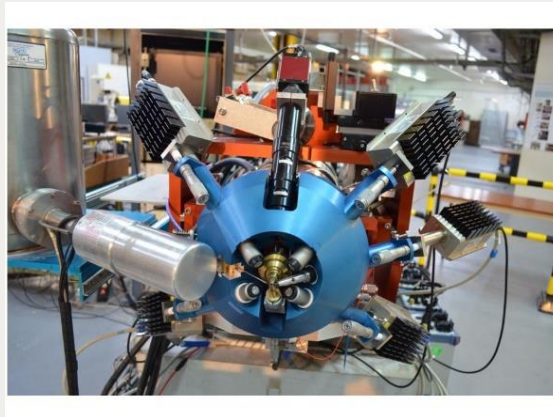
Modeling of soft and porous materials

Modelling of catalytic reaction mechanisms and optimization (homogeneous & heterogeneous)



Excellent facilities for research within Paris

- NMR / Microscopy and spectroscopy...
- New AGLAE @ Musée du Louvre



Energy

Environment

Materials

Health

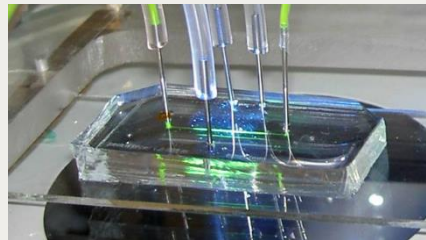


Pierre Gilles de Gennes Institute for microfluidics



- National excellence laboratory
- Created in 2011
- € 28.2M project
- To bring together, in a cross-disciplinary domain, experts from various disciplines (Physics, biology, chemistry, technology)
- To develop both basic and applied research

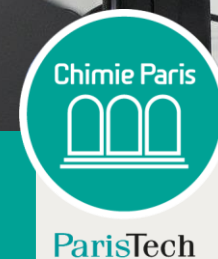
www.institut-pgg.com



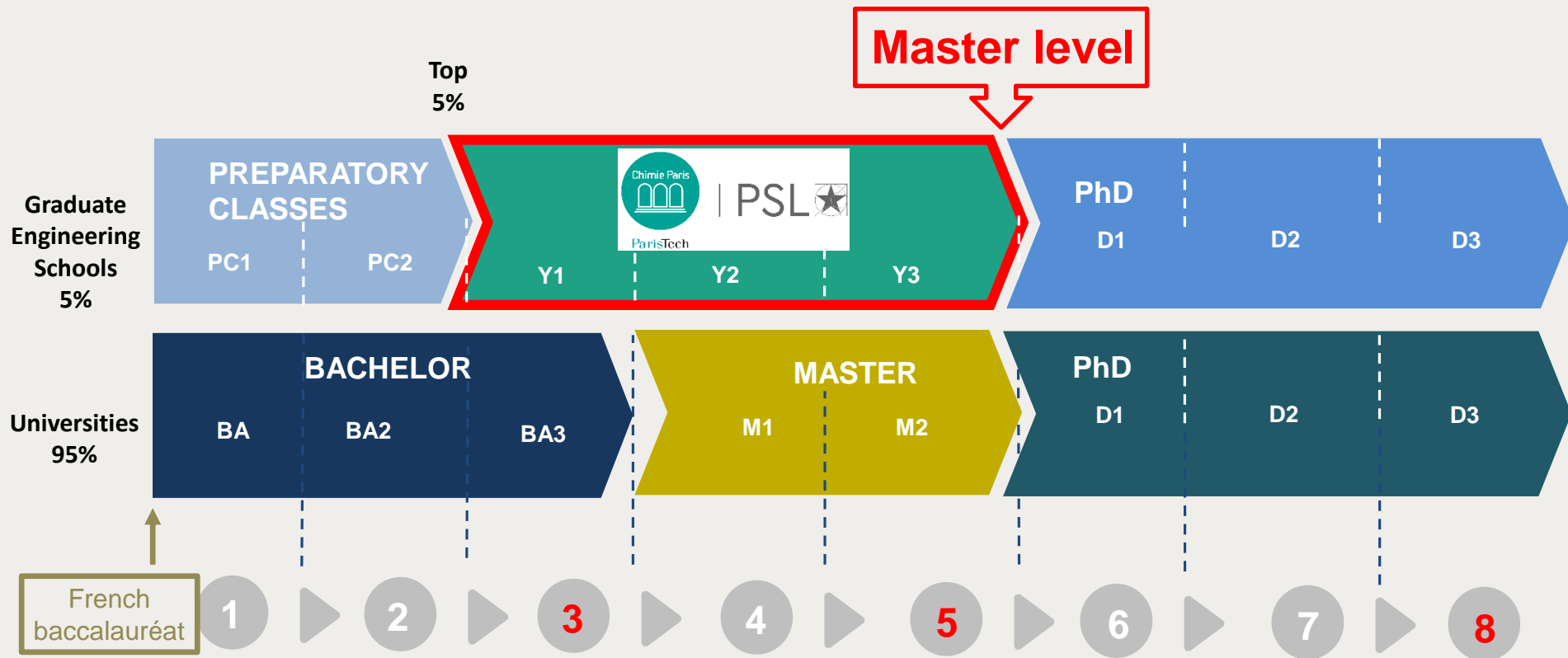
TRAINING



Chimie ParisTech geneal presentation



HIGHER EDUCATION SYSTEM



Training top level professionals in chemistry



Year 1

Towards engineering

Basic courses
Team projects
Management, Economy
Language and Cultures
Work internship 1-2 months

Year 2

Options

Basic courses & options
Projects (innovation)
Management, Economy
Language
Internship - 5 months

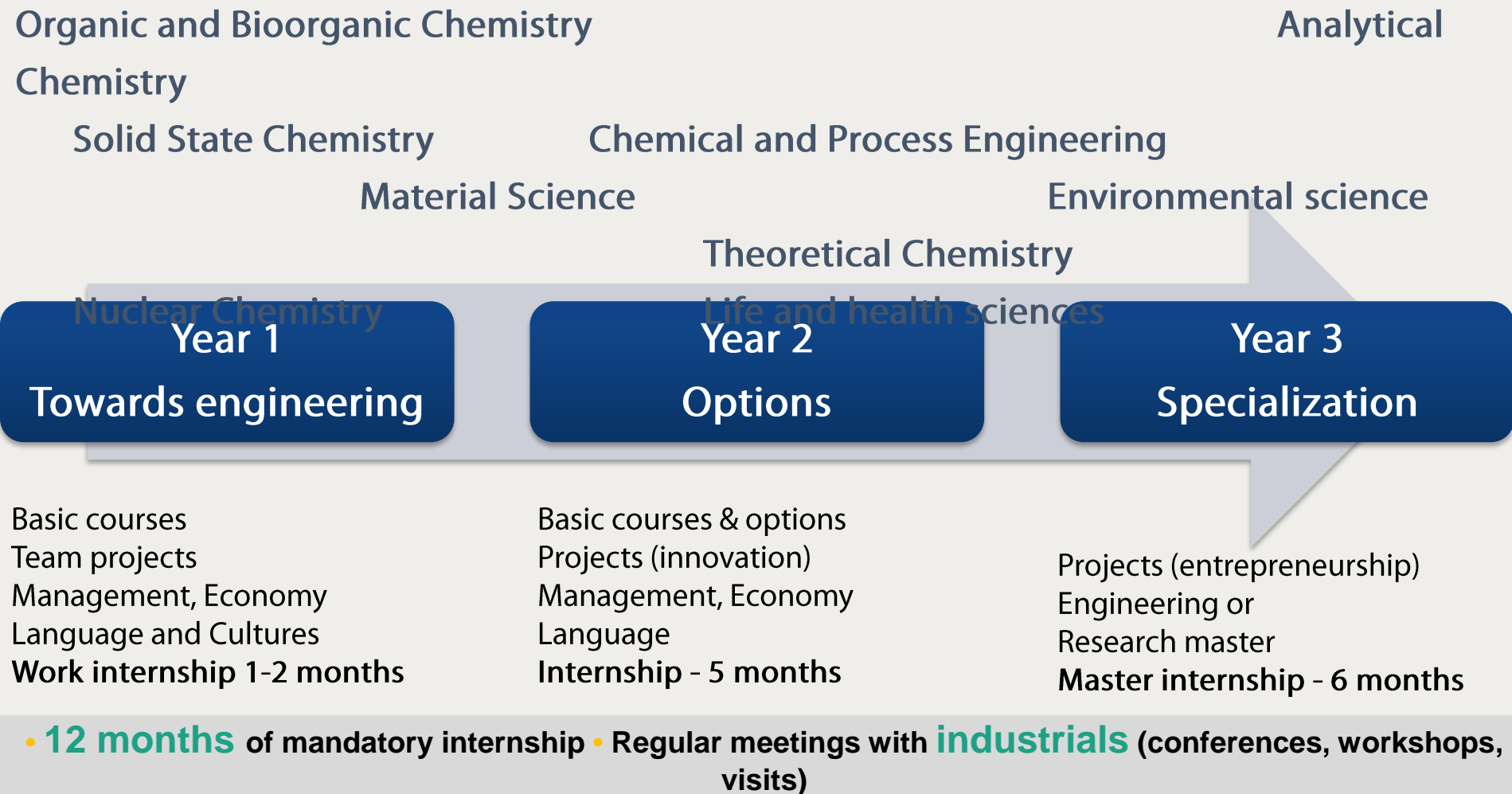
Year 3

Specialization

Projects (entrepreneurship)
Engineering or
Research master
Master internship - 6 months

• **12 months** of mandatory internship • Regular meetings with **industrials** (conferences, workshops, visits)

Training top level professionals in chemistry



First year: high level scientific skills

1 Sept-31 Dec



1 Jan-30 Apr



1 May-30 Jul

Courses

Chemical engineering,
Risks, Physicochemistry,
analytical , organic
chemistry I,
Mathematics, quantum
mechanics, Computing
and programming,
Management economy

Courses

Organic chemistry,
Quantum chemistry,
spectroscopy,
Crystallography, solid
state chemistry,
organic chemistry II,
Numerical methods

Lab project
team work in a lab

Work internship
(1 or 2 months)

Transdisciplinary project
team work on social, economical or environmental issues

Second year: New applications

1 Sept-31 Dec

Common bases
Chemical engineering,
Metallurgy, Polymers,
Analytical chemistry
II, Biochemistry,
Nuclear energy and
radioactivity,
Thermostatistics and
modelization,
Inorganic chemistry

1 Jan-30 Mar

Options
Molecular chemistry
Materials
Chemical engineering
Analytical and
Biological Chemistry
Biotechnologies

Techno Team project
(1/2 day per week)
teamwork Building of a
prototype

1 Apr-30 Aug

Internship
(4-5 months)

Third year: specialization industrial innovation and/or research

1 Sept - 31 Jan

Engineering

Biotechnologies
Sustainable processes &
materials
Industrial processing
Green organic chemistry
Cosmetology and Formulation
Energies



1 Feb - 31 Jul

Internship
(6 months)




Masters @ Chimie ParisTech

- Master in Chemistry with
- 5 tracks
 - Molecular Chemistry (FR)
 - Chemistry of Materials (FR)
 - Analytical, Physical and Theoretical Chemistry (FR)
 - Chemical Engineering (FR)
 - Chemistry and Life Sciences (EN)



<https://www.psl.eu/en/education/masters-degree-chemistry>


Masters @ Chimie ParisTech

- Material Science and engineering
 - Materials and Engineering Sciences in Paris (EN)
 - Materials of the future, Design and Engineering (FR)
 - Microfluidics, fluid science engineering (FR)
<https://www.psl.eu/en/education/master-s-degree-materials-science-and-engineering>
- BME BioMedical Engineering with  Université de Paris
 - Bioimaging (EN)

Masters @ Chimie ParisTech

- Energy (EN)
 - Sustainable Energy & Materials
 - Energy Efficiency
 - Decarbonation of fuels
 - Renewable Energy, grids

<https://www.psl.eu/en/education/master-s-degree-energy>

- Nuclear Energy with 
 - Fuel Cycle (EN)

Our PhD programmes

- Chemical engineering and advanced technology
- Physical chemistry and analytical chemistry
- Molecular chemistry
- Material physics and chemistry

<https://www.chimieparistech.psl.eu/en/programs/phd/>

IMPLEMENTATION OF EXCHANGES

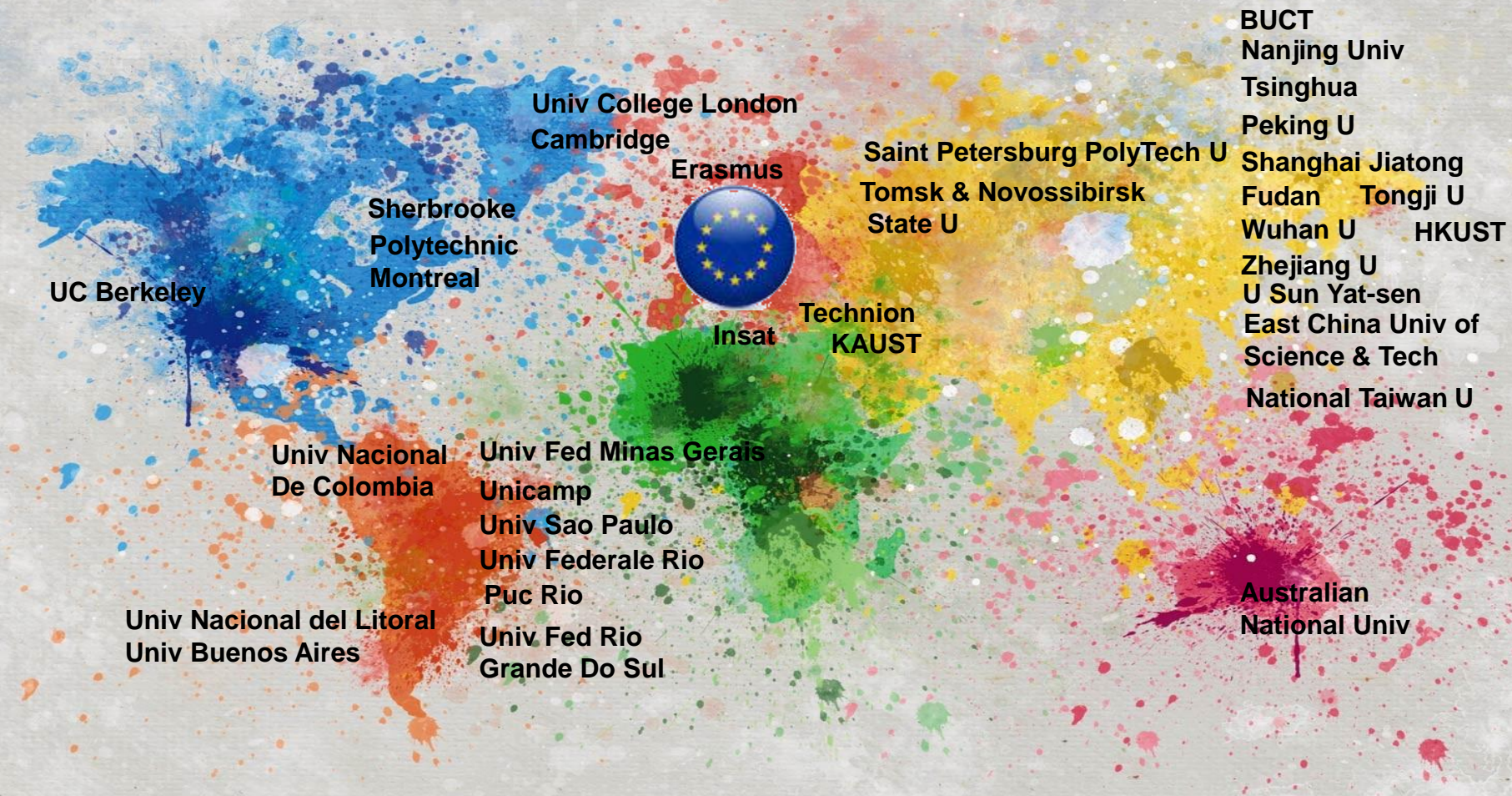


Chimie Paris

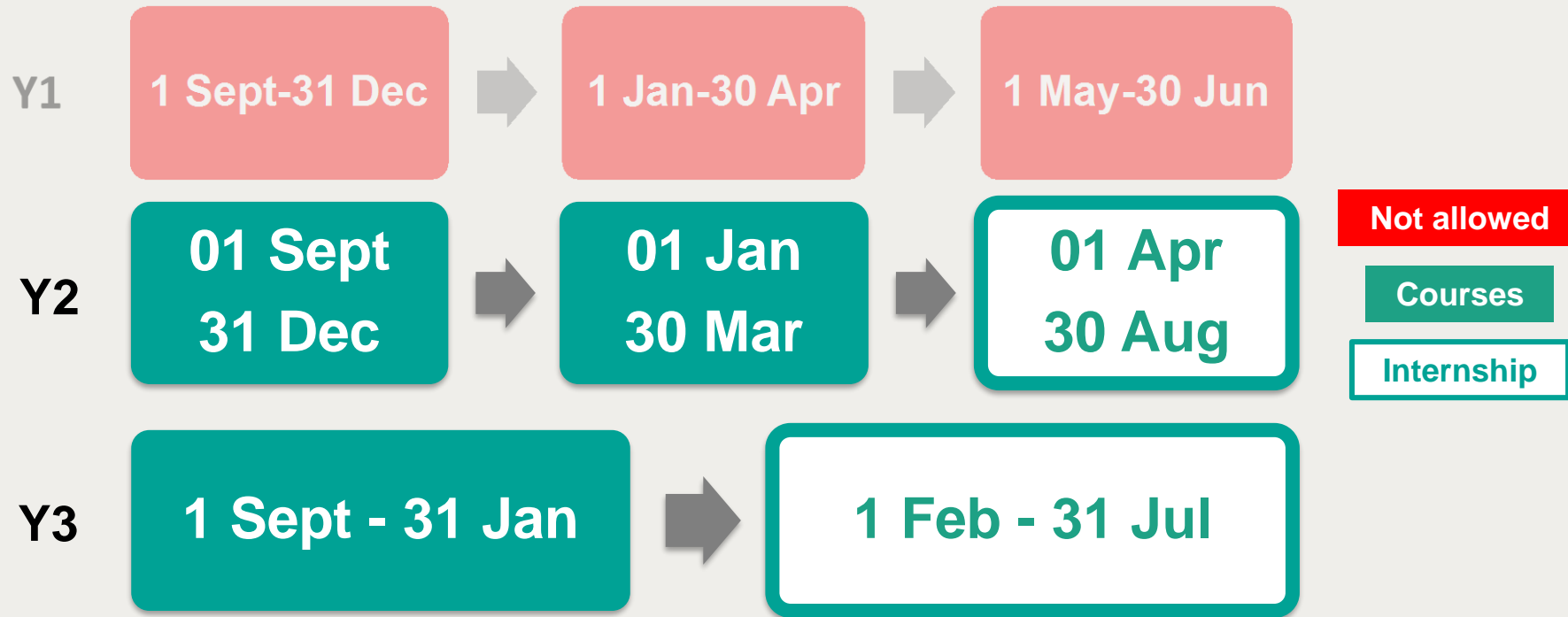
ParisTech



Our International network



Regular international mobility Exchange “engineering track”



<https://www.chimieparistech.psl.eu/erasmus/>



International mobility – “Master track”

M1

1 Sept-30 June

Including 3-4 months of Internship

M2

1 Sept-31 Jan



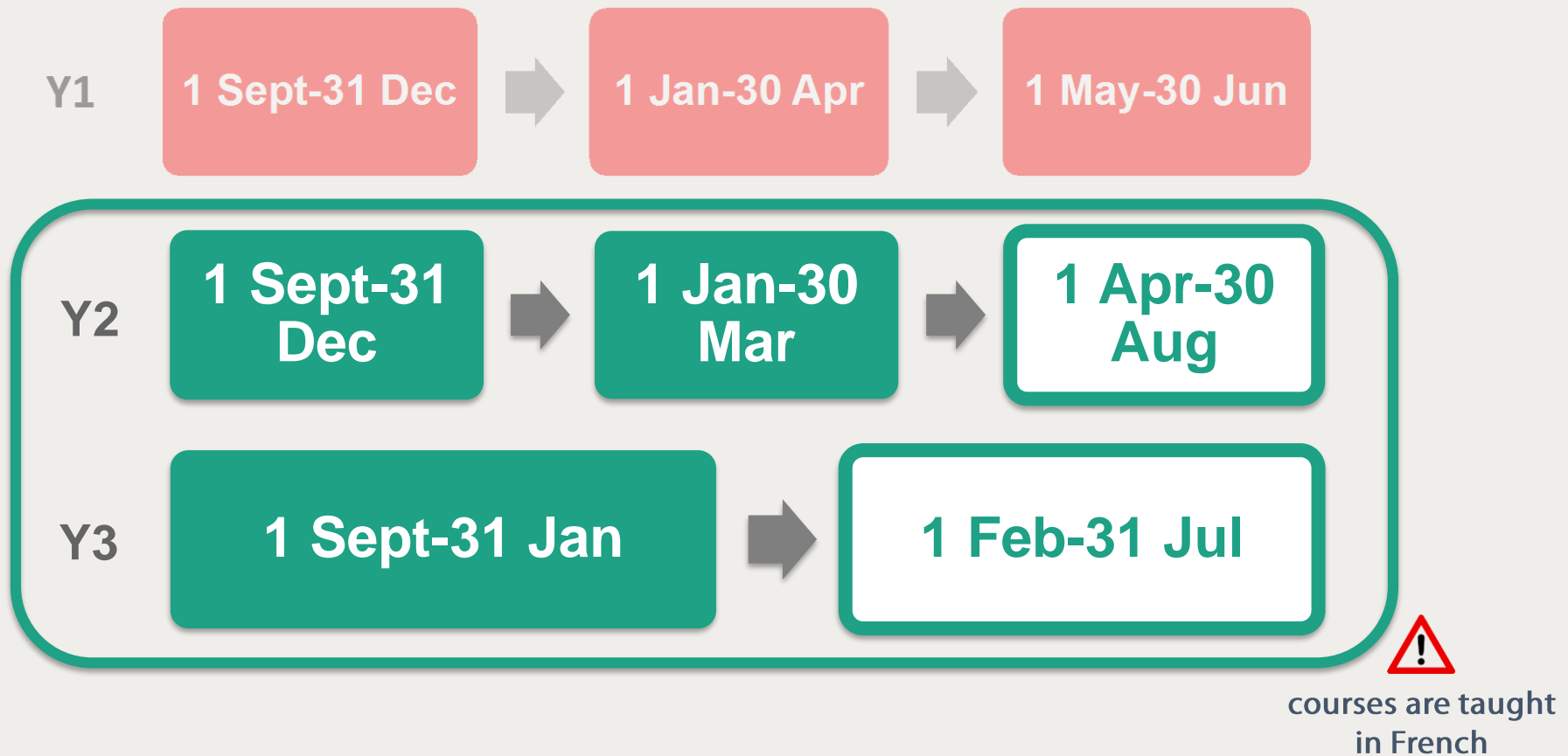
1 Feb-31 Jul

Internship

<https://www.chimieparistech.psl.eu/en/programs/masters-in-science-and-technology/>

Double Degree agreement

3 semesters @ Chimie ParisTech & 2 internships



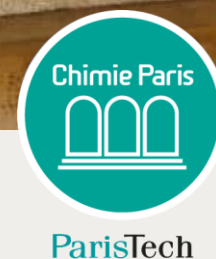
International students services



- Accommodation
 - Provided for international students in double degree
 - Affordable rents: ~ €340 pm
 - Possibility of accommodation allowance
 - Average living costs in Paris: €800 pm
- PSL Welcome Desk (visa...) & Student association
- Intensive Language Training Programs
- Mentoring by senior students
- Active participation in student activities



ECOLE
NATIONALE SUPERIEURE
DE CHIMIE



International Relations Office

Dr. Fethi Bedioui, Director
Mr. Antoine Mercier, Deputy
Mrs. Eloïse Hubert, Manager

international@chimieparistech.psl.eu