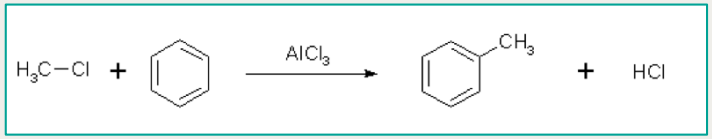
Chimie ParisTech – Université PSL

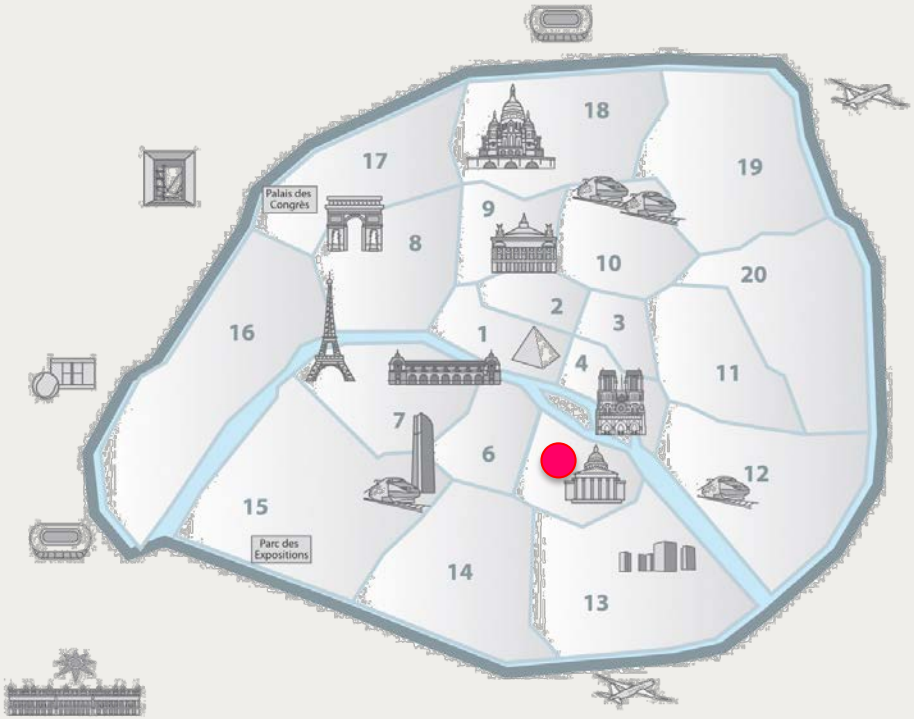
Fostering talents for tomorrow's chemistry

Chimie ParisTech general presentation

Chemistry at the heart of Paris

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 PARIS**

Chimie Paris ParisTech | PSL

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 Paris
ParisTech
PSL

Chimie ParisTech belongs to a world class University

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CONSERVATOIRE NATIONAL SUPÉRIEUR D'ART DRAMATIQUE | PSL

École nationale des chartes | PSL

ENS | PSL

École Pratique des Hautes Études | PSL

ESPCI PARIS | PSL

MINES ParisTech | PSL

l'Observatoire de Paris | PSL

Dauphine UNIVERSITÉ PARIS | PSL

COLLÈGE DE FRANCE 1530

institutCurie

cnrs

Inserm

Inria

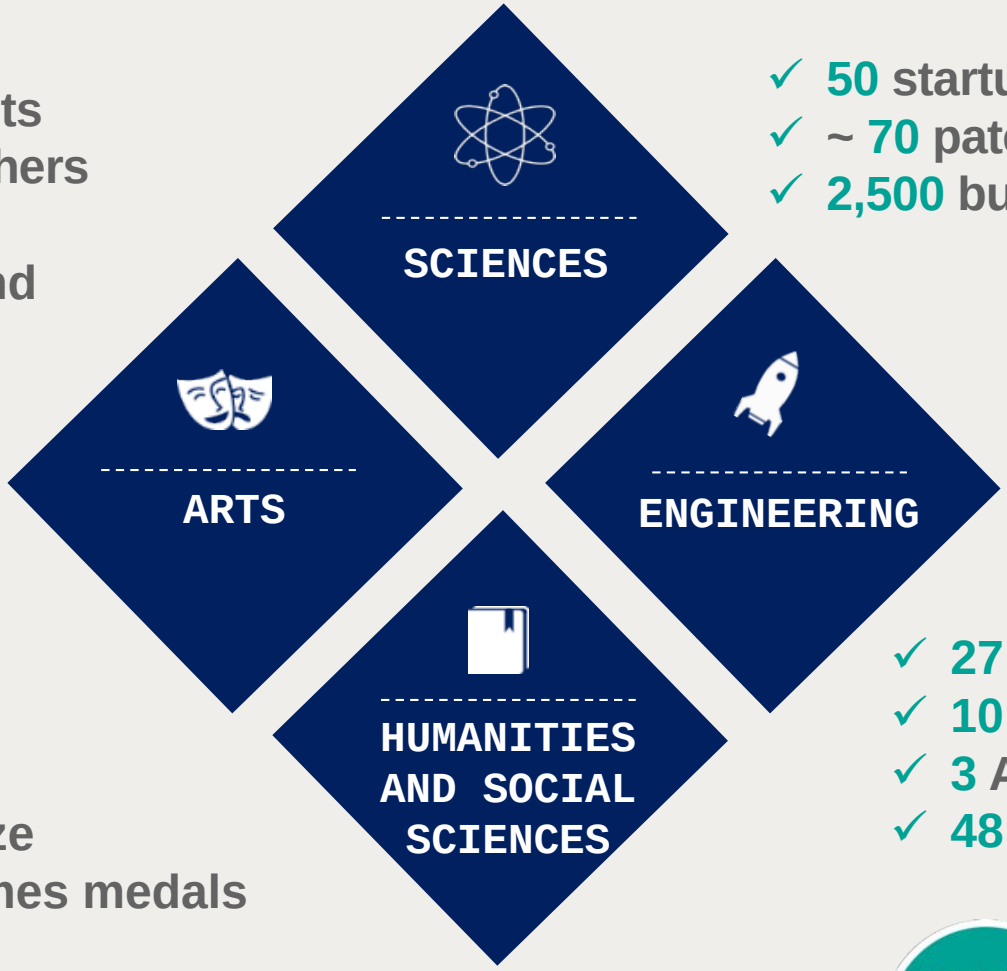
QS WORLD UNIVERSITY RANKINGS

THE WORLD UNIVERSITY RANKINGS

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

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

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

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ParisTech – Alliance of graduates schools in engineering

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

Our shared-values

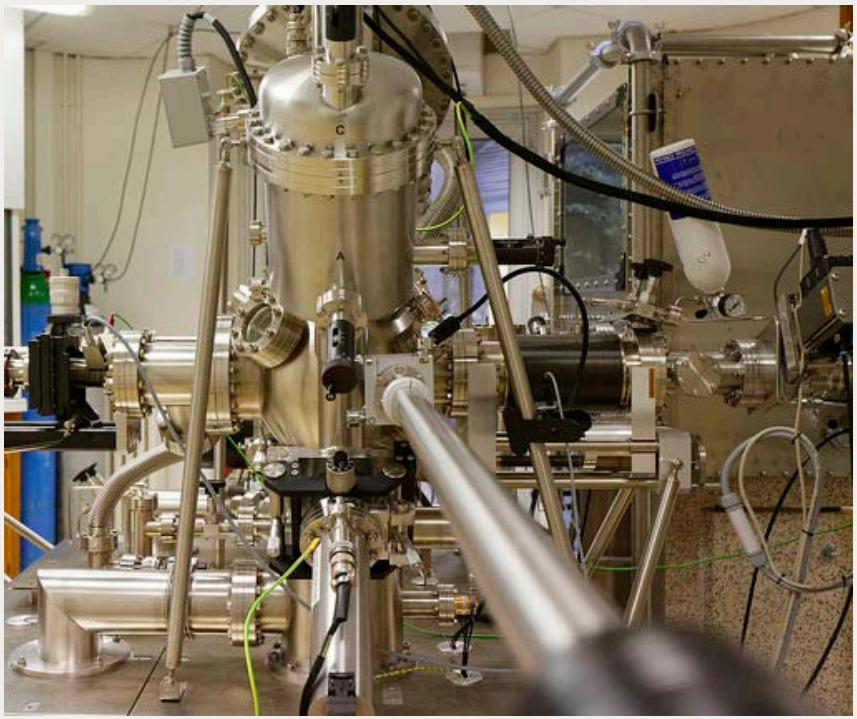
Excellence based on the model of French “Grandes Écoles”

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

AgroParisTech · Arts et Métiers · ParisTech | PSL · École des Ponts ParisTech · ESPCI PARIS PSL · Institut d'Optique Graduate School ParisTech · université PARIS-SACLAY · Mines ParisTech | PSL

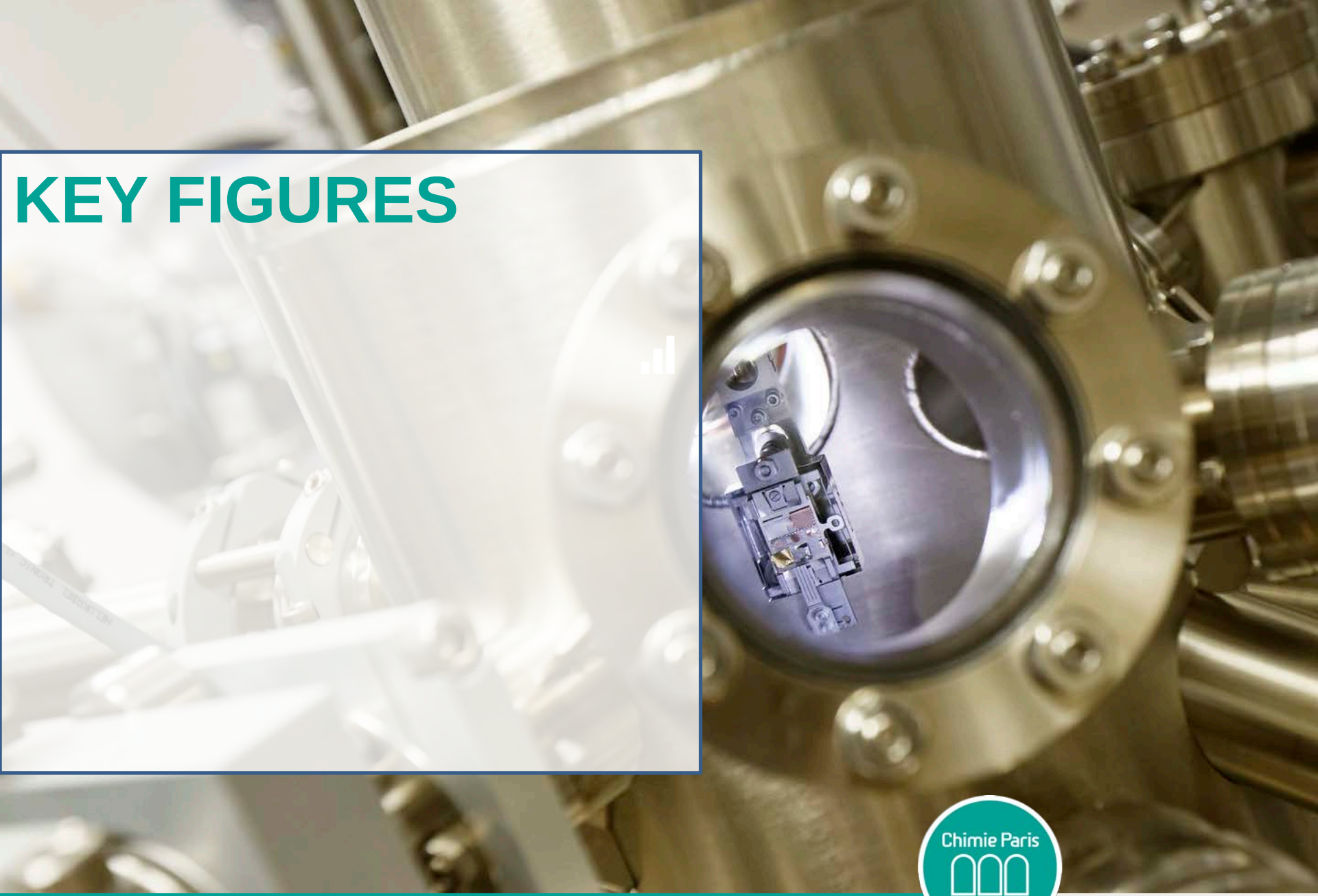
Our Vision



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

Chimie Paris ParisTech | PSL

KEY FIGURES



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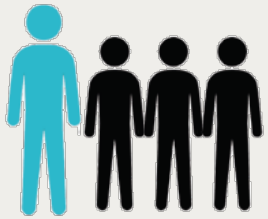
Training

1 Prof for
3 students



40%

Practical training

Highly selected students (50% of women)

350

140

Researchers and Professors & Associate Professors

20%

Business, management and human skills

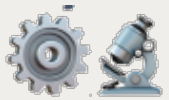
20%

international students

100%

abroad

12 months



Mandatory internship

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Research

PhD and post-docs 140

140 Researchers and Professors & Associate Professors

100% cnrs Label

7 per week

4 erc

Laboratories 3

13 Research Teams

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Research & Development

Chair
With Eco-Systèmes

1

50% of PhD funded by companies

>40

Research contracts per year

2 Labcom
(joint lab with SMEs)

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Chimie Paris Innov

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

- 700 000€ project
- Started in 2018

ENERGO, Ferroscan, LOMA, KOYA…

WOODOO

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

ENERGO

Plasma catalysis technology for methanation of CO_2

European patent [EP15202925.2] 2015

AZA

Electrically Rechargeable Zinc-Air Batteries

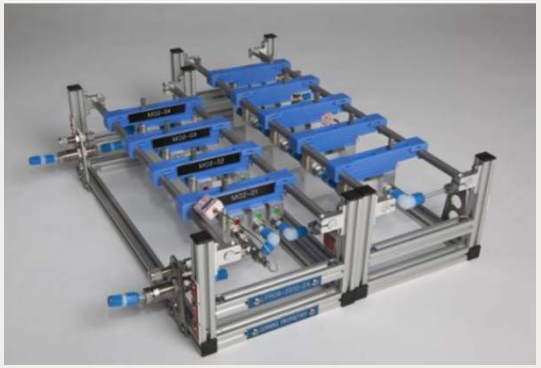
Zinc-Air

Cheap and Safe Batteries for Electrical Vehicles & Stationary Electricity Storage

Paris FLOW Tech

Continuous Flow Chemistry Technology Platform

- All activations in one place
- Unique in Europe
- 1.7M€ project
- Business need driven



Institut Carnot

The Carnot network

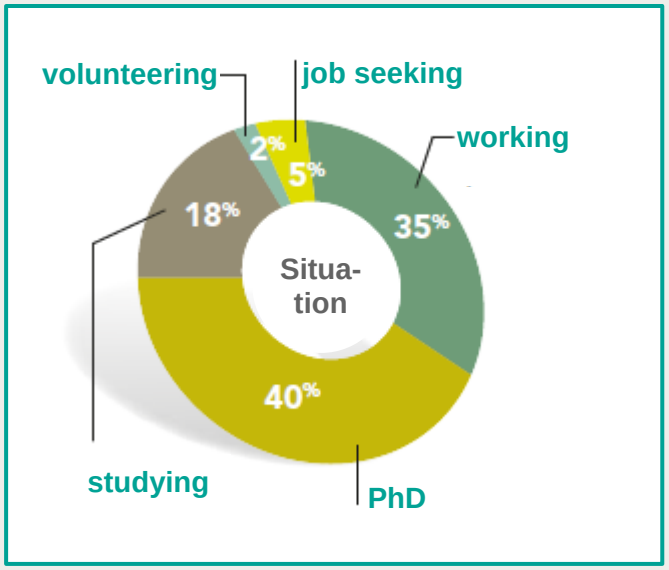
- **39 Carnot Institutes in France**
- **Given by the French Ministry of Higher Education, Research & Innovation**
- **Ambition to foster public/private partnerships**

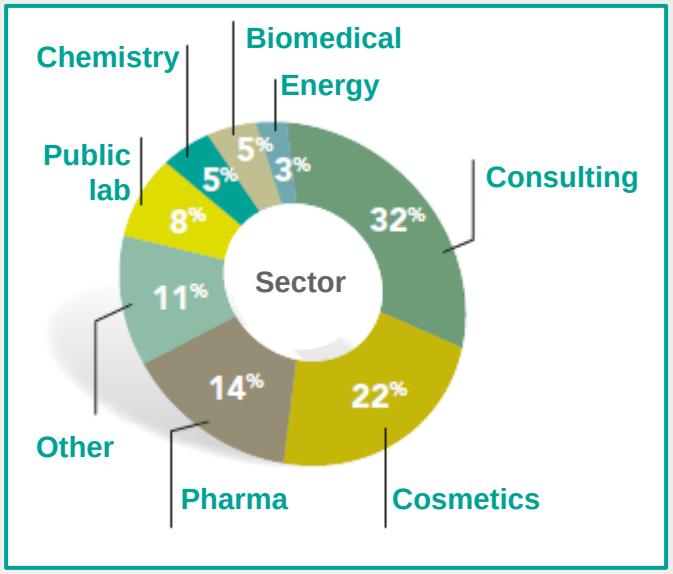
Institut Carnot IPGG Microfluidique represents:

- **350 researchers**
- **Common theme: flow at tiny scale and its many applications (milli-micro-nano-fluidics)**
- **Member institutions: Chimie ParisTech, ENS, ESPCI, PSL, CNRS**
- **Sectors**
  - ✓ Chemistry
  - ✓ Pharmaceuticals
  - ✓ Life sciences
  - ✓ Energy
  - ✓ Environment
  - ✓ Luxury goods

Employability of our Engineers

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





Class 2018 (110 students)

L'ORÉAL · CHANEL · ARKEMA · BAYER · SOLVAY · eDF · HERMÈS PARIS · MICHELIN · BOUYGUES · Unilever · TOTAL · AREVA · EXXON · P&G Procter&Gamble · DANONE

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RESEARCH

A world class research made to tackle global societal challenges

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ParisTech
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Our 3 research joint laboratories with CNRS

Paris Research Institute of Chemistry **Materials & Energies**

IRCP | Institut de Recherche de Chimie Paris

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

i-CLeHS

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

IPVF | Institut Photovoltaïque d'Île-de-France

Energy Environment Materials Health

Chimie Paris ParisTech | PSL

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

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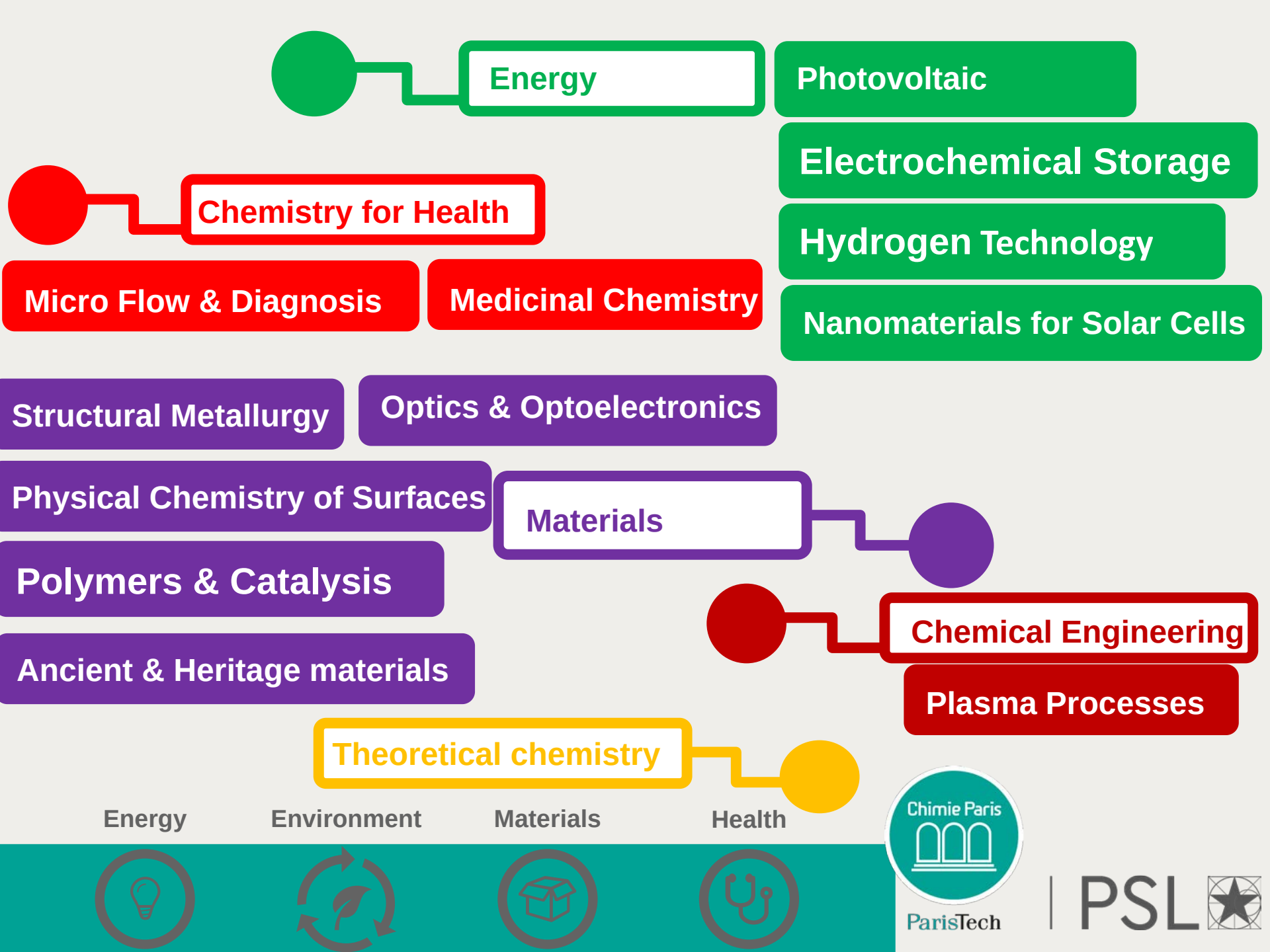
Energy
Photovoltaic
Electrochemical Storage
Hydrogen Technology
Nanomaterials for Solar Cells
Chemistry for Health
Micro Flow & Diagnosis
Medicinal Chemistry
Structural Metallurgy
Optics & Optoelectronics
Physical Chemistry of Surfaces
Materials
Polymers & Catalysis
Ancient & Heritage materials
Chemical Engineering
Plasma Processes
Theoretical chemistry
Energy
Environment
Materials
Health
Chimie Paris
ParisTech
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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

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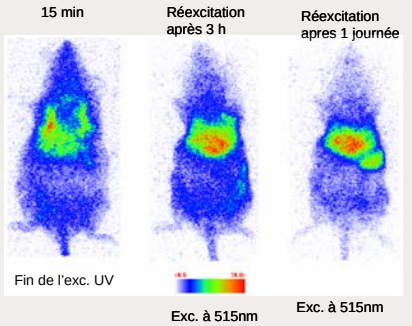
Imaging and characterization

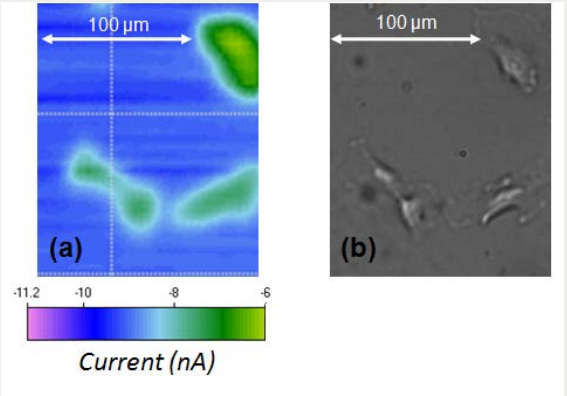
Design of new materials for Imaging and Biophotonic:

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

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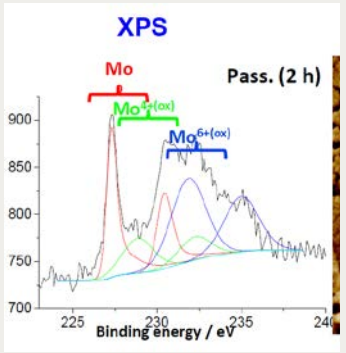
Characterization and imaging

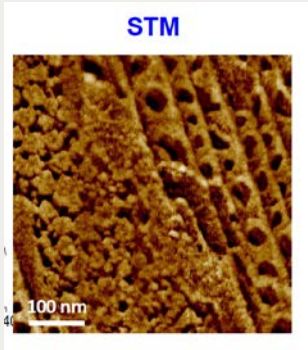
Characterization of surfaces

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)



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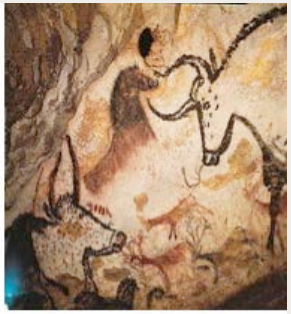
Ancient & Heritage materials

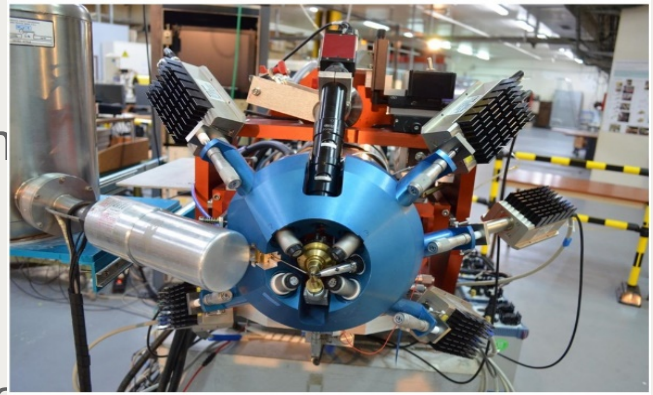
- **Authentification and conservation of cultural heritage artifacts**




Analytical techniques

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



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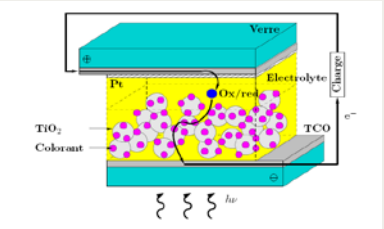
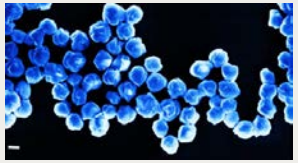
Nano & smart materials



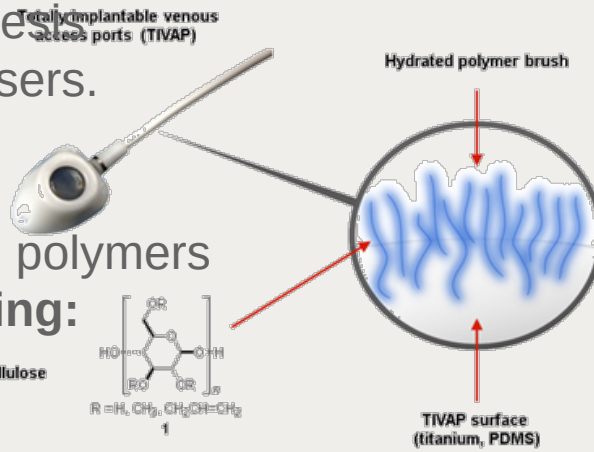
Nanostructured Materials for photovoltaics & optoelectronics
Hybrid solar cells (perovskite/dye sensitized/Quantum Dot)

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

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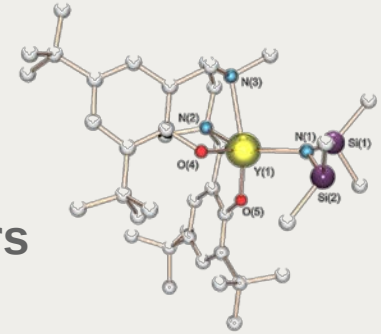
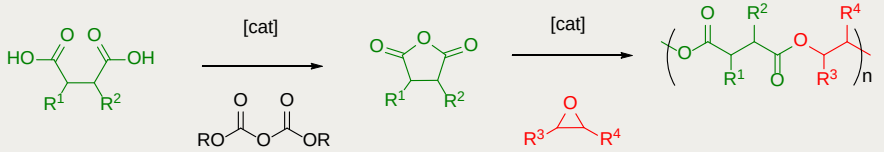
Catalysis



Monomers from renewable sources and **renewable monomers**

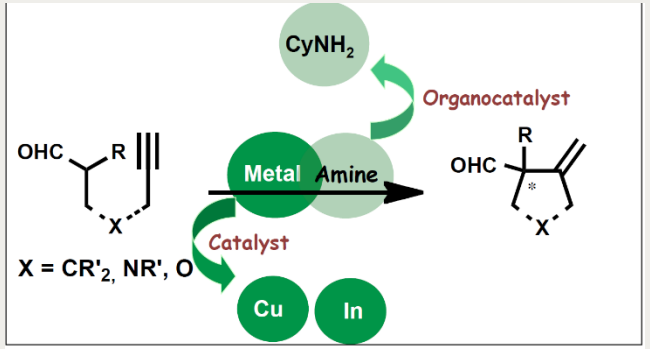
Organometallic catalysts for **stereoselective polymerisation**



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

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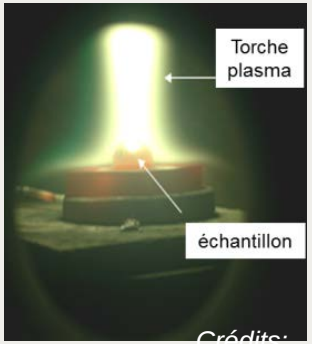
Chemical engineering and flow chemistry

- Deposition of coatings by innovative plasmas Processes
- Plasma Processes for depollution & recycling
- CO_2 methanisation by plasma assisted catalyst
- Flow chemistry for Functionalisation and Synthesis of molecules and polymers



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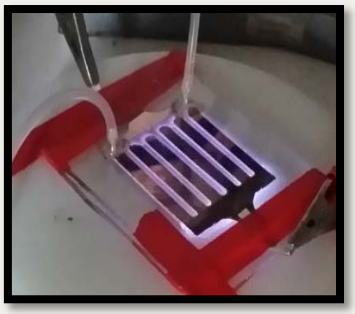

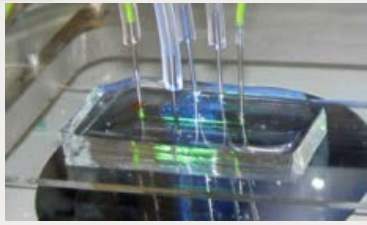

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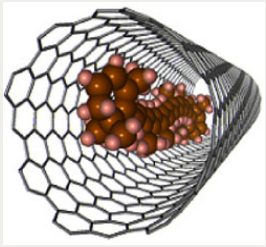
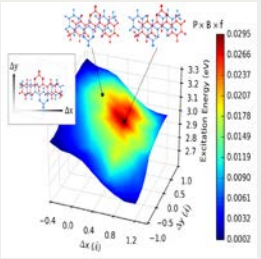
Modeling and theory

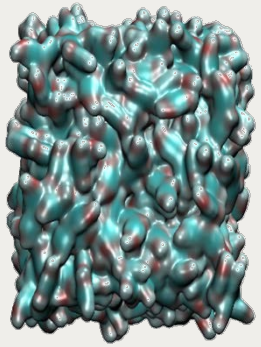


Development of new methods (electronic structure, environment): DFT approaches, embedding models, solvent models; Implementation in largely distributed codes



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**)**

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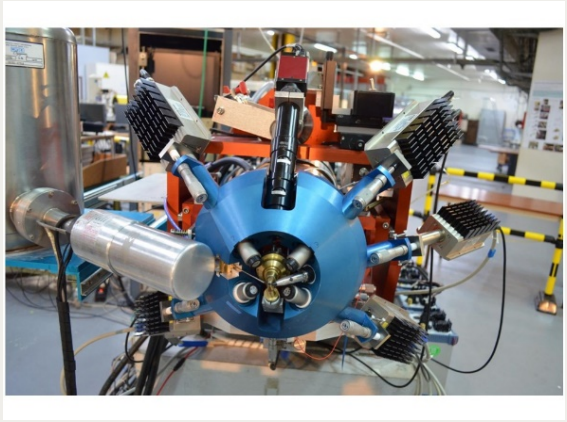
Excellent facilities for research within Paris

- NMR / Microscopy and spectrosopy…
- New AGLAE @ Musée du Louvre



Energy Environment Materials Health

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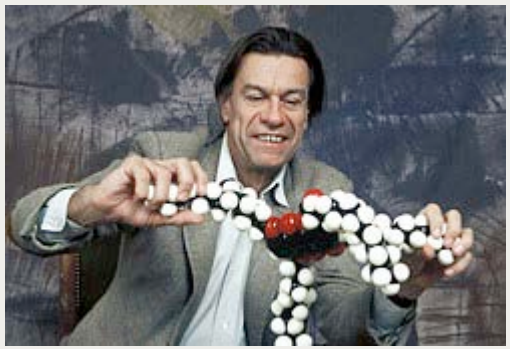
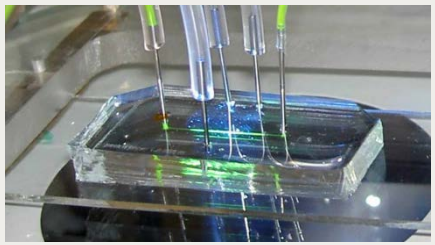
Pierre Gilles de Gennes Institute for microfluidics





- 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

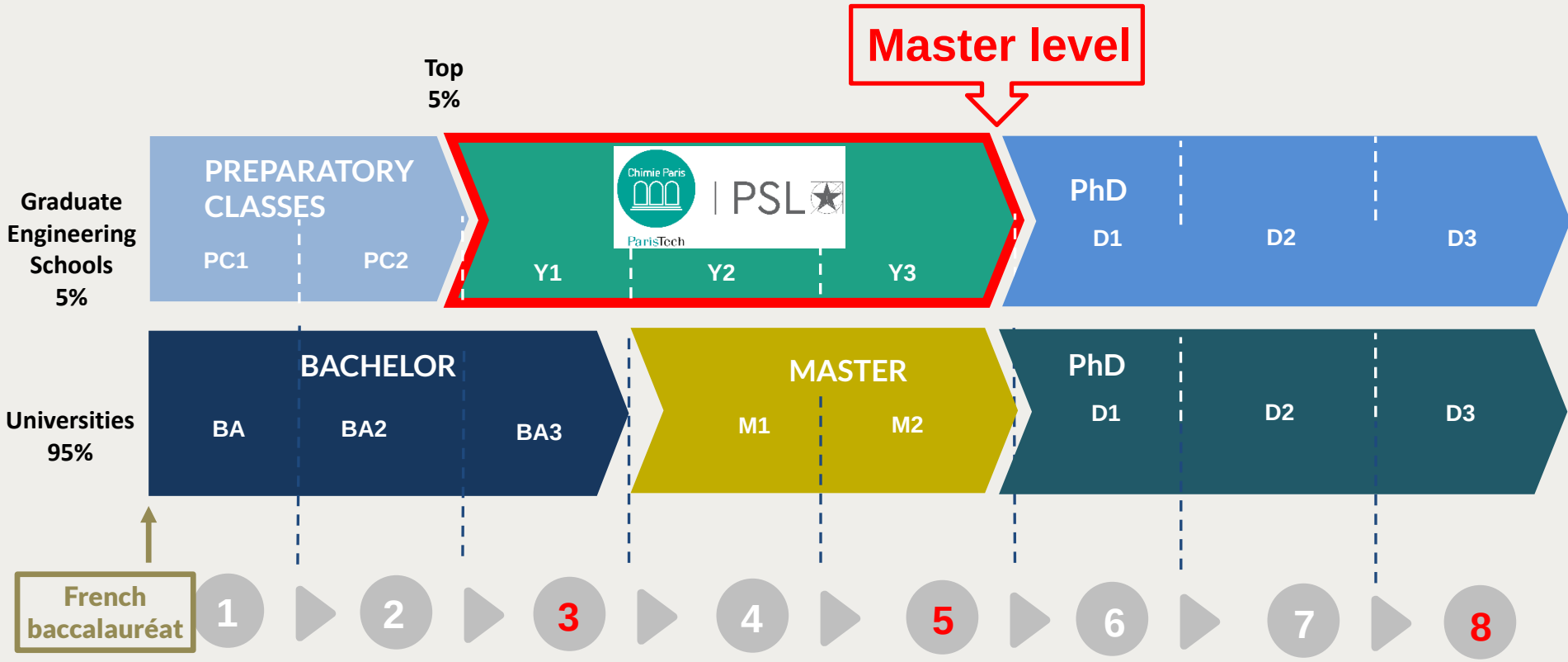
www.institut-pgg.com

INSTITUT PIERRE-GILLES DE GENNES
Pour la microfluidique

Chimie Paris ParisTech
ENS
institutCurie
PSL
ESPCI PARIS

TRAINING

HIGHER EDUCATION SYSTEM



Chimie Paris ParisTech | PSL

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

Organic and Bioorganic Chemistry
Analytical Chemistry
Solid State Chemistry
Chemical and Process Engineering
Material Science
Environmental science
Theoretical Chemistry
Nuclear Chemistry
Life and health sciences

Year 1 Towards engineering	Year 2 Options	Year 3 Specialization
Basic courses Team projects Management, Economy Language and Cultures **Work internship 1-2 months**	Basic courses & options Projects (innovation) Management, Economy Language **Internship - 5 months**	Projects (entrepreneurship) Engineering or Research master **Master internship - 6 months**

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

First year: high level scientific skills

1 Sept-31 Dec

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

1 Jan-30 Apr

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

1 May-30 Jul

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)

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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 SORBONNE UNIVERSITÉ
- 5 tracks
  - Molecular Chemistry (FR)
  - Chemistry of Materials (FR)
  - Analytical, Physical and Theoretical Chemistry (FR)
  - Chemical Engineering (FR)
  - Chemistry and Life Sciences (EN)
- New M1 Chemistry & Innovation

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

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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)**

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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** université PARIS-SACLAY
  - **Fuel Cycle (EN)**

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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/

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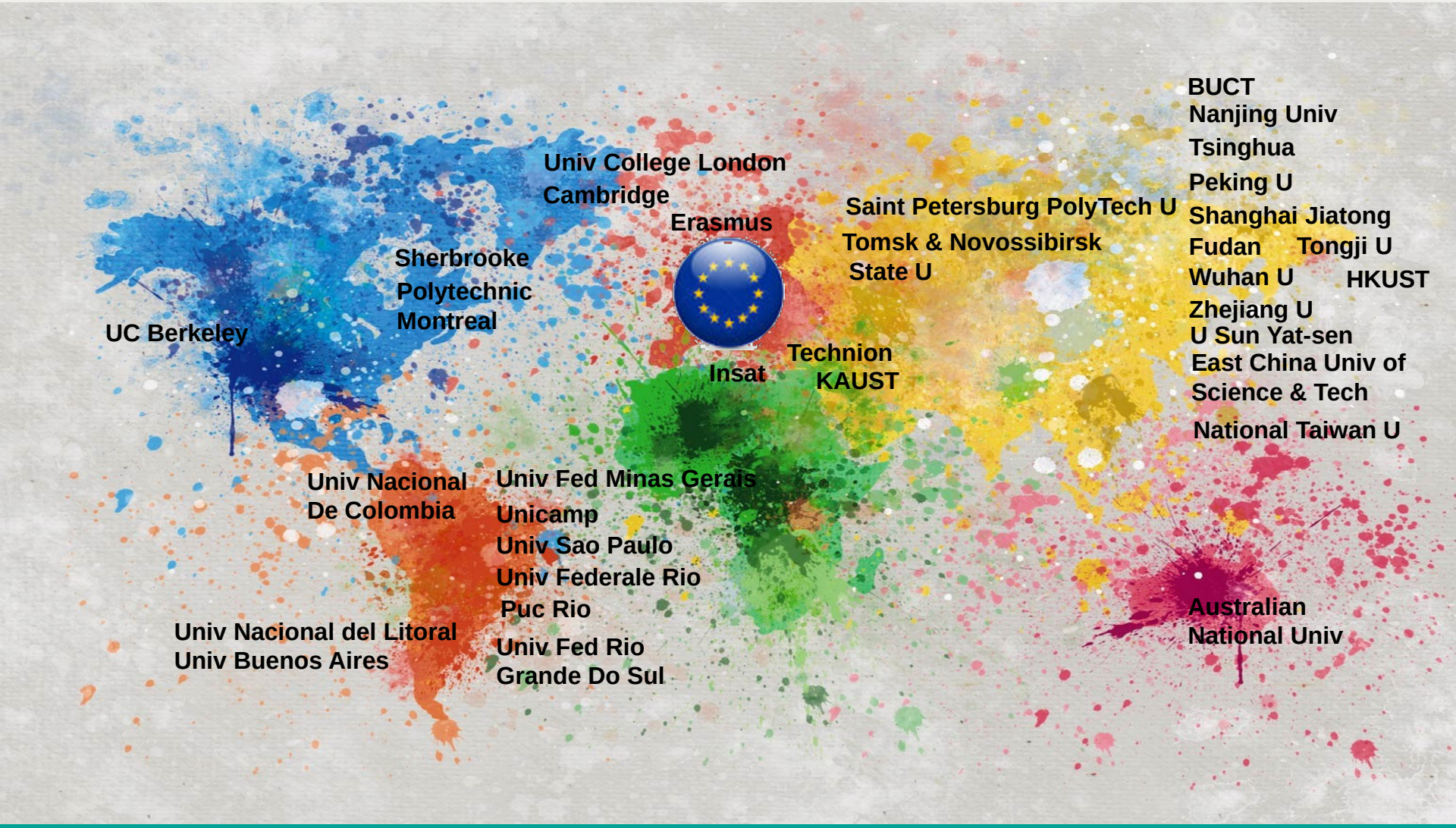
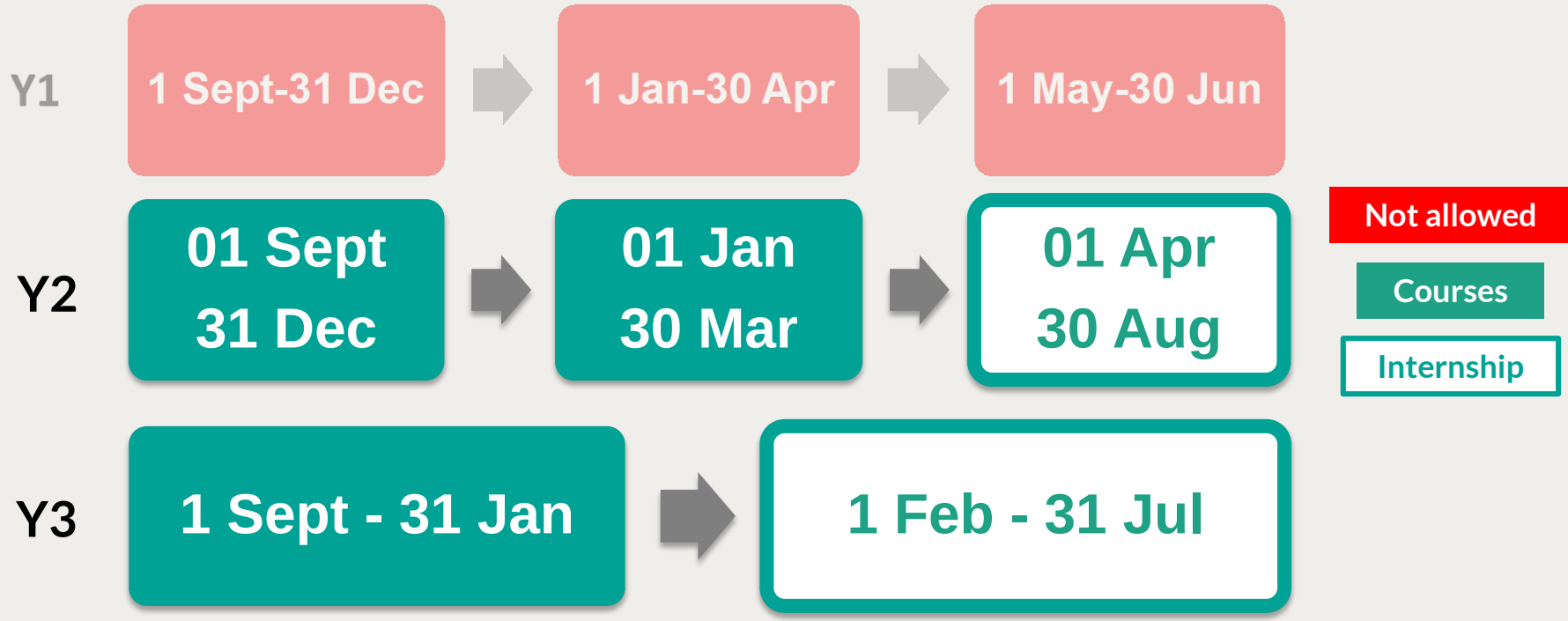
IMPLEMENTATION OF EXCHANGES

Our International network



Regular international mobility Exchange "engineering track"

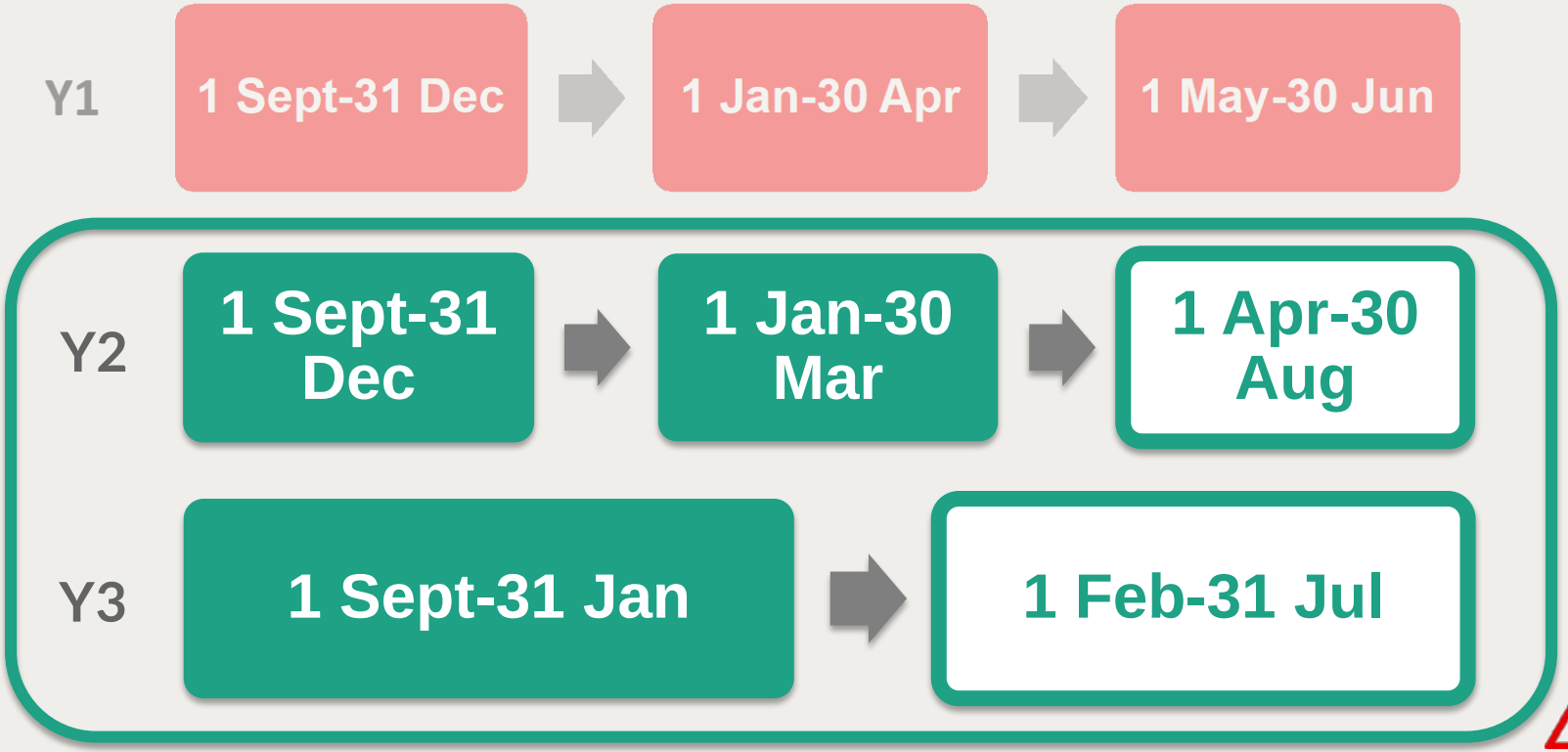


https://www.chimieparistech.psl.eu/erasmus/

International mobility – “Master track”

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

Double Degree agreement
3 semesters @ Chimie ParisTech & 2 internships



courses are taught in French

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**

Double degree with Russian partners

POLYTECH
Peter the Great St Petersburg Polytechnic University

Novosibirsk State University
*THE REAL SCIENCE

National Research Tomsk State University

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Prep classes → 1st year → 2nd year → 3rd year

4th year → M1 → M2 → Double Degree

Selection

NB: Mandatory internship in Russia

Double degree with Russian partners

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POLYTECH Peter the Great St.Petersburg Polytechnic University

Novosibirsk State University *THE REAL SCIENCE

National Research Tomsk State University

Selection

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Double degree with Latin American partners

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1st year → 2nd year → 3rd year

Eng. 3 → Eng. 4 → Eng. 5 → Double Degree

Selection

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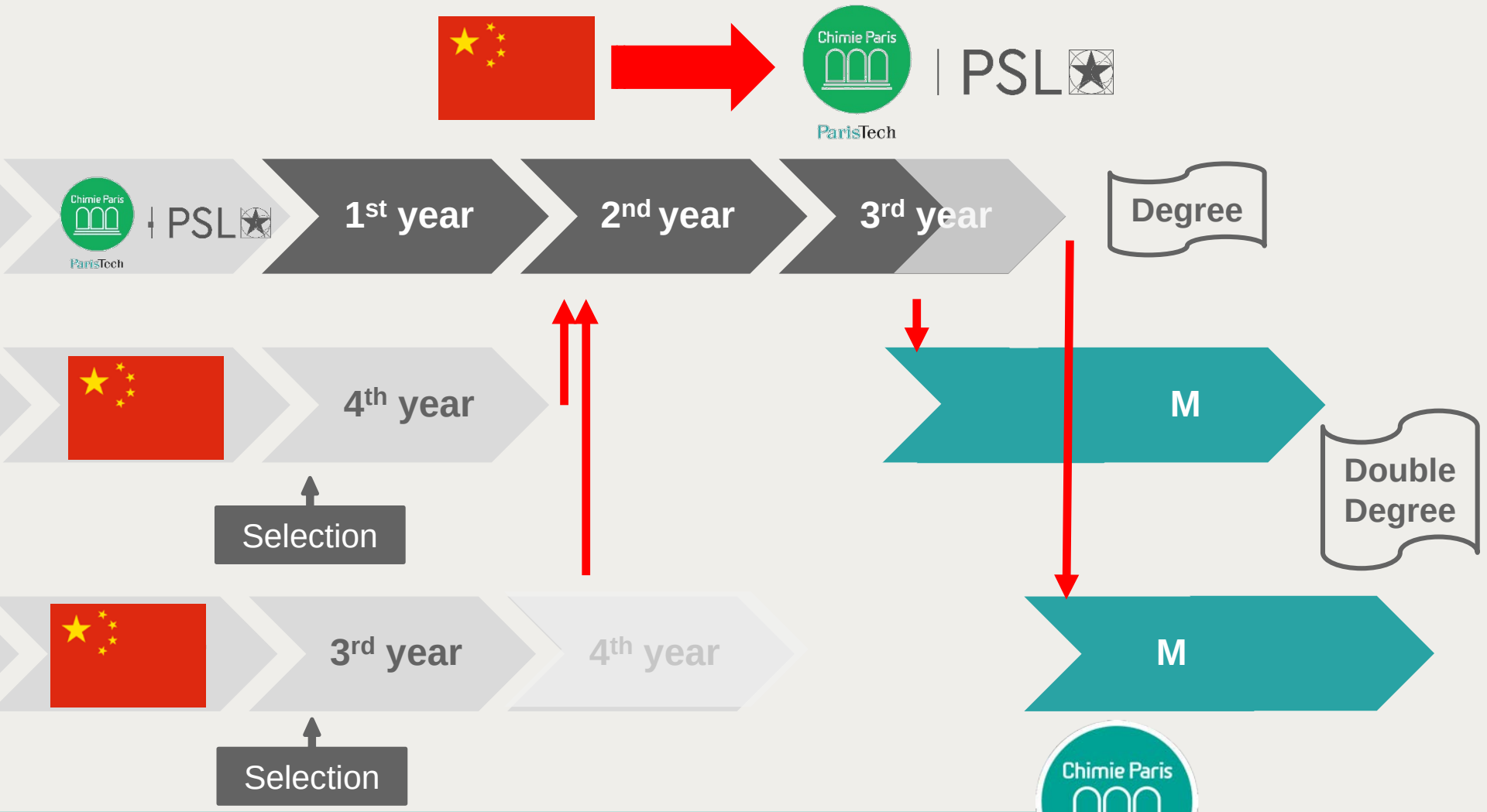
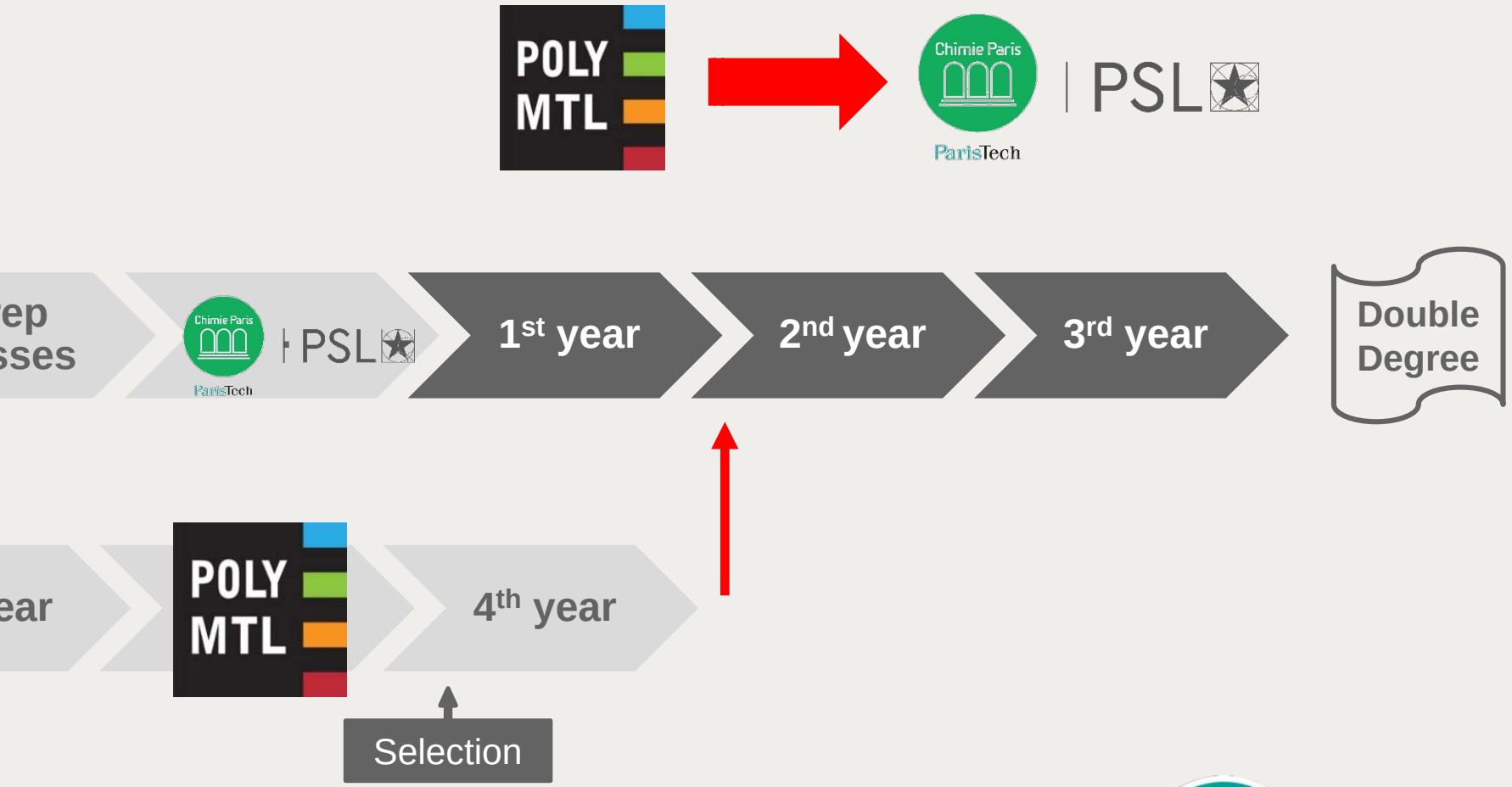
Double degree with Latin American partners

Double degree with Chinese partners

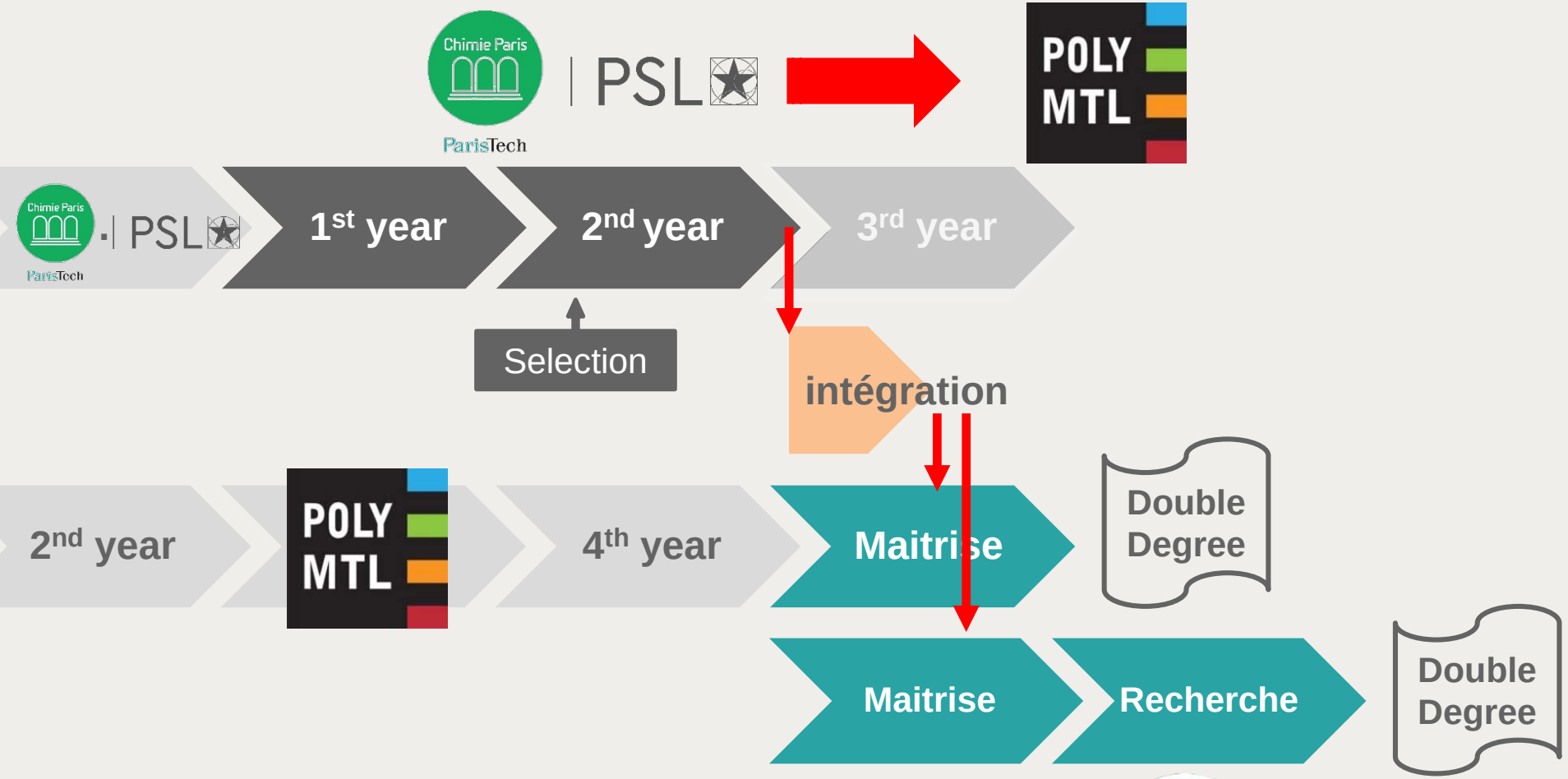


Double degree with Chinese partners

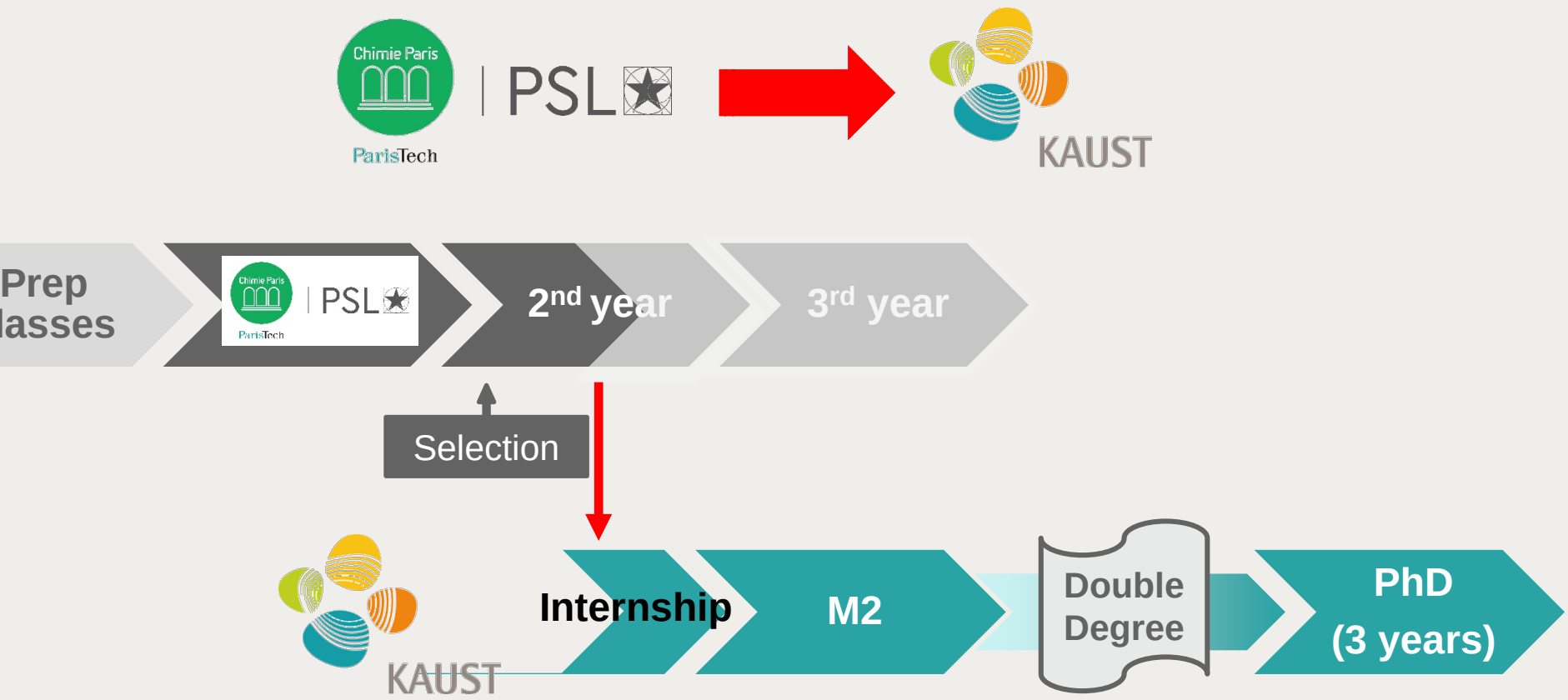
Double degree with Polytechnique Montreal



Double degree with Polytechnique Montreal

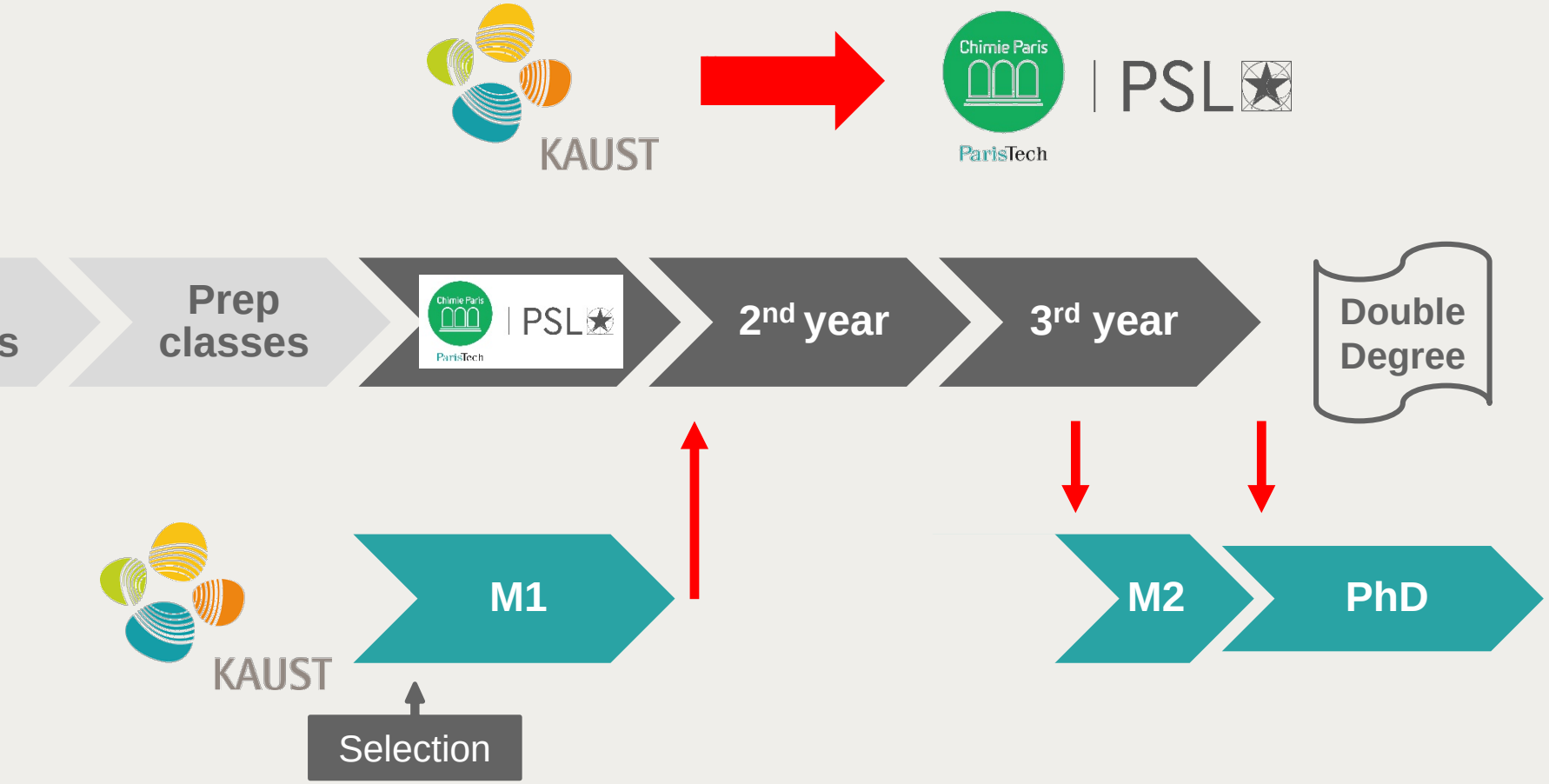


Double degree with KAUST

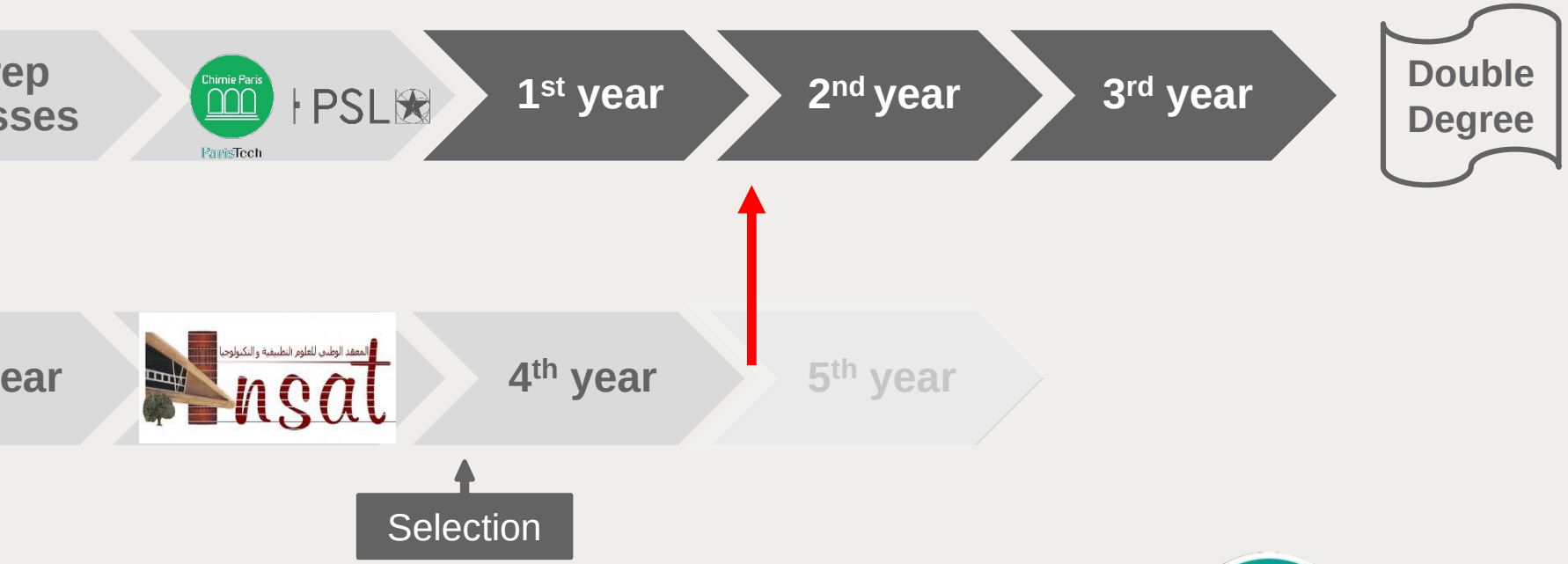


Cosupervision of Master's thesis

Double degree with KAUST



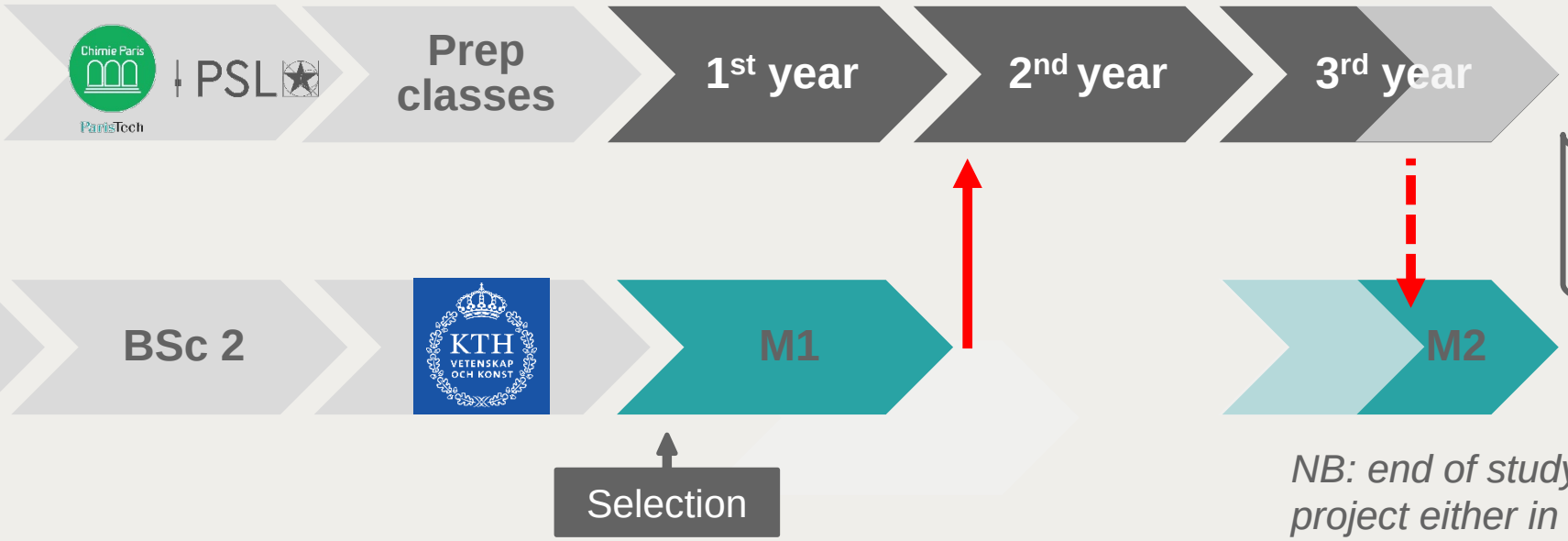
Double degree with INSAT



Double degree with INSAT

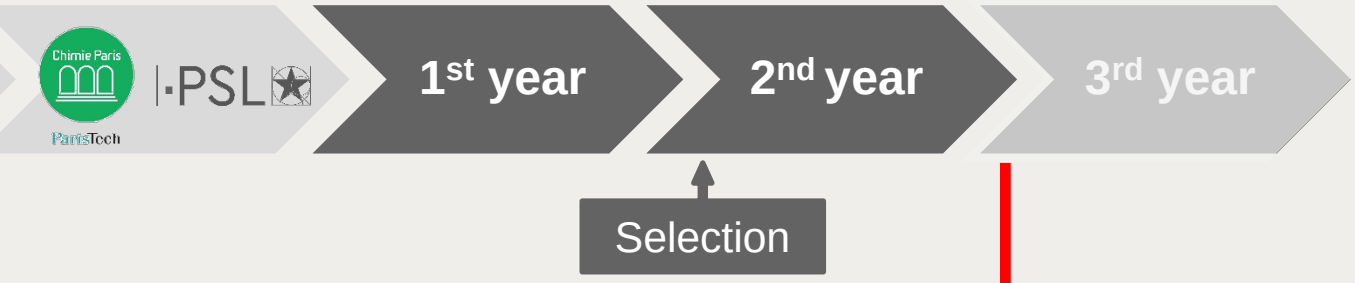
Selection

Double degree with KTH



NB: end of study project either in France or in Sweden

Double degree with KTH



Double degree with Politecnico di Milano

Double degree with Politecnico di Milano

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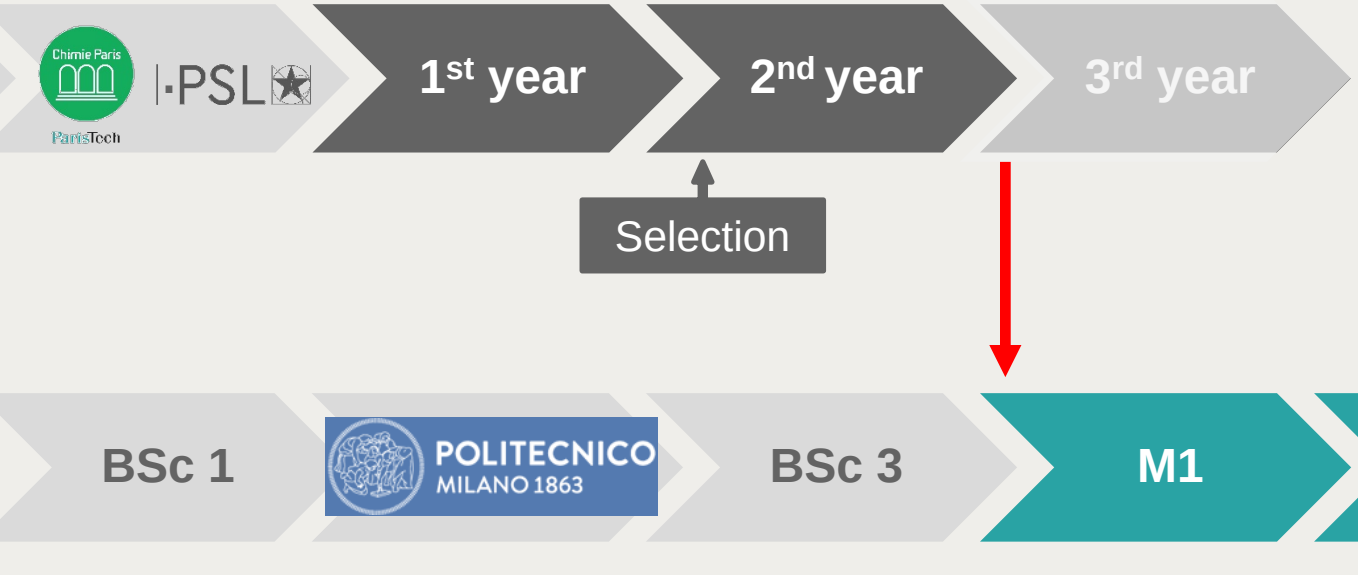

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