



ParisTech

**RESEARCH-BASED TRAINING  
PROGRAMS IN ENGINEERING AT  
THE PARISTECH SCHOOLS**

September 2023

## Research-based training in science and engineering at the ParisTech schools

ParisTech's seven schools train tomorrow's engineers, managers and researchers who contribute to solving global challenges in a society where innovation plays an increasingly important role.

The programs in science & engineering offered by ParisTech schools are firmly research-based: laboratories, academic staff and researchers, a lot of experimentation sessions and research-related courses... all aspects that enable the schools to offer a rich and varied ecosystem to their students, enabling them to come face to face with research during their studies, and often from the very start.

The introduction of research into the engineering curriculum allows to

- provide training at the cutting edge of scientific knowledge,
- introduce students in engineering to research and encourage vocations in this field,
- train students in engineering to evolve in an uncertain environment where solutions have to be invented,
- stimulate the creativity of students in engineering.



**Research-based training in science and engineering  
at ParisTech schools  
Key figures**

**AgroParisTech**

23 labs  
1200 researchers (220  
AgroParisTech)  
350 PhD candidates  
~1500 publications per year  
15% graduates pursuing a  
PhD

**Arts et Métiers**

258 academic staff  
15 labs and research  
teams  
220 PhD candidates  
1 doctoral school  
« Engineering Sciences »  
+ de 400 publications per  
year  
4,5% graduates pursuing  
a PhD  
1 ERC grantee

**École des Ponts  
ParisTech**

12 labs  
500 researchers (100  
ENPC)  
600 PhD candidates (incl.  
200 ENPC)  
~1000 publications per  
year  
15 % graduates pursuing a  
PhD  
6 ERC grantees

**Chimie ParisTech –  
PSL**

50 academic staff  
50 researchers (CNRS)  
About 100 PhD  
candidates  
475 publications per  
year  
40% graduates pursuing  
a PhD  
7 ERC grantees

**Institut d'Optique**

150 PhD candidate  
3 labs  
+ 150 researchers  
~ 350 international  
publications per year  
43% graduates pursuing  
a PhD  
8 ERC grantees

<b>Objective</b>	Introduce students to (academic or private) research in the 1 <sup>st</sup> or 2 <sup>nd</sup> year to raise awareness, without necessarily aiming for a PhD. So students in engineering know whether or not research is a field in which they can flourish.
<b>PhD</b>	Between 10 and 15% of new graduates pursue a PhD, with just under 20% working in R&D.  Some engineering graduates also embark on a doctorate after 3-4 years of professional activity.
<b>Ecosystem</b>	250 academic staff from AgroParisTech (1200 if you consider all staff in the labs who not depend from AgroParisTech)  <a href="#">Research at AgroParisTech</a> (multidisciplinary, ethical and open, from the fundamental to the applied, in symbiosis with its training mission and in direct contact with the socio-economic world in general) <ul style="list-style-type: none"> <li>• Ethical, open research in direct contact with society (including participatory research involving students in the questioning of our research): AgroParisTech has a charter of ethics and deontology, a policy on open science, research data and science and society with dedicated project managers.</li> <li>• Training through and for research</li> <li>• PhD (via Université Paris-Saclay or AgroParisTech). AgroParisTech leads the ABIES doctoral school</li> <li>• « Research and me »</li> </ul> <p>Innovation is underpinned by the <a href="#">Innlabs</a>, themed third-party spaces spread across the various AgroParisTech sites, which support various stakeholders (industry, local authorities, and above all students or graduate entrepreneurs) in their innovation projects from the earliest stage, in a high-level training and research environment. Today, AgroParisTech has 5 InnLabs: the FoodInnLab in Saclay, the FarmInnLab in Grignon, the ForestInnLab in Nancy, the TerritoiresInnLab in Clermont-Ferrand and the BiotechInnLab in Reims.</p>
<b>Training program</b>	<p><b><u>1<sup>st</sup> year and 2<sup>nd</sup> year<sup>1</sup>: « Research and me »</u></b></p> <p>Objective: discover research (academic, but not exclusively) to test a vocation or simply learn more about research.</p> <p>→ September: presentation of the school's research training and awareness program and research strategy - on a voluntary basis (e.g. 80 students in engineering for a class of 300 in 2022)</p> <p>→ Individual interviews to clarify the expectations of each interested student in engineering and plan the next steps (between 70 and 100 interviews each year).</p> <p>→ 1<sup>st</sup> year and 2<sup>nd</sup> year: Elective course « Research and me »: half a day a week for 6 months in a public or private laboratory, with a specific project. Agreement between the laboratory, the student and the school. Registered in the diploma supplement (no ECTS, but valorization as part of a day organized by the graduate schools of the Université Paris-Saclay around careers in higher education and research).</p> <p>→ 1<sup>st</sup> year: Integrative module « research immersion »: a two-and-a-half-week immersion in a laboratory + a series of interviews from technicians to the lab</p>

<sup>1</sup> The first year is equivalent to the last year of bachelor and the second year to the year of master.

	<p>director, based on a questionnaire drawn up together, to gain a better understanding of the workings and values of a research unit.</p> <p>→ 1<sup>st</sup> year: Elective course "Research careers": a week at the end of March to discover research careers and all aspects of the researcher's job, and a team exercise to identify research questions.</p> <p>→ Other information sessions along the year about PhD, researcher at international level</p> <p>Students in engineering are not obliged to take all these modules.</p> <p>AgroParisTech encourages academic staff to talk to students about their research work.</p> <p><b><u>3<sup>rd</sup> year</u></b>: students can follow a master program in research in the third year</p>
<b>Outreach</b>	Claire Chenu and Daniel Tomé : INRA Laureates in 2019 and 2016 respectively

<p><b>Objective</b></p>	<p>Train local players capable of innovating to create and implement the impactful technological and organizational advances essential to energy, environmental and societal transitions.</p> <p>To achieve this goal, we offer 3 career paths:</p> <ul style="list-style-type: none"> <li>- Industry professions</li> <li>- <b>Research and development</b></li> <li>- Entrepreneurship and technological innovation</li> </ul>
<p><b>PhD</b></p>	<p>Research supported by <a href="#">15 laboratories</a> and more than 250 academic staff</p> <p>Thanks to the diversity and complementarity of its research fields, Arts et Métiers contributes to scientific advances across the entire product life cycle, in mechanical engineering, industrial engineering and energy engineering: design and innovation, industrialization processes, sustainability, maintenance and recycling. This positioning benefits not only the industrial world, but also the school's students, who have the opportunity to learn about the full range of industrial issues, in close contact with the school's academic staff.</p> <p>Two indicators confirm the quality of the research carried out at Arts et Métiers:</p> <ul style="list-style-type: none"> <li>- numerous publications in leading international journals (over 400 per year)</li> <li>- <a href="#">Carnot</a>-certified research partnerships since 2006</li> </ul> <p>The <a href="#">Evolutive Learning Factory</a> project aims to develop innovative learning factories based on the technological platforms of the Arts et Métiers campuses, <b>accelerating the transfer of research results into training</b>. These evolutive training/research platforms integrate real industrial systems and their digital twin, so as to position students in an authentic learning situation. These new workspaces, requiring interdisciplinarity, confront learners with the technologies and organizations of the factory of the future, integrating the challenges of ecological transition, digital transition and social responsibility.</p>
<p><b>Ecosystem</b></p>	<p>A low rate of graduates pursuing a PhD, attributed to the strong demand from industry for promising, well-paid career opportunities right out of school, which encourages students to go straight to work.</p>
<p><b>Training program</b></p>	<p>Training through and for research is organized in a progressive manner:</p> <ul style="list-style-type: none"> <li>- 1<sup>st</sup> year: All students are introduced to research through visits to the laboratories on the different campuses and research training objectives integrated into training units.</li> <li>- 2<sup>nd</sup> year: Practical application of research methodologies in projects for all students, with assessment of these specific skills</li> <li>- 3<sup>rd</sup> year: Specialization through a research-based master's degree in France or abroad. The school's laboratories provide a privileged learning ground, and are supported by four master's programs - mechanical engineering, industrial engineering, energy and health engineering - with 27 courses on offer.</li> </ul> <p>At the end of the course: Selection for admission to a doctoral school at Arts et Métiers or another institution.</p>
<p><b>Outreach</b></p>	<p>Francisco Chinesta: CNRS' Silver Medal in 2019 Nicolas Ranc : ERC (European Research Council) grantee in 2017</p>



ParisTech

<b>Objective</b>	Training students in engineering through research
<b>PhD</b>	35 to 40% of graduates (less than 10% at Chimie ParisTech - PSL, 90% at another establishment in France or abroad)
<b>Ecosystem</b>	<p>The ratio of hours taught by the school's academic staff to total hours of face-to-face teaching is 81%.</p> <p><b>3 laboratories in partnership with the CNRS (Unité Mixte de Recherche, UMR), including 2 at the school and 1 on Saclay campus:</b></p> <ul style="list-style-type: none"><li>- <a href="#">Institut de Recherche de Chimie de Paris (IRCP)</a> UMR Chimie ParisTech – PSL/CNRS, 8 teams (from 5 to 25 persons: academic staff, PhD candidats, post-doctoral researchers) Molecular and polymer chemistry, energy, materials and processes, surfaces and interfaces</li><li>- <a href="#">I-CLeHS</a> (Institute of Chemistry for Life &amp; Health Sciences) UMR Chimie ParisTech – PSL/CNRS, 4 teams Medicinal, physical and analytical chemistry Analysis, diagnostics, imaging.</li><li>- <a href="#">Institut Photovoltaïque d'Île-de-France (IPVF)</a> Located on Saclay campus, in partnership with École Polytechnique and companies (EDF, Air Liquide...)</li></ul>
<b>Training program</b>	<p><b>1<sup>st</sup> year:</b> April: <b>visit to laboratories - exchanges with researchers</b> (1 day): a laboratory member explains the laboratory's research work to the students. → <b>Presentation</b> by the students to the class in the presence of researchers, with a focus on the ways in which the research can be put to good use: presentation of what they have seen + a special theme on how it can be applied to everyday life.</p> <p>May (duration: 3 weeks) : <b>Projects</b> in the research labs. This scheme involves around 10 students (target: 20-25), while the other students carry out more conventional practical work in the teaching laboratories.</p> <p>Second semester: transdisciplinary project (approx. 60h), which enables students to interact with different research teams based on their topic.</p> <p><b>2<sup>nd</sup> year:</b> Research-based <b>Team Innovation Projects (PIG)</b>: Students work all year round, 3 hours a week, on topics proposed by laboratories or companies (providing an innovative solution to a problem). They must adopt the entire research approach (bibliographic research, proposal of an innovative prototype, etc.). The steering committee is composed of researchers. Resources : labs (consultancy, lab for experimental/prototyping phase). End of March: Written report and oral presentation to class and customers.</p> <p><b>Long internship</b> of at least 5 months in an academic or industrial laboratory in France or abroad.</p> <p><b>3<sup>rd</sup> year:</b></p>

	<p><b>Entrepreneurship module:</b> the whole business creation project contributes to innovation training.</p> <p><b>End-of-studies internship (5-6 months):</b> academic research or R&amp;D.</p> <p>40% of students do a <b>research master's degree</b> in parallel with the 3<sup>rd</sup> year (e.g. Master's degree in Materials Science and Engineering, Master's degree in Chemistry, Master's degree in Energy, Master's degree in Integrative Chemistry &amp; Innovation, Master's degree in Health Engineering).</p>
<p><b>Outreach</b></p>	<p>Philippe Goldner: CNRS Silver Medal (2022)  Guillaume Lefevre: CNRS Bronze Medal (2023)  Carlo Adamo: ERC Advanced Grant (2022)</p>





École des Ponts  
ParisTech

<p><b>Objective</b></p>	<p>To enable students to familiarize themselves with research, by having the opportunity to work with researchers on projects in ENPC laboratories.</p> <p>Demonstrate that research is not separate from the world of engineering, but part of the same technological ecosystem of innovation and value creation. ENPC's research partnerships with socio-economic players are strong and vibrant.</p> <p>Demonstrate that the doctorate is the benchmark diploma for scientific and technical excellence and competence at international level. It is therefore an important complement to the engineering training provided at leading French grandes écoles such as ENPC. A PhD is an important asset in major international industrial companies.</p>
<p><b>PhD</b></p>	<p>From 10 to 15% of students pursue a PhD after graduation, a minority of them in ENPC laboratories. These students mainly come from the Mathematics and Computer Science (IMI) and Materials and Mechanical Engineering (GMM) departments.</p>
<p><b>Ecosystem</b></p>	<p>The ENPC supervises 12 research laboratories covering a very broad spectrum of scientific disciplines, from mathematics to human and social sciences, including mechanics, civil engineering, computer science, economics, environmental and climate sciences. They bring together some 500 researchers, including 100 from ENPC, and almost 600 PhD candidates, including 200 from ENPC.</p> <p><b>CEREA - <a href="#">Centre d'Enseignement et de Recherche en Environnement Atmosphérique</a></b> Themes : Atmospheric environment - Air quality - Data model - Renewable energies</p> <p><b>CERMICS - <a href="#">Centre d'Enseignement et de Recherche en Mathématiques et Calcul Scientifique</a></b> Themes: Uncertainty modeling - Systems optimization - Numerical analysis and simulation</p> <p><b>CIRED - <a href="#">Centre International de Recherche sur l'Environnement et le Développement</a></b> Themes: Sustainable development - Climate change - Environment economics</p> <p><b>HM&amp;CO – <a href="#">Hydrologie Météorologie et Complexité</a></b> Themes: Physics of heterogeneity - Hydro-meteorological risks - Resilient city</p> <p><b>LATTS - <a href="#">Laboratoire Techniques, Territoires et Sociétés</a></b> Themes: City design - Sociotechnical infrastructures - Design and appropriation</p> <p><b>LEESU - <a href="#">Laboratoire Eau, Environnement et Systèmes urbains</a></b> Themes: Water, soils and sustainable cities – Uses and innovations – Water system and society</p> <p><b>LHSV - <a href="#">Laboratoire d'Hydraulique Saint-Venant</a></b> Themes: Renewable energies – Natural risks</p> <p><b>LIGM - <a href="#">Laboratoire d'Informatique Gaspard Monge</a></b> Themes: AI – 3D-Vision – Learning</p> <p><b>LMD - <a href="#">Laboratoire de Météorologie Dynamique</a></b> Themes: Climate and atmospheric physics - Data models - Renewable energies</p> <p><b>LVMT - <a href="#">Laboratoire Ville, Mobilité, Transport</a></b> Themes: Sustainable mobility - Territorial dynamics - Transport economics - Modelling and analysis of digital traces - New mobility services</p> <p><b>Laboratory NAVIER</b></p>

	<p>Themes: Innovative structures &amp; digital manufacturing - Multi-scale and multi-physics behavior - Ecomaterials – Geomechanics</p> <p><b>PjSE - Paris-Jourdan Sciences Économiques</b></p> <p>Themes : Public policies – Environment economics – Market, behaviours, governance – Macroeconomics and international economy.</p>
<b>Training program</b>	<p>September: Inaugural lesson on research (e.g. “can engineers still invent the future?”, “reversal of time and innovation: or how to transform beautiful physics concepts into startups”).</p> <p><b>1<sup>st</sup> year:</b> An awareness program for the whole class</p> <ul style="list-style-type: none"> <li>- <b>Courses</b></li> <li>- <b>Research Path:</b> discover research at Ecole des Ponts and better know the researchers’ activities (meetings with researchers and PhD candidates in the labs along the study year)</li> <li>- <b>Engineering and Research Project</b> (2<sup>nd</sup> semester)</li> </ul> <p><b>2<sup>nd</sup> year: Short or long internship</b> in a company or in a lab</p> <p><b>3<sup>rd</sup> year: Introduction to research - deepening</b> (elective activity)</p> <p>A research project (research in a lab) during one semester:</p> <ul style="list-style-type: none"> <li>- 200 hours / 8.5 ECTS / about 20 h mentoring</li> <li>- Article-type writing and conference-type presentation</li> <li>- Work in pairs (rather than groups of 4)</li> <li>- Introduction to research methodology: bibliography, writing, etc.</li> </ul>
<b>Outreach</b>	<p>Jean Sulem: International Society of Rock Mechanics science achievement award (2022)</p> <p>Amaury Hayat: Forbes under 30 (2021)</p> <p>Olivier Baverel: Pioneer award in architecture (2021)</p>

<b>Objective</b>	To carry out a public-interest mission to develop the industry in optics through training, research and commercialization.
<b>PhD</b>	<p>43% of graduates pursue a PhD</p> <p>A lot of PhDs in semi-public institutions (CEA, ONERA) or industrial PhDs (CIFRE) in big companies (SAGEM, St Gobain, Essilor...).</p> <p>The rate of graduates pursuing a PhD is much lower in the Innovation-Entrepreneurship Program.</p>
<b>Ecosystem</b>	<p><b>3</b> research labs:</p> <ul style="list-style-type: none"> <li>- <a href="#">Laboratory Charles Fabry</a> : <b>43</b> permanent researchers, <b>67</b> PhD candidates and post-doctoral researchers</li> <li>- <a href="#">Laboratoire Photonique Numérique et Nanosciences</a> : <b>20</b> permanent researchers</li> <li>- <a href="#">Laboratoire Hubert Curien</a> : <b>90</b> permanent researchers.</li> </ul> <p><u>Research themes</u>: Biophotonics &amp; Microscopy, Imaging and Information, Artificial Intelligence, Optical Design, Computer Graphics, Mixed Reality, Lasers, Nonlinear Photonics, Optical Telecom, Fibers, Radiation, Nanophotonics, Quantum Optics.</p> <p>Close partnership with CNRS.</p> <p><b>Research and Higher Education Evaluation Agency (AERES):</b></p> <ul style="list-style-type: none"> <li>- A virtuous triptych of fundamental research-applications-innovation, supported by top-quality scientific and technical training with a strong experimental component</li> <li>- Innovation-Entrepreneurship Program: an innovative teaching program unique among graduate engineering schools</li> <li>- Research at the highest level, with international visibility</li> <li>- A proactive commitment by IOGS and its local partners to campus policy in Bordeaux and Saint-Etienne</li> <li>- A strong sense of specialization, giving IOGS a unique position within the University Paris-Saclay.</li> </ul>
<b>Training program</b>	<p><b>1<sup>st</sup> year</b></p> <p><b>Laboratory insertion project</b> (at the end of the year, duration: 1 week): Immersion in a research team in a compact, concentrated form to observe the day-to-day work of researchers.</p> <p>Objective: to discover a research field and a research team by understanding the link between long-term research issues and the day-to-day activities of researchers.</p> <ul style="list-style-type: none"> <li>- Visit to the host team's activities</li> <li>- Bibliography work (at least 2 articles: 1 popularization article introducing certain questions in the research field and 1 article by the host team describing recent work in this field).</li> </ul> <p>→ Gives students an insight into academic research.</p> <p><b>2<sup>nd</sup> year:</b> students can take a Master 1 program at a partner university in addition to their engineering courses at Saclay ("Irène Joliot-Curie route").</p>

	<p><b>3<sup>rd</sup> year</b></p> <ul style="list-style-type: none"> <li>- Students follow <b>all Master's courses and more specific engineering science courses at the Institut d'Optique.</b></li> <li>- <b>Internship in a lab</b></li> </ul> <p><u>Campus of Paris-Saclay :</u>  M1 « Physics – "Irène Joliot-Curie route" (Univ. Paris-Saclay)  M2 « Optical Network and Photonic Systems » (ROSP) (Univ. Paris-Saclay)  M2 « Automation and Signal and Image Processing » (ATSI) (Univ. Paris-Saclay)  M2 « Biological systems and physical concepts » (SBCP) (Univ. Paris-Saclay)  M2 « Large instruments » (Univ. Paris-Saclay)  M2 « Plasma and fusion physics » (Univ. Paris-Saclay)  M2 « Quantum Light Materials and Nano Sciences » (QLMN) (Univ. Paris-Saclay)  Path "Light and Matter"</p> <p><u>Campus of Bordeaux:</u>  M1 « Light Sciences &amp; Technologies » (Univ. Bordeaux)  M2 « Light Sciences &amp; Technologies » (Univ. Bordeaux)  M2 « Image and signal systems engineering »</p> <p><u>Campus of Saint-Etienne :</u>  M1 + M2 « Optics – Image – Vision - Multimedia » (OIVM) (Univ. Saint-Etienne)  M2 « Medical Imaging Signal and System » (Univ. Lyon)</p>
<b>Outreach</b>	<p>Alain Aspect : Nobel Prize in Physics en 2022</p> <p>Jacques Herbrand Prize (physics) 2022</p> <p>CNRS Innovation Medal 2022</p> <p>3 awardees of the Prize For Women in Science 2022</p>