EPFL

Development Plan 2025-2028

École polytechnique fédérale de Lausanne

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“Knowledge is our greatest resource, education and innovation are our greatest responsibilities: EPFL at the service of progress and society.”

Faced with the major challenges of the 21st century, EPFL reaffirms its role as a driving force in innovation, research and education in Switzerland and beyond. We are pleased to present the EPFL Development Plan 2025-2028, with an ambitious vision: to educate the minds that will shape the future, push the boundaries of knowledge and transform scientific discoveries into tangible solutions.

Our commitment is clear: to ensure excellence in education, make knowledge accessible to all and strengthen the link between science and society. In a rapidly changing world, where technology shapes future balances, we must innovate, collaborate and anticipate.

With boldness and a sense of responsibility, EPFL is committed to shaping a sustainable, inclusive and inspiring future.

Our community - students, researchers, faculty members and all the professionals who ensure its smooth operation - is at the heart of this transformation. Because beyond institutions, it’s dedicated and passionate individuals who drive the science and innovation of tomorrow.

EPFL Direction

1.
SUMMARY

EPFL's development plan for the 2025-2028 period affirms our unwavering commitment to positioning the institution as a key driver of education, research and innovation in Switzerland.

Faced with the most pressing societal challenges, it is crucial to prepare future generations of engineers, architects and scientists to evolve in an increasingly complex world. In line with the ETH Domain's strategic priorities, we are pursuing three major objectives:

1. **Excellence in research, education and lifelong learning**
2. **Fair and inclusive access to high quality education**
3. **Open dialogue between society, science and engineering.**

To achieve these goals, our roadmap defines several strategic areas covering crucial issues such as climate and sustainability, energy and health. It also aims to strengthen fundamental pillars of our curriculum such as data science, materials science and engineering.

In order to bring together and optimize resources for research in these and other areas, particularly for new inter-institutional collaborations, EPFL has introduced a new Vice Presidency for Support to Strategic Initiatives.

An initiative benefiting from this approach is the **national initiative on artificial intelligence (Swiss AI)**, in partnership with ETH Zurich, which will be managed by the EPFL AI Center. This center will capitalize on our institution's expertise in information technology, data management, algorithms and cryptography.

Since the creation of the School of Life Sciences, EPFL has excelled in innovation in the field of health engineering and biotechnologies ('health-tech'). This dynamic will be strengthened by establishing solid partnerships with other universities, teaching hospitals, international organizations and companies. EPFL is firmly committed to cultivating these strategic relationships while fostering a spirit of initiative among its student and research communities.

With its five campuses offering complementary and synergistic expertises, EPFL is ideally positioned to play a key role in transforming the Swiss energy system and in actively contributing to efforts to achieve carbon neutrality.

In the field of education, particular attention will be paid to the sciences of learning within the Bachelor and Master cycles and continuing education, as well as to the evolution of teaching methods.

To exploit the tremendous potential of the ETH Domain, EPFL is committed to strengthening the spirit of collaboration that it has cultivated over the years with ETH Zurich and with the Domain's research institutes. It will play a key role in the reorganization of the Domain, in particular with the creation of a dedicated digital entity.

Internally, the promotion of a strong corporate culture, based on a fair distribution of responsibilities and mutual support, will remain a constant priority. Emphasis will be placed on a service approach and on a sense of community.

Substantial efforts will be made to provide an environment in which every member of the community can excel, give their best, acquire new knowledge and skills and develop their full potential. Strengthening an open and inclusive institutional culture is a key priority, and EPFL is firmly committed to this.

By the end of 2024, almost all available reserves had been allocated to real estate and academic projects. In view of the current difficult financial environment, EPFL will further consolidate its financial processes and strengthen its budget planning in collaboration with the Schools and Colleges, while reinforcing and diversifying its external funding sources.

Confronted by budgetary constraints and rising student numbers, we need to explore innovative strategies to ensure adequate resources for education and research. This complex challenge, marked by the interconnection of disciplines and the scale of the issues at stake, requires a collaborative and interdisciplinary approach. EPFL is fully aware of its responsibility in the face of complicated and interdependent challenges such as climate, health and energy.

EPFL's success depends on the curiosity, creativity, boldness, expertise and commitment of its students, scientific, administrative and technical staff and faculty. The ambitious roadmap presented in this document aims to propel EPFL to a new level of academic excellence and influence.

2.
OUR VISION

To serve society effectively, EPFL is committed to applying the highest standards of quality in the fulfilment of its fundamental missions.

Firstly, **education**, encompassing both basic university training and the promotion of lifelong learning, designed to meet constantly changing needs and adapt to technological advances.

Secondly, **innovative research** at EPFL must harmoniously join basic sciences and fundamental research with applied research. The former represents a long-term investment and acts as the basis for the latter, which responds to more specific societal challenges.

Finally, the **transfer of knowledge** and practical expertise to society through innovation and outreach is of paramount importance. Thanks to its campuses in Geneva, Neuchâtel, Fribourg and Valais, as well as the Switzerland Innovation Park Network West EPFL, EPFL's intercantonal impact is growing. It is by maximizing this impact that EPFL will be able to contribute fully to the major challenges of our time.

Achieving these ambitious goals depends on EPFL's ability to attract and retain the best talent - students, teachers, staff and scientists - in all their diversity and creativity. Over and above the infrastructure and resources made available, this requires a dynamic community, driven by a deep sense of belonging and trust. EPFL is fully committed to cultivating this spirit, which is essential to its excellence and impact.

3.
HOW BEST TO SERVE SWITZERLAND

In accord with the ETH Domain, EPFL has defined its three major objectives in terms of societal challenges that are particularly important for Switzerland, and to which a technology institute can make a significant contribution.

3.1. Excellence in research, education and lifelong learning

Serving Switzerland depends on excellence in the fulfilment of our missions, making full use of our potential as well as our intellectual and material resources. Recruiting and retaining talent at all levels and in all areas is essential. Our community, like our study and research programs, must constantly evolve to adapt to the ever-changing fields of knowledge and research. We must achieve these goals while offering students cutting-edge education and research opportunities.

The dazzling progress of science and its applications - from renewable energies and artificial intelligence to quantum science, robotics and automation to space exploration - has profoundly redefined our daily lives. At the same time, these rapid and interconnected technological advances are generating a growing demand for tools to assess and understand the ethical and environmental issues involved.

These fields interact with each other in complex and often synergistic ways. EPFL takes a proactive approach to this complexity, identifying emerging challenges and anticipating the necessary developments in education, research and innovation.

Maintaining excellence means not only attracting a diverse range of talent but also retaining it among our teaching staff and employees. This requires a strong commitment to international openness, while considering national security imperatives. Adaptability and flexibility are essential, as is the ability to embrace change and integrate new approaches and resources for acquiring and sharing knowledge.

EPFL ensures that its educational programs are perfectly aligned with the current and future requirements of research, business, industry and the public sector. Particular attention is paid to engagement with potential employers, to ensure the relevance of curricula and to enhance the value of learning outcomes

The challenge is to develop fundamental research while promoting innovations that respond to concrete problems. To meet this challenge, it is essential to strengthen teaching and research capabilities, as well as to improve infrastructure. Critical issues such as carbon capture, climate change, global security, energy and public health require critical mass, made possible by substantial funding and close collaboration with industry, as well as with other national and international research institutes.

EPFL has the expertise to make an active contribution to meeting the major challenge of the global ecological crisis. Innovative advances in this field include the modernization of hydropower, the development of photovoltaics, environmentally friendly storage technologies, synthetic fuels, green hydrogen and nuclear fusion. EPFL is also working on carbon dioxide capture and low-carbon building materials.

In a world riven by tensions, weakened international cooperation and threats to peace and human rights. EPFL is committed to developing scientific and technological solutions that promote sustainability, humanitarian action and crisis management. Thanks to its expertise in the digital field, it can play a major role in human rights and cybersecurity. The development of faster and more effective means of communication in emergency situations, early warning systems in the event of natural disasters, remote monitoring and assistance through technologies such as drones and satellites illustrate these efforts.

Global public health remains a major challenge, marked by the rise of non-communicable diseases and epidemics. EPFL can make a significant contribution by harnessing the power of AI and integrating it with neurotechnologies to improve medical diagnosis, predict epidemics and analyze complex health data with a view to early detection of diseases or personalized treatments. These advances will enable more effective management of cardiovascular disease, cancer, diabetes and tuberculosis. Spinal implants will help paralyzed people to walk again, while retinal implants will partially restore the vision of blind people.

EPFL must help to develop, understand, deploy and manage these technologies in a way that promotes social well-being and economic growth, while respecting ethical considerations. In collaboration with the institutions of the ETH Domain, it will strengthen its key role in knowledge and technology transfer for the benefit of the public sector, society and the economy, by supporting start-ups, SMEs and established companies.

In this context, EPFL will promote and contribute to the cultural change of science towards Open Science in line with national strategies for Open Access and Open Research Data.

3.2. Fair and inclusive access to high-quality education

Fair and inclusive education promotes justice, diversity, innovation and social progress. It guarantees equal opportunities for all to learn and to make a responsible contribution to society.

Equitable and inclusive access to quality education is a fundamental principle. Equity ensures that procedures and assessments are impartial and fair, offering equal opportunities to all. Inclusion strengthens the sense of acceptance and belonging within the community.

Barriers to inclusive education can discriminate against various groups, based on factors such as ethnic origin and gender. EPFL is committed to promoting broad and equitable access to quality education and lifelong learning, free from all forms of discrimination. Widespread quality education is crucial not only to foster inclusive and stable societies, but also to strengthen a country's capacity for innovation and creativity, thus contributing to better economic performance.

Although EPFL is renowned for the quality of its teaching thanks to its exceptional teaching staff and its leadership in the learning sciences, it is imperative that we persevere in developing additional infrastructures and programs, such as lifelong learning for all and cross-disciplinary skills development. These programs will facilitate educational opportunities in Switzerland. and beyond.

EPFL also aims to increase the level of diversity in all senses of the word, and to offer access to study programmes to people from all social and gender backgrounds.

The representation of women in management and supervisory positions within the teaching staff, the research community and administrative and technical staff remains a challenge. Awareness-raising programs are specifically aimed at attracting more female students, particularly in fields where their representation is limited. Through the implementation of concrete measures, intensive efforts in favour of equity and the introduction of innovative educational models, EPFL is actively working to create a more equitable and inclusive environment for all members of the community.

EPFL faces the challenge of strategically adapting to the rapidly changing needs of industry and society. It must not only anticipate these transformations but also equip its students with the skills needed to remain competitive in a changing job market and navigate effectively in a constantly evolving professional landscape.

EPFL is a varius ecosystem made up of multiple communities and stakeholders, including students, faculty, staff, alumni, employers and industry, professional and student associations, regulators and government agencies, donors, funding partners, as well as national and international research partners, NGOs, the media and the public. Each of these entities has its own interests and needs. EPFL's success and societal impact depend on its ability to interact effectively with all these partners.

The research environment is constantly changing, influenced by political dynamics and requiring an increasingly interdisciplinary approach. International cooperation, ethical research practices, Open Access and diversity characterize the environment and redefine how the impact of research is assessed.

In this context, innovative funding models, public engagement and agile communication on scientific and financial issues are playing an increasing role. EPFL's researchers and support services must anticipate and adapt to these changes.

As an employer, EPFL has a responsibility to move with the times and position itself as a model of good practice in terms of employment and personal development. Adapting the workspace to keep pace with these changes and guaranteeing all employees opportunities for professional development are essential if we are to remain competitive.

By adopting a proactive mindset and anticipating developments and the expectations of its community, EPFL will be better prepared to manage uncertainty, seize opportunities and fulfil its missions.

3.3.
Open dialogue between society, science and engineering

Science and technology play an essential role in resolving or remedying society's challenges. At the same time, technology is becoming an increasingly integral part of our daily lives. As scientists and engineers, we must draw nearer to the public, listen to their questions and expectations and engage in an open dialogue on pressing challenges. Sustainability, ethical issues related to new technologies such as AI and the social acceptance of scientific and technological advances are concrete elements of this dialogue. It is essential that our community actively commits itself to making scientific and technical concepts accessible, both to the public and to political decision-makers.

Technology has a profound influence on the way society defines itself and evolves. An open, transparent and proactive dialogue between science and society fosters mutual learning, democratic decision-making based on objective criteria and responsible scientific progress, capable of responding to societal challenges and contributing to general well-being.

As a key player in education, research and innovation in Switzerland, EPFL intends to strengthen its interactions beyond its natural collaborations with ETH Zurich and the national research institutes. It will intensify its links with the local and national communities and affirm its role in supporting government bodies in scientific and technical decision-making. Making science and technical concepts accessible is a major challenge for strengthening the confidence of civil society, and is a priority for the years to come.

For the acceleration of technological development to benefit all, it must be accompanied by ethical reflection and appropriate regulations. EPFL is committed to ensuring that research remains guided by curiosity and is developed and deployed for the common good, placing the well-being of individuals, society and the environment at the center of its priorities.

4. ENABLING FACTORS

To make a positive contribution to the challenges facing society and the academic world, EPFL needs to enter a new phase in its development

4.1.
Infrastructure for top-level education and research

For the 2025-2028 period, EPFL is committed to strengthening the framework conditions that enable the members of its community to carry out their missions at the highest level, by continuing to develop its infrastructure. With new buildings such as the Advanced Science Building and the transformation-renovation project for the Couple/Esplanade area, the institution is demonstrating its strong support for fundamental science, interdisciplinary approaches and education.

EPFL offers cutting-edge academic programs in various fields of research, attracting students, technical staff and faculty of excellence. These commitments require significant investment in world-class research infrastructure, modern facilities and an environment conducive to obtaining substantial funding through high-impact projects.

Where appropriate, putting resources together and creating synergies can improve efficiency and optimize available resources. The development of the scientific community and international collaboration also play a key role in this dynamic.

EPFL will collaborate closely with the institutions of the ETH Domain to develop, operate and modernize strategic research infrastructures and interdisciplinary platforms. Considering the long-term needs of the scientific community, as well as stable and sustainable funding, will be guaranteed by informed strategic decisions and clearly established priorities.

4.2.
New forms of teaching and learning

EPFL continuously adapts its teaching methods to the requirements of a changing professional environment. These measures also apply to lifelong learning (continuing education). By consolidating the integration of AI into teaching, EPFL recognizes its potential as a pedagogical assistant.

To train the future actors of a technological and humanistic society, we introduce new educational tools to teach the fundamental and applied sciences as well as the essential principles and methods specific to each discipline. We are also promoting crucial cross-disciplinary skills such as critical thinking and the use of AI, leadership, teamwork, effective communication, interdisciplinarity, problem-solving and entrepreneurship.

Fully integrating these skills into academic curricula prepares Master students, doctoral candidates and postdocs for exerting a lasting influence on society throughout their careers, well beyond the academic sphere.

Interdisciplinary teaching is becoming increasingly important in the face of today's complex challenges. By encouraging collaborative learning experiences and bringing students from different fields together in concrete projects, EPFL prepares them for the realities and demands of their future careers. Project-based learning reinforces their technical knowledge and enables them to apply it to real-life situations, in collaboration with partners from a variety of educational, cultural and professional backgrounds.

New forms of teaching also include the integration of entrepreneurship into academic training, notably through the creation of the role of «professors of practice»,

individuals from outside the EPFL who hold leading positions in the public or private sector, who have an interest in student training and academic initiatives and who, by virtue of their proven expertise and extensive experience, are in a position to contribute to expanding the range of practice-oriented studies and to furthering the transfer of knowledge between science and practice. This approach will enable students to identify new opportunities, dare to take risks and apply the results of their research to concrete solutions to global challenges.

Supporting graduates throughout their careers plays an increasingly important role in their professional success. By 2028, EPFL will have significantly strengthened its continuing education offering and put in place attractive programs specifically designed for its alumni. By giving them access to the latest technological advances, artificial intelligence, industry trends and interdisciplinary knowledge, EPFL will provide them with the tools they need to adapt to market developments and anticipate future challenges.

4.3. Attracting diverse and international talents

EPFL aims to broaden the social and cultural diversity of its community of students, staff and researchers. This development will have an impact beyond the academic sphere, by influencing future teachers. In this way, the institution will increase its attractiveness to international talent, while maintaining a strong commitment to addressing Switzerland's own societal challenges.

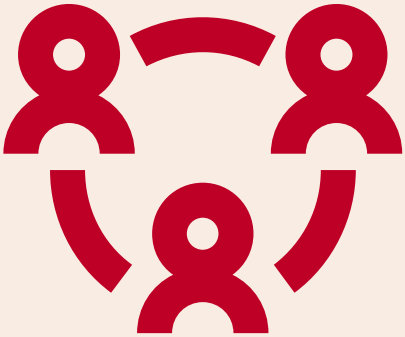
EPFL is recognized as one of the world's most cosmopolitan higher education institutions. To fully exploit this potential, it is committed to enhancing diversity in all its forms, broadening the social and cultural horizons of its community and cultivating an inclusive environment where every member feels supported and valued.

To increase its impact, EPFL must attract and retain the best teachers, scientists, students and staff, regardless of their origin. To this end, it is committed to offering competitive education and research opportunities, attractive funding options and a welcoming working environment that promotes both individual well-being and professional development.

In order to consolidate its excellence and influence, EPFL is placing particular emphasis on recruiting highly-qualified staff to support its academic activities. Developing their skills and career prospects will be a key lever in creating a culture of service that is conducive to academic excellence.

5.
STRATEGIC AREAS

To take EPFL to a new stage of development in the 2025-2028 period, particular attention must be paid to key strategic areas alined with the strategic areas of the ETH Domain (Human health, Energy, climate and environmental sustainability, Responsible digital transformation, Advanced materials and key technologies, Engagement and dialogue with society). EPFL has therefore identified nine major transversal and academic axes. The strategic orientations related to these areas serve as a guide for the entire EPFL community and will be translated into concrete actions within the Schools and Colleges.



5.1.
EPFL community and campus

Ongoing efforts in recent years have strengthened diversity and harmony within the community, with initiatives around the themes of respect and mental health, as well as mentoring programs. This work will continue and training programs in collaboration and leadership will be expanded, while strengthening links with campuses outside the canton of Vaud and reinforcing the communication strategy at all levels.

SUMMARY

EPFL serves Switzerland through world-class technical and scientific education, research and innovation in a responsible and sustainable manner. EPFL is committed to developing its own values within its student and professional community (scientific, administrative and technical staff), in particular by developing a sense of belonging; thus contributing to attracting and integrating the next generation of scientists in Switzerland. Aware of this responsibility, EPFL is committed to creating a welcoming, open and inclusive environment. It intends to value and encourage collective and individual contributions, through critical questioning, the reinforcement of equal opportunities as well as respect and inclusion.

Over the last few years, initiatives such as the **Respect and Compliance Office** and the systematic mentoring of undergraduate and doctoral students have helped to strengthen conviviality and harmony within the community, in favour of a more inclusive and respectful campus.

The creation in 2025 of a **Vice Presidency for Human Development (VPH)** embodies this desire to place people and humanist values at the heart of the institution. Its aim is to promote an increasingly healthy, stimulating and inclusive working environment, where each member of the community feels valued, listened to and invited to contribute fully. To achieve this, the VPH focuses on three key missions: strengthening partnership and trust within the community, fostering well-being and promoting inclusion and equity.

Aware of the importance of responsible management, EPFL has launched several initiatives to improve feedback and communication mechanisms. These initiatives will be continued, strengthened, encouraged and systematically implemented by the new VPH. Training programs to ensure constructive collaboration on topics such as respect, feedback and listening will be expanded and strengthened. EPFL will encourage all team leaders to attend these courses on a regular basis to ensure the ongoing development of their leadership skills and the professional fulfilment of their team members. Particular attention will be paid to campuses outside the canton of Vaud, whose links with the main campus will be further strengthened

Communication is essential to promote commitment, collaboration within and between teams, satisfaction and efficiency. EPFL will continue to work on a systematic strategy of regular information at all levels of the institution.

MEASURES AND PROCESSES FOR THE COMING PERIOD

The following sections group the actions under three main headings

1. Understanding the community and strengthening partnerships
2. Promoting well-being, inclusion and equity,
3. Developing the skills of all employees

1. Understanding the community and strengthening partnerships

In line with recent efforts towards greater inclusion, the focus will be on appropriating EPFL's values in a community-driven process. This exercise aims to ensure responsible participation by all in the running of the institution and will reinforce a climate of trust at all levels.

A key objective for the coming period is to strengthen a culture of collective responsibility across the entire community. To foster a respectful environment for everyone, each member is encouraged to act with courage and kindness when witnessing inappropriate or disrespectful behavior. This shared commitment, embraced at all levels of the institution, helps make EPFL an ever more inclusive, healthy, and inspiring place, where the well-being of every individual is a collective priority.

Continuing the efforts of recent years - in particular through the plenary meetings on the Management orientations (Townhalls) and the **Open Campus** newsletter sent to the entire community - EPFL will continue its regular communication strategy. The institution will also analyze its impact in order to make adjustments to better meet needs.

Finally, to improve coordination between the various EPFL bodies and set benchmarks throughout the year, an **Annual Clock** tool will be deployed throughout the institution.

2. Promoting well-being, inclusion and equity

EPFL continues to promote a culture based on kindness and collaboration, both in interactions between individuals and in hierarchical relationships. The institution will ensure an environment where everyone

feels safe and free to express their ideas while respecting those of others, to share and receive feedback at all levels of the hierarchy, and to recognize mistakes and failures as levers for learning and improvement. Broad communication about good practice builds trust and fosters a constructive working culture.

Several initiatives will reinforce these principles, focusing on three priority areas: **mutual respect, mental health and quality of life at work and in education.**

The role of the **EPFL Person of Trust** is now well identified within the community and helps to embed a culture of respect. This system will be strengthened by the **Trust and Support Network**, which will be evaluated in 2025 before being improved and given greater prominence

At the same time, and to support this dynamic, EPFL will be expanding its range of training courses for staff and the student community. Following the launch of mandatory training on respect, new digital tools will be developed to raise **awareness of mental health prevention, unconscious bias and respect for personality**.

Working on unconscious biases and promoting a culture of respect are essential and complementary to actions to support diversity. EPFL is already committed to these issues, in particular through **the promotion of women in science and innovation**.

In collaboration with the **Science Promotion Department, the VPH** will continue its concrete initiatives to support women in their academic careers, in particular through **mentoring programs and inspiring role models**.

The mental health survey conducted in 2022 highlighted several points that needed to be addressed. As institution, EPFL commits to the need to make a lasting contribution to the improvement of such indicators and the progress of its member's own well-being. A subsequent satisfaction survey will be the subject of an in-depth analysis from the point of view of **EPFL's values**, in order to identify the key elements that will guide the evolution of the **institution's human and societal priorities**.

EPFL has also introduced the possibility of **teleworking**, offering all its staff the flexibility of working from home at certain times. This system allows everyone to strike an optimal balance between **teamwork and individual concentration**. Team leaders play a key role in ensuring the flexibility needed to adapt working hours, while guaranteeing a clear and structured framework.

EPFL is also strengthening its **support for families**, in particular by developing **childcare services** on its various campuses.

3. Developing the skills of all employees

Quality of life at work and during studies is essential to maintaining a close-knit and innovative community. EPFL is developing a system that encourages all team leaders to carry out an annual appraisal interview and another set objectives, and also to look at the workload of all the members of their team, with the aim of maintaining a healthy work-life balance for staff. The new system also allows staff to give each other feedback, agree a development plan and express any wishes they may have for internal mobility.

EPFL wishes to offer its scientific, administrative and technical staff favourable conditions for their development and careers. EPFL promotes the mobility, employability and adaptability of its staff by providing targeted training to acquire transferable skills, including digital and relational skills (soft skills). In particular, it intends to support all its employees by enabling them to adopt IA tools with the aim of optimizing their work, while respecting the best institutional practices.

Leadership training for young faculty and managers will be stepped up to support them in team management.

Improving mutual respect on campus also means learning how to interact with each other. EPFL will be expanding its range of training courses in leadership/management, constructive dialogue, empathy and non-violent communication. This will enable everyone to acquire the skills needed to act with patience, self-control and tolerance, and to contribute to a constructive and transparent feedback culture.

By bringing together efforts to support the careers of future graduates and the continuing education of employees, the VPH is strengthening and adapting its offering to different profiles and reinforcing the culture of partnership between employer and employee.

Through our Career Center and apprenticeship programs, we give everyone the means to progress, develop their skills and excel to reach their full potential.

From 2025, the VPH will be working to offer stimulating and motivating career paths to attract and develop the best talents. Bringing together the continuing education (learning and development for employees) and transversal training (transversal skills and career center for students) poles, and making them accessible to the whole community, will be a key step in this direction.

EPFL fulfils its social role through apprenticeships and will continue to do so, notably by strengthening its learning laboratory for apprentices and creating new courses.

HOW DO THESE AMBITIONS AND ACTIONS SERVE SWITZERLAND?

EPFL's mission is to serve Switzerland through technical/scientific education, research and innovation, and to convey a positive image of our country to the world. This mission cannot be dissociated from responsible and empathetic action. Building a community with a strong sense of belonging and a shared mission contributes to the goal of attracting and integrating an internationally competitive, diverse and highly skilled workforce in Switzerland.

5.2.
Learning sciences

EPFL aims to strengthen its capabilities in learning sciences and digital education, both for the education of its own student population and as a contribution to the Swiss education system.

SUMMARY

EPFL has developed recognized expertise in learning sciences and in digital education, and collaborates with numerous institutional stakeholders such as schools, cantons, associations and companies throughout Switzerland. The high-level translational research developed at EPFL has had a significant impact both on its own educational culture and on elementary and secondary schools and vocational training.

EPFL'S AMBITIONS IN THE LEARNING SCIENCES

EPFL's activities in learning sciences make education more effective, by making schooling a unique experience. To achieve this, EPFL aims to :

- improve the quality of its teaching through teacher training;
- contribute to the Swiss education system by promoting, at the national level and beyond, a culture of decision-making based on data science;
- strengthen resources, in particular through the joint EPFL-ETH Zurich doctoral program in learning sciences, which trains students from various engineering disciplines.

EPFL AND DIGITAL EDUCATION

Digital education refers to activities that cut across education and the digital revolution, as well as the advent of AI. It is based on the use of digital tools: augmented reality/ virtual reality environments, simulations, online courses (MOOCs), educational robotics and generative AI. Digital education also includes computational thinking, which covers all aspects of computing such as coding, digital literacy and digital citizenship.

EPFL is particularly active in digital education, at all levels of education from nursery school to higher education, including lifelong learning.

THE EPFL LEARNING SCIENCES COMMUNITY

The learning sciences community at EPFL can be represented by three circles:

- the four laboratories that conduct research and teach courses on digital education
- the support teams who provide teaching and technological support to the teaching staff
- EPFL teachers who take part in digital education projects.

IMPACT ON SWISS SOCIETY

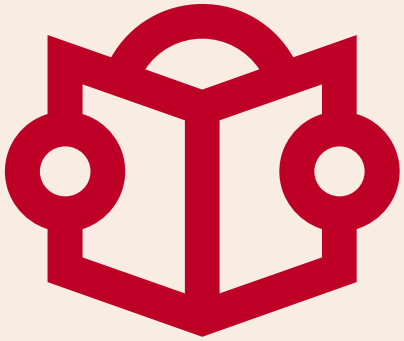
The impact achieved over the last ten years is already significant. For example, more than 80,000 Thymio robots are now used in schools (mainly in the cantons of Vaud and Neuchâtel) to teach computational thinking skills. The LEARN Center has trained more than 2,000 teachers in Vaud in this field. In higher education EPFL is at the forefront of digital courses (MOOCs), with over 150 courses totaling more than three million registrations. EPFL launched the Swiss EdTech Collider in 2017, bringing together more than 100 start-ups. The canton of Berne has launched a partnership between EPFL and the canton's higher education institutions.

PLANS FOR 2025–2028

EPFL aims to reinforce the transformational effects of the learning sciences by creating an Institute for Learning Sciences, whose missions will be to

- conduct world-class research in learning sciences and digital education
- train a new generation of learning scientists
- carry out translational and research projects within several EPFL units (CAPE, CEDE) and with education stakeholders throughout Switzerland
- provide empirical data for educational decision-making within and outside EPFL;
- support EPFL teachers in improving their teaching through research and by integrating AI
- stimulate the development of the EdTech economy in Switzerland.

The Swiss Institute for Learning Sciences will be created jointly with ETH Zurich, in order to achieve a critical mass that will have a wider impact on Swiss education.



5.3.
Continuing education

Aware of developments in the professional environment, EPFL is committed to ensuring that learning can take place at the highest level throughout life. To this end, we aim to offer a comprehensive range of MINT disciplines, including top-quality online, on-site and hybrid programs for engineers, managers and decision-makers. Building on its recognized expertise, EPFL will work closely with its partners while focusing on faculty engagement and strategic and business development, to establish itself as one of Europe's leading institutions for continuing education.

SUMMARY

The world of work is changing rapidly, driven by the knowledge economy, digitization, automation and the challenges posed by the climate crisis. To bridge the skills gap and promote lifelong learning, higher education institutions like EPFL need to adapt their teaching practices to meet the diverse needs of adult learners.

EPFL's objective is to develop a comprehensive and coherent range of continuing education programs that respond to changing social and market needs in the MINT fields, particularly in relation to digitization and the green transition. The Extension School portfolio aims to offer the highest quality, flexible training opportunities, combining online, on-site and hybrid courses to meet the expectations of engineers, technical specialists, managers, executives and decision-makers from different sectors and industries.

EPFL's ambition is to become one of the best continuing education establishments in Europe by drawing on its expertise, infrastructure and networks. Collaboration with the University of Lausanne (UNIL) via the joint UNIL-EPFL Continuing Education Foundation (FCUE) and with ETH Zurich will help to optimize resources and offer multidisciplinary courses. Stronger links with the International Institute for Management Development (IMD) and participation in national and international networks will enable EPFL to develop a flexible and accessible portfolio for learners around the world. Finally, a strategic partnership with the Swiss Data Science Center (SDSC) will focus on training in data science and machine learning.

To achieve these goals, EPFL will adopt a structured approach based on two parallel processes. Internally, the priority is to increase the commitment of teachers in Schools, Colleges and Centers through targeted communication, awareness-raising and incentive campaigns. EPFL's Centers will play a crucial role in supporting the development of quality courses and teachers in their role as scientific coordinators.

Externally, EPFL, in collaboration with FCUE, will strengthen its business development capacity to engage with industrial partners, federal and cantonal government bodies and other organizations, enabling them to influence portfolio development and course design. The institution will also work with the Alumni Office to meet the ongoing need for professional development and re-skilling. In addition, a micro-accreditation framework will offer learners flexible and targeted courses that are recognized by EPFL for the skills and knowledge they have acquired.

This transformation will give professionals and decision-makers the means to adapt successfully to the changing workplace, thereby contributing to the overall progress of society, the economy and the labour market.

MEASURES FOR THE COMING PERIOD

EPFL has always been a pioneer in continuing education, investing from the outset in the creation of a portfolio of high-quality MOOCs, introducing innovative degrees such as the Certificate of Open Studies (COS) and developing guided online courses designed to adapt to the pace of each learner. However, despite the undeniable quality of existing programs, our overall offering remains limited and can suffer from a lack of coherence.

By bringing activities together in the new EPFL Extension School, we aim to build a portfolio of courses that responds to societal and market needs in science, technology and engineering, ensuring access to lifelong learning opportunities. This will maintain EPFL's excellence by capitalizing on our areas of expertise and implementing rigorous quality assurance methodologies, meeting meets the specific needs of learners by offering flexible and personalized learning pathways.

A combination of online, on-site and hybrid courses, as well as the design and implementation of a micro-accreditation framework will enable EPFL Extension School courses to reach a wider audience of qualified learners from the professional world. With regard to the portfolio of online and hybrid courses in particular, we will study the possibility of using MOOCs that respond directly to market needs in continuing education offerings, in order to capitalize on the competitive advantage we have acquired as a forerunner in the field.

The EPFL Extension School's offer must reflect our scientific essence while meeting the needs of continuing education. It aims to support engineers, technical specialists, business and industry through robust professional development programs and to provide managers and executives in industry (both large companies and SMEs) and other governmental and non-governmental decision-makers with lifelong learning opportunities to understand the scientific and technological advances that are transforming society, the economy and the labour market.

Within five years we can develop a portfolio of courses aligned with the needs of the Swiss economy on topics in which EPFL has strong and often unique expertise, such as

- **Digitization and technological design** (data science, AI, blockchain, cybersecurity, imaging, quantum computing)
- **Sustainability and green transition** (sustainable energy, carbon capture and use, green mobility and sustainable cities)
- **Industrial transformation and healthcare** (additive and advanced manufacturing, new materials, robotics, personalized and predictive medicine, medical biotechnology).

STRATEGIC SYNERGIES

To achieve these goals, we will capitalize on our expertise, infrastructure and networks. The renewal of our shared vision and integrated operations with the University of Lausanne through the UNIL-EPFL Continuing Education Foundation (FCUE) will enable both institutions to create effective synergies, optimize resources, streamline processes and strengthen expertise to develop multidisciplinary courses. The activities and brand of the EPFL Extension School will be hosted and promoted by the FCUE, ensuring maximum impact and reach.

Closer collaboration with ETH Zurich will also help to meet the needs of society and the economy in engineering, science and technology, and ensure that the necessary courses are available in most regions and languages of Switzerland.

At the same time, we will strengthen EPFL's vast and successful experience in executive education through an enhanced partnership with IMD, capitalizing on complementary expertise, campus proximity and existing joint initiatives (E4S, TransformTech, etc.).

By actively participating in national and international networks, such as swissuniversities and EuroTeQ, EPFL will be able to influence national policy, disseminate good practice and align itself with international leaders. This will create a flexible and accessible portfolio, reaching a wider audience in Switzerland and internationally.

Finally, given the key role of artificial intelligence in cross-sector transformation, EPFL will be working with the Swiss Data Science Center (SDSC, SDSC+) to develop a broad portfolio of training courses in data science, machine learning and LLM drawing on the expertise of faculty members at EPFL and ETH Zurich.

ACTION PLAN

With the implementation of these synergies, we will be focusing on two parallel areas: making continuing education an institutional priority in Schools, Colleges and Centers, and creating a permanent 'pipeline' with business and industry to ensure the relevance of the portfolio.

Internally, targeted efforts will be made to strengthen the culture of continuing education at EPFL as a core activity, provide appropriate resources (time, funds, remuneration and support) for faculty members to engage in relevant activities and create an entrepreneurial framework around continuing education. School and College managements will have a continuing education faculty resource person responsible for guiding, researching and coordinating relevant activities for their laboratories. Centers of pedagogical and technical excellence (CAPE, LEARN, CEDE) will also be increasingly involved in the development of quality courses.

At the same time, EPFL Centers will be placed at the heart of continuing education activities, given their close collaboration with industry and their access to laboratories that are often much closer to industry and its needs. The Centers will be actively encouraged to recognize and prioritize continuing education as one of their core missions, and to explore scenarios in which EPFL teachers could act as scientific coordinators, with partial delegation of teaching activities. Finally, the Extension School will work closely with EPFL's Leadership and Development unit to help create a genuine culture of lifelong learning at EPFL.

Externally, we will strengthen our business development capacity by working closely with our industry partners, primarily through the Vice Presidency for Innovation and Impact (VPI), to make continuing education a strategic commitment. Our key industry partners will become a key part of our learner base and will also be able to inform the development of our courses.

We will also be working closely with the Alumni Office to ensure that the development and requalification needs of EPFL alumni are directly taken into account when developing the portfolio.

More specifically, we will set up a regular workflow involving all industrial partners and EPFL alumni as follows:

- identify gaps in the EPFL Extension School portfolio, on an annual basis
- influence the design of new courses (and the adaptation of existing courses) on subjects likely to be of interest to them
- participate in courses where they have significant expertise as external instructors
- send cohorts of relevant employees to courses
- actively exploiting the talent pool of EPFL Extension School graduates for recruitment purposes.

Finally, the EPFL Extension School will set up an advisory committee, made up of high-level representatives from EPFL's alumni and industrial partners, to ensure that the needs of the market and society are closely linked to the development and implementation of the strategy.


MIGROS

5.4. Impact and commitment to society

EPFL plans to develop a global impact strategy to amplify its positive contributions to society and strengthen its links with Swiss citizens. Impact has been added to the missions of the Vice Presidency for Innovation and Impact (VPI) and will be included as a criterion for academic promotions.

SUMMARY

Over the next four years, EPFL will roll out a global strategy aimed at amplifying its impact and commitment to society, in line with ETH Domain's strategic priority «Engagement and dialogue with society». In addition, it will carry out related joint initiatives.

This strategy will be based on better coordination of existing initiatives, more rigorous measurement of impact, and greater recognition of researchers' commitment to society. It will also encourage the development of concrete demonstration projects, enhanced dialogue with political decision-makers and outreach to the public. Through these initiatives, EPFL aims not only to increase its contribution to global and local challenges, but also to inspire and mobilize society around scientific and technological advances.

CURRENT CONTEXT AND COMMITMENT

Our society is facing major challenges which EPFL is actively committed to addressing through research and partnerships with industry, policymakers and civil society. It develops innovative solutions based on scientific research to some of the world's most pressing local and global issues, and trains engineers and professionals with the skills, responsibility and ethics needed to build a sustainable and inclusive future.

By promoting innovation and entrepreneurship, EPFL contributes to economic and social progress through the transfer of knowledge and the exploitation of scientific discoveries. It also plays a key role in public engagement, making science accessible and encouraging citizen participation. Already a leader in Switzerland in raising awareness of science and technology, EPFL is stepping up its initiatives to arouse the interest of young people and the public and to strengthen the link between science and society.

STRATEGY FOR 2025-2028

The first stage of the strategy will be to carry out a global mapping of EPFL's current activities in terms of impact and societal commitment. This analysis will make it possible to identify existing actions, optimize their coordination and clarify their objectives to increase their effectiveness, and align their communications to improve their reach. Better recognition of efforts in this area, combined with appropriate training, will also encourage more staff to become actively involved.

With the creation of a new Vice Presidency to support strategic initiatives, EPFL already intends to strengthen its action in priority areas such as sustainability, energy, health and artificial intelligence. At the same time, new projects and initiatives will be added to the portfolio of existing initiatives, consolidating EPFL's impact. The institution will also strengthen its collaboration with its key partners - public, political, industrial and academic players - to work on the research, creation and implementation of concrete solutions and together tackle the major challenges facing our society.

OBJECTIVES AND MAIN STRATEGIC INITIATIVES

1. Strategy: Structure, coordinate and measure impact

- map existing activities and optimize coordination between active units (VPs, Centers, departments, etc.)
- develop a global impact strategy, aligned with EPFL's missions in research, education, innovation and dialogue with society
- develop an impact measurement framework with KPIs to assess progress, guide actions and ensure effective reporting
- strengthen external communication on the impact of the project, by simplifying and structuring the dissemination of EPFL's contributions.

2. Valuing and supporting the commitment of the EPFL community

- include societal impact as a criterion in academic promotions
- develop a range of training courses in public engagement (e.g. covering science popularization, media exercise, political dialogue)
- encourage and support public engagement activities (e.g. provision of resources, time dedicated to public engagement, «Impact Awards»)
- highlighting success stories that illustrate EPFL's impact on society.

3. Catalyze the launch of collaborative projects demonstrating impact

- launch large-scale demonstrators in partnership with industry, decision-makers and civil society, to test and promote innovative solutions; secure dedicated funding to support these initiatives and ensure their sustainability
- encourage student participation in impact projects
- encourage co-creation with the public, through participative approaches to societal challenges.

4. Strengthening support for public authorities and political decision-makers

- develop the interface between public authorities and EPFL scientists, for example by creating an EPFL Public Policy Hub bringing together a list of in-house experts to respond to requests from decision-makers
- strengthen the provision of expertise on issues related to areas of impact to public authorities; offer information sessions for federal and cantonal legislators, elected representatives, civil servants, international organizations and other audiences focusing on technological and scientific challenges in which EPFL has recognized expertise
- contributing scientific and technological input to the drafting of Policy Papers
- organize high-level round tables between researchers and policymakers to encourage strategic dialogue
- establish collaborations with think-tanks and international political institutions to ensure an influence beyond Switzerland, with International Geneva
- clearly communicate EPFL's local and national economic contribution to public authorities.

5. Promoting science, inspiring the next generation and disseminating knowledge

- develop collaborations with other Swiss academic institutions to pool scientific promotion efforts
- secure funding for collaborative scientific dissemination projects in Switzerland
- set up a support center for the promotion of science for the EPFL community, with the provision of expertise and resources
- strengthen collaboration with trusted media to combat misinformation and promote scientific literacy.

6. Deepening the exchange and proximity with the public

- organize theme days on areas of social importance for the public, providing opportunities for discussion and listening
- increase the number of off-campus initiatives, by organizing events and interactive exhibitions in towns and cities, to get as close as possible to the public
- develop interactive travelling exhibitions on strategic themes (e.g. DeepFakes)
- strengthen the media presence of key EPFL figures to increase institutional visibility
- create a Visitor Center promoting EPFL activities and serving as an entry point for visitors
- increase the coherence and visibility of the current cultural offering, and strengthen collaborations with museums, libraries and cultural institutions.


KAT VR

5.5. Fundamental Sciences

Fundamental research contributes to global knowledge and long-term social and economic prosperity. EPFL is a leader in this field and must strengthen its impact by supporting core disciplines, improving research infrastructure, integrating students at an early stage of research and addressing pressing societal challenges through data-driven approaches and full academic freedom.

SUMMARY

Research in the fundamental sciences increases knowledge and awareness of the world around us and helps to secure our future in it. In the absence of thematic restrictions and the need for direct financial gain, basic research and the intellectual creativity associated with it pave the way for innovation and are essential to long-term social and economic prosperity. Fundamental research has a positive influence on all aspects of human life, health, education, the economy and the wider environment in which we live, and provides solutions to the major challenges we face, such as climate change and sustainability

EPFL is well positioned as a leader in fundamental sciences, both in Switzerland and internationally. However, a number of measures need to be considered to further strengthen its impact:

- continue to provide strong support for the fundamental disciplines and increase the interfaces between them;
- set up state-of-the-art infrastructures and platforms for advanced experimentation and the early integration of students into research
- combine the data-driven approach with advanced mathematical techniques and AI
- intensify targeted efforts, while leaving researchers complete academic freedom, on outstanding issues facing science and society whose resolution can be accelerated by fundamental understanding, including climate, energy, sustainability, health, space, quantum computing and communication.

AMBITION

Research and education in fundamental sciences are at the heart of EPFL's mandate and form the foundation of its activities. An in-depth understanding of the laws of nature and how to use them for the common good is the basis of all technological development. Breakthroughs in fundamental research are often transformative and lead to major improvements. Technological advances, in turn, often encourage basic research to move towards a better understanding of basic principles. The development of renewable energies, life-saving therapeutics and medicines and the promotion of future sustainable uses of land, cities and transport are eloquent examples of initiatives at the frontier of our understanding, where a lack of fundamental knowledge limits progress.

EPFL aims to facilitate the symbiotic relationship between fundamental understanding and the technologies that underpin the Swiss economy and security, as well as the health and well-being of society worldwide. EPFL also recognizes the need to disseminate theoretical understanding across all scientific communities and to pass it on to the next generation of scientists. As fundamental research and technological development are interdependent aspects of the discovery ecosystem, EPFL seeks to maintain a balanced portfolio between fundamental and mission-oriented research. This will ultimately lead to new knowledge and answers to today's questions, identify future challenges, pave the way for tomorrow's innovation, train future generations to think in a focused but open way and help attract and retain talent in Switzerland.

EPFL's fundamental sciences encompass the traditional disciplines of mathematics, physics and chemistry, but also digital and theoretical computing and the life sciences. In addition to translational research related to health, the life sciences address fundamental aspects ranging from elucidating the function of biochemical macromolecules to the development of organs in higher organisms, while revealing fundamental brain functions, pushing back the limits of our understanding of vital processes. Fundamental discoveries are also being made today in the engineering sciences thanks to advanced detection, imaging and computing technologies, such as the discovery of new materials and their specific properties, as well as new structures and devices.

All these fields are making increasing use of data science, machine learning and different aspects of AI, leading to a transformation of discovery processes, an opportunity that EPFL is ready to seize. AI has made enormous progress on many complex problems in recent years, mainly through trial-and-error exploration of computational architectures and heuristics inspired by neural networks, combined with real-world data. A solid mathematical and computational foundation for understanding the fundamental limitations, robustness, optimality and safety of these tools is needed before they become more deeply embedded in our society and economy.

Although entirely new mathematical tools may be required, several established sub-fields are likely to play a central role, including statistics and machine learning, algorithms, causal inference and mathematical optimization. This combination of fundamental understanding and data mining, or more generally a data-driven approach, needs to be present in both research and teaching, providing students and scientists with the tools to create knowledge.

The second quantum revolution is revolutionizing communication, computing and imaging, with access to unprecedented levels of detection. Beyond the remarkable prospects for computing capabilities, quantum science is exploring in depth the fundamental laws of nature, such as quantum gravity. EPFL is ideally placed to create an ecosystem around quantum science that will extend from fundamental research to engineering and communications.

One of EPFL's ambitions is to expose undergraduate and postgraduate students to research as early as possible. In this way, these students can discover the combination of fundamental sciences and data and apply concepts, algorithms and visualization tools that provide a better understanding of the disciplinary and interdisciplinary science conducted by EPFL researchers. However, EPFL must not neglect practical experiments in the context of education, to avoid creating a gap with natural phenomena, which are the basis of natural sciences.

Sustainability research, a vital area at this stage in human history, is a perfect example of this mix of traditional and new fundamentals, deployed across all EPFL campuses and student and research communities. In this context, the basic sciences are an essential element in the development of decarbonized energy sources and the reduction of net greenhouse gas emissions.

EPFL AND SWITZERLAND

The long-term vision and commitment of its political system to fundamental research and teaching at the highest level of excellence make Switzerland one of the world leaders in research and technology. Switzerland has one of the highest numbers of Nobel Prize winners and Fields Medal winners per capita. It is one of the few European countries without a brain drain across the Atlantic

and consistently figures among the most innovative countries in the world.

Fundamental research generally takes several years or decades to bear fruit. In many cases, fundamental discoveries are made by individuals or groups driven by curiosity long before others make inventions or develop applications based on this knowledge. It is often difficult to trace innovations and applications back to specific research projects, but it is sometimes possible to identify the origin of the central idea of an application.

EPFL has a duty to facilitate the discovery process, nurturing fundamental science to bring long-term benefits to society. Sharing a strong commitment to and support for curiosity-driven research, the federal organizations, the Swiss National Science Foundation (SNSF) and the ETH Domain, complement each other. While the SNSF provides competitive, project-based funding, the role of the institutions of the ETH Domain, in particular ETH Zurich and EPFL, is to support outstanding individuals conducting world-leading research and, in collaboration with the cantonal universities and universities of applied sciences, to train human capital for industry and society.

EPFL's support for its research and student communities ranges from individual coaching to professional administration and local logistics units to unique, state-of-the-art facilities and platforms, some of which are large-scale. This support is infused with an unequivocal respect for academic freedom and extends to fundamental, translational and applied research, through which EPFL researchers can move freely.

STRENGTHENING FUNDAMENTAL SCIENCES

Providing an a priori, top-down, detailed prescription of the fundamental research avenues that EPFL should pursue runs counter to the very nature of the fundamental sciences. Instead, it is important to establish a framework within which the most original and impactful ideas, concepts and methods can flourish. This framework can be built around three elements: support, infrastructure and the link with education.

1. Support

There is a need to provide sufficient financial support for exploratory research ideas, both basic and applied, including competitive seed funding for high-risk, high-return projects and to enable participation in long-term international partnerships. In addition to the traditional core disciplines, it is important to foster the interconnection between the fundamental sciences and the core areas of engineering, as creativity is often nurtured at the frontier between the two, encouraging new collaborations between the life sciences, the natural sciences and engineering. EPFL intends to continue to extend the culture of technology transfer to more fundamental disciplines, providing the necessary education and support, in particular through its Technology Transfer Office (TTO), to help fundamental scientists identify and be inspired by industrial and societal applications of their results.

2. Infrastructure

It is essential to build and maintain state-of-the-art, internationally competitive research infrastructures, access to which must be guaranteed based on excellence. This means developing and managing the careers of administrative and technical staff with relevant, cutting-edge expertise, who play a key role in maintaining and operating complex instruments. Large-scale advances are needed in some areas of fundamental science, including quantum experimentation, energy research, greenhouse gas capture and sequestration, atomic-scale measurements, space observation and the measurement of life processes. EPFL is incorporating some of these needs into the design and construction of a new Advanced Science Building, which is resistant to mechanical vibrations, temperature variations and electromagnetic interference.

These large-scale projects are intended to complement the activities of small laboratories, whose agility and flexibility are major assets in a number of areas, and which must remain extremely critical in their scientific capabilities if they are to make a significant contribution to their respective niches. Infrastructure platforms, such as mechanical workshops, materials synthesis and characterization facilities, including the relevant human expertise, should be jointly exploited in the most flexible and integrated way feasible,

involving all of our campuses where possible. Exchanges with related institutions with unique skills and infrastructure, such as PSI, are essential in areas such as radiography, space-time or ultrafast spectroscopy and superconductivity. Access to high-performance Swiss, international and campus computing facilities with the most modern architectures must be ensured.

In addition to experimental and digital platforms, EPFL intends to recognize and consider the specific needs of fields such as pure mathematics and theoretical physics, while supporting internal and external mobility and adequate workspaces. In these fields, the most effective way to make progress is to be able to exchange and cooperate with other researchers and students, without geographical or disciplinary boundaries.

To take fundamental experimental science beyond the state of the art, the scientific infrastructure, instruments and techniques for collecting, analyzing and interpreting data must themselves go beyond state-of-the-art. Combining the various fields of experimental and numerical science with pure and applied mathematics, data science and AI enables EPFL to play a leading role at an international level in this context. Imaging clearly illustrates the importance of this combination for progress, as it covers all scales, from astronomy to microscopy. It relies on physics to design and build the instrumentation and on advanced mathematics to drive the reconstruction process. The EPFL Imaging Centre and the Dubochet Imaging Centre, a joint initiative of EPFL, the University of Lausanne, the University of Geneva and the University of Bern, are well positioned as catalysts for interdisciplinary research and innovation.

3. Link with education

EPFL is continually developing its Bachelor and Master programs, emphasizing polytechnic education and ethical values. It participates in internationally competitive training programs for doctoral students that combine academic training with cutting-edge practical science and technology.

It is necessary to encourage programs that allow students to participate in all research disciplines from the outset, and to establish well-defined perspectives for internships and present them clearly to the communities concerned. In addition to teaching cutting-edge knowledge, concepts and methods, EPFL's student and research communities must develop the capacity to acquire new knowledge and develop new methods. EPFL must continue to develop appropriate pedagogical approaches to increase student exposure to the scientific method. Learning to learn and acquiring new expertise, such as using AI to solve problems, requires an openness and intellectual rigor rooted in the fundamental sciences. This essential skill is crucial in a rapidly changing society where current methods will soon become obsolete. The teaching of fundamental sciences and technologies includes ethical values such as sustainability, an open scientific approach, good leadership practices and respect.

OUTLOOK FOR THE PERIOD 2025-2028

New areas of fundamental research are difficult to predict. However, several paradigm questions can be identified where fundamental scientific advances and possible fringe benefits can be envisaged for EPFL. These include: how to develop quantum computing, how the universe began, what dark matter and dark energy are, how to improve affordable health monitoring or prevent disease, how to convert and store sustainable energy using globally scalable systems, and how to deal with climate change and its consequences, or urban population growth and increased mobility.

EPFL will intensify its efforts in the field of quantum science, focusing on quantum algorithms, the key ingredients enabling quantum computers to outperform standard computers. Quantum detection and programmable quantum simulators are areas of research set to grow. This will naturally lead to a new generation of high-precision bench-top experiments that will test the fundamental laws of physics. These activities will flourish under the aegis of the Centre for Quantum Science and Engineering (QSE).

EPFL will continue to push back the frontiers of space in observing the Universe to answer fundamental questions using a multi-wavelength and multi-messenger approach. Massive surveys of the large-scale structure of the Universe will continue with the Euclid space mission, mapping dark matter at different scales, while ground-based surveys will contribute to creating a precise

3D map of the Universe. These new observations will lead to constraints on the possible nature of dark energy, as well as on the measurement of neutrino masses. Deep images from the James Webb telescope and relevant spectroscopic measurements will be used to reveal the birth of the first stars and galaxies. The SKA observatory will shed light on the role of cosmic magnetism in the evolution of the Universe. Synergies with astro-particle experiments such as the Cherenkov Telescope Array or the particle physics experiments at CERN could also lead to fundamental new discoveries, for example about the nature of dark matter. In addition, thanks to quantum physics, advanced photonics and massive computing, EPFL has been able to participate in the new generation of gravitational wave observatories.

High energy theory (HET) plays a fundamental role in the interpretation of all these observations in the laboratory and in the cosmos, considering the two main pillars of modern physics, quantum mechanics and relativity. EPFL's HET covers particle physics, cosmology, quantum field theory and string theory. Continuing the HET could revolutionize our understanding of the real nature of space-time and quantum mechanics. EPFL must also remain closely linked to CERN, where the very precise measurements from the high-luminosity LHC will open new horizons in Higgs and flavour physics.

The discovery of new materials, such as high-temperature superconductors and quantum matter, is at a turning point thanks to new concepts linked to topological properties and strongly correlated electronic systems. The emergence of spectroscopic tools in the ultra-short spatial range and on the nanometric scale, combined with sophisticated theory, will open a new era in condensed matter physics. New catalytic materials are needed to transform the chemical and pharmaceutical industries from their current dependence on fossil resources into sustainable industries based on renewable energies. This transition will be accelerated by fundamental advances in digitization, quantum computing and spectroscopy.

Complex systems, in which many phenomena are still poorly understood, provide a paradigm for interdisciplinarity that is attracting increasing attention at EPFL. Complex systems are defined by their non-equilibrium nature and cover a wide range of fields, from condensed matter to high-energy theory, from particle physics and plasmas for fusion energy to living systems.

Complex studies can lead to the examination of questions as general as how biological networks are established and maintained to create life, and many other questions ranging from genetic networks to the dynamics of organelles and brain diseases.

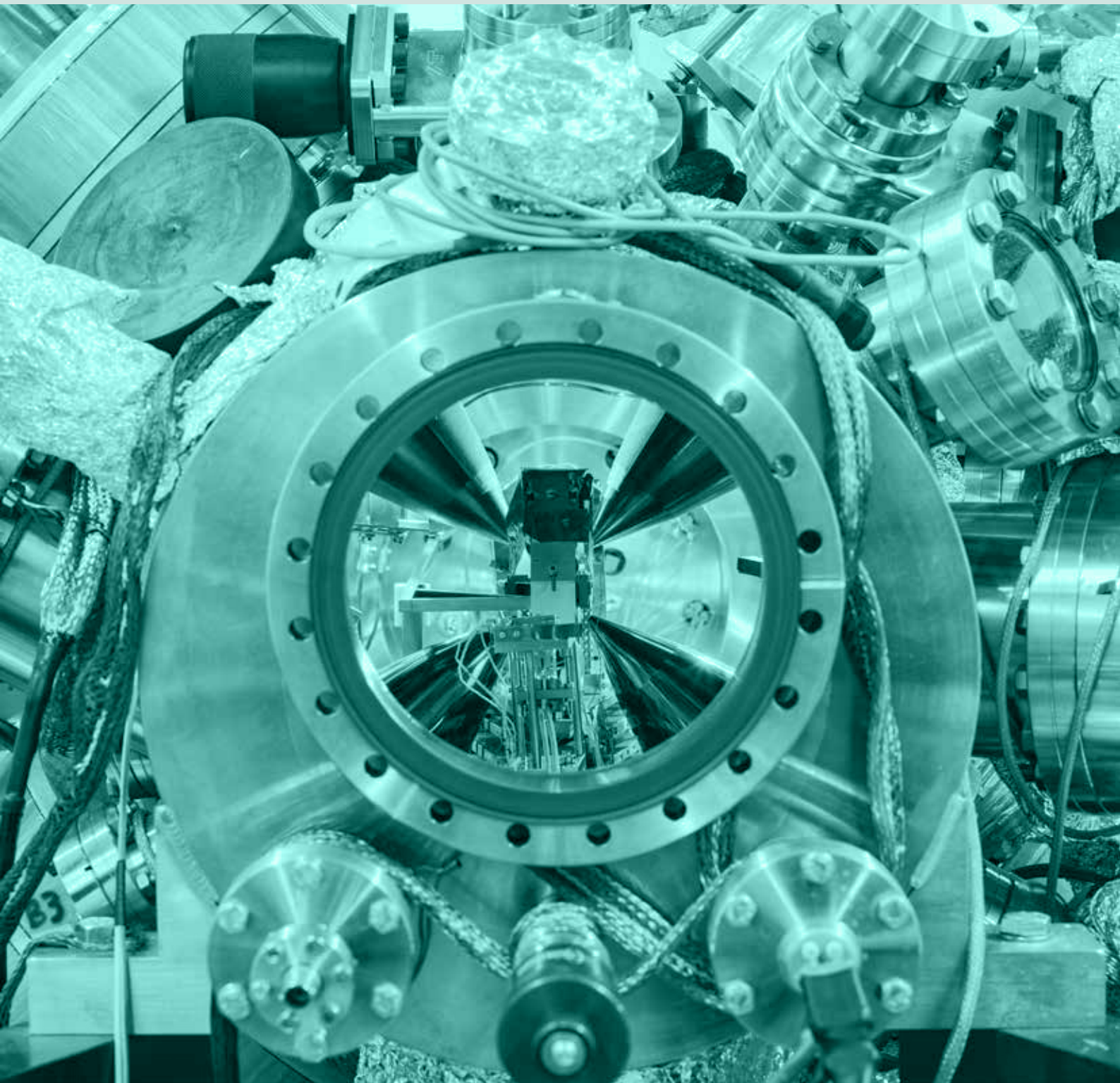
Climate change defines a wide range of current and future challenges that require anticipation, adaptation and mitigation measures.

Fundamental sciences can address the complicated interactions of all aspects of the Earth system and their interfaces with society, understanding the effects of global climate change on the environment, as well as the challenges and opportunities presented by renewable energies and energy transition.

New and increasingly sophisticated mathematics, combined with advanced theoretical computer science and concepts such as digital twins, are essential to answer many of these questions. Several areas crucial to a sustainable future, including the simulation and design of advanced materials, plasma fusion simulation, advanced manufacturing, resource optimization in AI applications through a basic understanding of artificial neural networks and associated machine learning processes, will not be able to develop without a continuous effort to create highly sophisticated mathematical, statistical and computational foundations.

Maintaining existing infrastructures and building new ones are essential to enable cutting-edge basic research. For the 2025-2028 period, the ETH Board is giving strategic priority to a selection of large-scale research infrastructure projects submitted to the Swiss Roadmap 2023. In addition to infrastructure, it is also important to optimize the appropriate intellectual environment, evaluation criteria and promotion mechanisms, for Centers or Institutes but also for individuals, with well-defined career paths for all categories of staff, for the pursuit of fundamental science.

Given the crucial importance of fundamental sciences and education for Switzerland's advancement, human well-being and economic success, it is essential that the ETH Domain and EPFL maintain their function at the highest possible level. The current situation of support for fundamental research at EPFL is sufficient and balanced with applied research, and the expected infrastructural developments, favouring the fundamental disciplines in themselves and their mutual interfaces, are compatible with the vision presented in this document. However, in the current context of geopolitical and economic uncertainty, including budgetary constraints at federal level and difficulties in relations between Switzerland and the European Union, it is essential that basic research and education remain an absolute priority. This would guarantee the short- and long-term international competitiveness of the Swiss science and technology environment, while preserving human capital, creative potential and a central position in the world.



5.6. Data sciences and engineering

EPFL recognizes the importance of IT and digital transformation, with a focus on responsible digital transformation. It has identified six strategic directions: the expansion of the Swiss Data Science Center (SDSC+), privacy and cybersecurity, the integration of data science into the first-year curriculum, the promotion of AI in engineering and science, the development of the EPFL AI Centre and the impact of social sciences in addressing the disruptive role of AI and its societal consequences. These initiatives will position EPFL as a leader in the field of digital technology and AI.

SUMMARY

Information technologies permeate every aspect of our society. They lie at the crossroads of many academic disciplines, including data management and engineering, statistics, machine learning and artificial intelligence (AI), algorithms, optimization, cryptography, computer architecture, communication protocols and networks.

Computing and information technologies offer new tools and techniques for all areas of science to understand and control complex real-world systems and to tackle some of the most challenging problems in our society.

The ETH Domain has made responsible digital transformation a strategic priority refering to the fair, secure and ethical use of digital information. It covers many aspects of data management, including trust, security, preservation of resources, user needs and acceptance by the public and professionals. It also covers the hardware and protocols used in digital transformation.

The challenges associated with responsible digital transformation are numerous and require close interaction between different scientific fields, because the underlying digital technologies are never neutral in terms of value. For example, there is a confluence between security and privacy on the one hand and machine learning on the other. Artificial intelligence is being used to launch new types of attacks against critical infrastructures, but also to detect them. The clash of cultures between the extraction of knowledge from massive data and the expectation of privacy from information further complicates the development of individual technologies in terms of responsible use. We identify six strategic directions for EPFL on a global scale, the first two of which are covered by the ETH Domain's strategy on responsible digital transformation:

1. **SDSC+.** The Swiss Data Science Center (SDSC) was created to accelerate the use of data science, machine learning and artificial intelligence across academic disciplines. Building on its successes over the period from 2017 to 2024, the SDSC will have an expanded role and scope in 2025-2028 (SDSC+).

2. **Confidentiality and cybersecurity.** This responds to a major challenge of digital transformation, namely the erosion of existing trust relationships. This domain-level focus builds on separate initiatives such as EPFL's C4DT and ETH

Zurich's ZISC, joint initiatives such as the Combined Master in Cybersecurity and major successes in technology transfer working with several federal offices to design responsible digital applications and laws.

3. **Integrating data science into the first-year curriculum.** EPFL's cross-disciplinary ICC (Information, Computation, Communication) class offers all first-year students' compulsory exposure to the fundamentals of computing and communications. The program will be revised to introduce students to the fundamentals of machine learning and data science.

4. **AI for Engineering and Science.** This internal initiative aims to ensure the use of AI/machine learning at EPFL through (1) coordinated curriculum development, (2) widely accessible shared infrastructures and (3) research excellence through interdisciplinary research collaboration.

5. **EPFL AI Centre.** Development of a center that brings together all AI-related efforts in a single entity and serves as a single-entry point for all AI-related activities. The goal is to position EPFL as a world-leading institution AI, with a strong and coherent pedagogical component at Bachelor, Master and doctoral levels, with impactful innovations, collaboration with industry and society and coordinated strategic planning.

6. **Impact on social sciences.** Based on the observation that AI will disrupt the humanities and social sciences, but also that the social sciences (e.g. ethics, law) will be needed to study the societal and economic consequences of AI, the Digital Humanities Institute should play a leading role in AI4Humanities and the SHS program should include Humanities4AI in its portfolio.

1. SDSC+

The creation of the Swiss Data Science Center in 2025 as a national platform called SDSC+ will provide a standardized offering of machine learning and AI services designed to accelerate the use of data-driven methods in all scientific disciplines. SDSC+ will act as a data science partner for higher education institutions and research institutes at a national level. Originally, the SDSC was a partnership between ETH Zurich, EPFL and PSI providing all institutions in the ETH Domain with a standardized offering in machine learning and AI, as well as additional services and know-how tailored to customers. As part of its extension (SDSC+), it will become a national digital research infrastructure encompassing all the institutions of the ETH Domain and serving the entire ERI landscape, complementing SWITCH and CSCS. SDSC+ offers the opportunity to coordinate and encourage collaboration between Centers and facilities within EPFL (such as the Centre for Intelligent Systems, AI for Science, Ecocloud), within and beyond the ETH Domain across the ERI landscape (cantonal universities, hospitals, federal offices, industry) to meet the needs of the community over time with cutting-edge methods.

SDSC+ will therefore make it possible to :

- provide and coordinate state-of-the-art AI, machine learning and data science services and platforms offered to all research domains across ERI landscape (universities, industry and public sector) to: (1) facilitate the use of research data (secure and private replication, reuse and collaboration); (2) accelerate the use research data and provide state-of-the-art capabilities (e.g. integrated R&D collaborations); (3) promote the use of research data (educational services, events)

- ensure reliable use of data science and AI/machine learning in ERI: (1) transfer expertise in the responsible, ethical and legal use of data in research; (2) use next-generation explainable AI methods designed in an interdisciplinary approach; (3) provide technologies for decentralized and personalized AI systems that match the performance and experience of the centralized business models that currently dominate and infringe on privacy; (4) collaborate with EPFL's C4DT and other centers of excellence on these topics

- accelerate the adoption of best practice Open Research Data (ORD) and Open Science (e.g. Renku and Swiss Data Custodian)

- train professionals in cross-disciplinary data science skills by offering CAS and DAS in data science that include the FAIR and ORD principles. At EPFL, this will be done mainly through the EPFL Extension School.

2. CONFIDENTIALITY AND CYBER SECURITY

This strategic priority addresses a major challenge of digital transformation, namely the erosion of existing trust relationships, as well as key issues such as data ownership and control, how to protect sensitive data and trusted systems, and how to develop systems that respect confidentiality and security by design, not only for privacy and security researchers, but also for the public.

Many countries, research institutes and universities around the world have recognized these challenges and are making considerable efforts to establish leading centers for cybersecurity. Examples include CMU's CyLab, the creation of a cyberdefense cluster with eleven new chairs in cybersecurity at the Bundeswehr University in Munich, a Max Planck Institute for Cybersecurity in Bochum and the new Helmholtz Security Centre (CISPA) in Germany..

The following list of cybersecurity domains and examples of their sub-themes gives an idea of the variety and complexity of the security aspects of modern IT systems:

- **System security:** secure smartphone platforms, reliable execution environments, secure microarchitectures, cellular system security, positioning and telemetry technologies.
- **Information security:** access control, formal software models, security protocol verification, monitoring, document authentication.
- **Network security:** future Internet architectures, reliable and secure routing, high-availability communications, public key infrastructures, satellite network technology.
- **Applied cryptography:** end-to-end encrypted messaging applications, encrypted cloud storage, secure communication standards such as TLS, searchable encryption, post-quantum cryptography.
- **Fundamentals of security:** cryptographic primitives, definitions of security, security verification techniques, models for secure distributed systems, quantum computing.
- **Programming languages and formal methods:** programming language design, programming proofs, software and hardware verification, theorem proving, static analysis, bug-finding.
- **Security and privacy in machine learning:** privacy implications of machine learning technology, attacks on machine learning systems, defenses, robust machine learning.

The aim of this strategic priority is to strengthen EPFL's leading role in privacy and cybersecurity, thereby providing the necessary support for Switzerland to meet current and future cybersecurity challenges. This includes expanding EPFL's contributions in terms of research, education and continuing education, as well as in terms of the services provided by the institutions involved in privacy and cybersecurity. By joining forces, the institutions of the ETH Domain will strengthen their existing capabilities in cybersecurity, privacy protection, secure systems engineering, digital trust education, research and knowledge transfer to meet the growing importance of society, industry and politics.

EPFL will extend its leading role in cybersecurity in Switzerland in terms of research, education and continuing education, with the Center for Digital Trust (C4DT) playing a key federating role by coordinating stakeholders with university laboratories carrying out fundamental research, providing continuing education for decision-makers and engineers, and advising and guiding the administration in the development of new legislation (e.g. the revised E-ID).

3. INTEGRATE DATA INTO THE FIRST-YEAR PROGRAM (ICC)

Since 2017, EPFL has been focusing on computational thinking as one of its main educational initiatives. This is because all science and engineering is being transformed using data-driven

computational methods, leading to a profound disruption in the way future graduates will work. All EPFL students must therefore be prepared and know how to formulate problems in such a way as to find solutions using computational methods, while also appreciating the limits of these methods. The first step towards achieving these objectives was the creation a compulsory first-year course for all EPFL students on the general theme of information, calculation and communication (ICC). This course, taught annually to 2,000 students on campus, combines a traditional programming course with an introduction to modern computer architecture and elements of computational theory, leading to a better understanding of the problems that can be solved and how to solve them efficiently (exactly or approximately).

During the propaedeutic year at EPFL, CCI is given the same weight as basic mathematics or physics, which testifies to the importance of this topic for new students. Given the rapid integration of machine learning tools into science and engineering, EPFL would like to extend this initiative by adding an additional module dedicated to data, covering topics related to data acquisition and processing, as well as the basics of AI and aspects of data confidentiality, security and causality. The impact on society of data-driven technologies is so great that these subjects should also be discussed in a coherent way as part of the SHS (Humanities and Social Sciences) program.

The proposed strategic objective is to expand the current ICC class into two modules:

- **CCI Module I:** programming and introduction to computer architectures and the theory of computation.
- **CCI Module II:** Introduction to data and information.

These two modules will be implemented as part of the evolution of the current ICC program, that is t say without any increase in ECTS credits.

4. AI FOR ENGINEERING AND SCIENCE

As the fields of engineering and science continue to evolve rapidly, the integration of artificial intelligence has emerged as a transformative force. EPFL recognizes the importance of embracing AI technologies to equip students, researchers and faculty with the skills and tools to excel in the digital age. EPFL aims to enable students to formulate complex problems in a way that allows them to be solved, to develop the ability to interpret results and to understand their implications and to develop the skills necessary to adapt to new challenges and engage in lifelong self-learning.

This requires EPFL-wide coordination to enable the student and research communities to learn and apply cutting-edge AI methods:

- **Coordinating curriculum development.** Integrate AI courses and modules into programs, ensuring that students acquire a solid grounding in AI concepts, methodologies and applications. At equilibrium, AI/machine learning courses should be streamlined as a service offering similar to the current portfolio of core mathematics and physics courses;
- **Infrastructure and resources.** Exploit and develop shared computing resources and hardware infrastructure (RCP, SCITAS) to facilitate interdisciplinary research and provide access to them throughout EPFL; provide dedicated research grants and funding opportunities for interdisciplinary projects that combine AI with technical or scientific expertise;
- **Research excellence.** Promote interdisciplinary research projects at the intersection of AI, engineering and science, by encouraging faculty members to collaborate across disciplines through collaborative fellowships, joint research initiatives and specific postdoctoral programs.

5. EPFL AI CENTER

The Center will help advance AI fundamentals, methods, technologies and applications, leading to more robust and reliable AI. It will leverage the expertise of the entire institution in basic science, machine learning and complex systems engineering to promote Science and Engineering for AI (SE4AI). The Center will also accelerate the use of AI to solve major challenges in all areas of science and engineering and to advance discovery through AI for science and engineering (AI4SE). The Center will also support EPFL's commitment to solving critical societal problems using AI technology.

6. IMPACT OF AI ON THE SOCIAL SCIENCES

The humanities and social sciences will play a crucial role in understanding and driving the AI revolution. Addressing issues of trust, prejudice, misinformation, confidentiality, manipulation and other malicious uses requires proactive, multidisciplinary approaches that go beyond simple engineering solutions. However, these fields will also see upheavals in research methods, and some researchers and teachers in these disciplines will adapt to these technologies and reconsider their basic methodologies. This positive feedback loop has the potential to give rise to a new paradigm in the human sciences that harnesses the power of AI systems to study and understand their societal consequences.

Faced with these transformations, EPFL must not only foster critical engagement with AI systems by addressing ethical considerations, prejudices and benchmarking, but also lead the integration of AI into the humanities, social sciences, arts and design, stimulating innovation and generating ground-breaking knowledge by developing two symmetrical programs:

- **an AI4Humanities program,** led by the Digital Humanities Institute (DHI), could stimulate research and education initiatives to advance AI methods and systems in support of research and innovation in the humanities and social sciences. With its expertise in digitization, computational approaches to historical data, museography, digital history of science, social computing and digital musicology, AI4H could work closely with the EPFL-wide AI for Science and Engineering initiative;

- at the same time, a **Humanities4AI program** could coordinate research and teaching in the social sciences and humanities aimed at understanding the societal consequences of new AI systems. Drawing on the full SHS offer, which encompasses various disciplines including philosophy, history, sociology and anthropology, H4AI could design a coherent program to achieve this objective.


AI Center
EPFL

5.7. Health and life sciences

EPFL is committed to pushing back the frontiers of health sciences and technologies to make a real impact. Through its interdisciplinary and strategic approaches, it will actively contribute to advances in precision medicine, prevention, diagnostics and therapies. By investing in education, research and innovation, EPFL is helping to shape the medicine of the future for patients and society.

SUMMARY

Advances in data science and technology are transforming healthcare and paving the way for a new medical revolution. EPFL, with its strengths in engineering, life sciences, chemistry, mathematics, computer science and environmental sciences, is ideally positioned to make its contribution. By combining fundamental discoveries, interdisciplinarity and commitment to society, EPFL plays an active role in advancing biomedical and environmental research, education and innovation.

Large-scale data collection and analysis enables precise monitoring of risk factors and paves the way for effective prevention strategies. In collaboration with healthcare players, EPFL is developing cutting-edge diagnostic and treatment technologies, integrating artificial intelligence, omics technologies, microfluidics, imaging, miniaturized sensors and portable systems. The institution also plays a key role in therapeutic innovation, notably through the targeted administration of drugs based on computer-designed proteins or brain-machine interfaces.

In this context, training the next generation of scientists and engineers is a priority. EPFL will be stepping up its teaching of biology and quantitative methods to equip its students with the tools they need to meet the challenges of the health sciences. Integrating the ethical, social and cultural dimensions of biomedical innovation is essential to foster responsible dialogue and effective cooperation. Our interactions with the Schools of medicine at the Universities of Lausanne and Geneva will be intensified, further anchoring EPFL in a dynamic of co-creation for precision medicine and high-impact translational research.

SCIENCE AND TECHNOLOGY FOR TOMORROW'S MEDICINE

EPFL is establishing itself as a key player in research and innovation in neuroscience, oncology and infectious diseases, by closely combining basic science and translational research. With its expertise in biology, imaging, AI and technologies, EPFL analyses biological mechanisms and biomedical data and develops new approaches to diagnosis and therapy.

In neuroscience, EPFL is making advances in fundamental research and neurotechnology. It will strengthen its efforts in integrative neuroscience to better understand the neural bases of behavior and motor control, as well as the mechanisms underlying mental and neurodegenerative diseases. Research into healthy ageing and the factors influencing cognitive longevity

will be stepped up, integrating the impact of the environment, lifestyle and technological interventions on brain health. In oncology, an interdisciplinary approach combining data sciences, biology and engineering will pave the way for new advances in diagnosis and treatment. EPFL will also strengthen its commitment to understanding, preventing and treating infectious diseases, by integrating experimental research, mathematical modelling and epidemiology.

The increasing volume and complexity of biomedical data is transforming approaches to healthcare. AI will radically transform the field of healthcare, from medical practice to drug design. To exploit its full potential, EPFL will bring together experts from different Schools to develop rigorous methodologies in machine learning, statistics and mathematics. Its expertise in AI, genomics and bioinformatics, supported by collaborative Swiss initiatives such as Health2030 and the Swiss Data Science Center, will position our institution as a leader in this strategic field.

PREVENTION AND SURVEILLANCE: ANTICIPATING FOR BETTER ACTION

EPFL must play a key role in prevention and surveillance, which are essential for improving public health. Prevention relies on innovative strategies in vaccination and nutrition, as well as considering environmental impacts (heat islands, pollution, etc.). Surveillance involves analyzing health and environmental data to identify and anticipate risks.

Thanks to its strengths in engineering, life sciences, environmental sciences, mathematics and computer science, EPFL is developing advanced solutions in robotics, intelligent sensors and data science to monitor air and water quality. Protein engineering, structural biology and AI are also opening new perspectives in the design of vaccines and immunotherapies.

EPFL will strengthen and extend its collaborations with partners in the field, such as hospitals, research centers like the Swiss Tropical and Public Health Institute in Basel and the Swiss School of Public Health, NGOs and industry, to maximize the impact of its innovations. These partnerships will be encouraged and intensified to accelerate the development of new prevention and surveillance solutions.

Finally, health is not just about science and technology. Socio-economic determinants influence the effectiveness of interventions. It is essential to train students and researchers who are aware of societal dimensions. EPFL will integrate these issues into its teaching to better prepare students for the complex challenges centered on human beings.

DIAGNOSTICS AND THERAPIES: INNOVATING FOR PERSONALIZED CARE

Accurate and accessible diagnostics are essential for tomorrow's medicine. EPFL will develop innovative approaches arising from interdisciplinary efforts in imaging, omics, microfluidics and intelligent sensors to improve disease detection and monitoring.

The integration of AI and omics technologies (such as epigenomics, transcriptomics, proteomics and metabolomics) is revolutionizing preventive medicine and the personalization of treatments, particularly for cancer and neurological disorders.

EPFL will continue to make advances in flexible robotics, micro-engineering, bioengineering, biomaterials, digital health and wearable technologies. These innovations will enable real-time monitoring and optimized remote surveillance of patients.

Thanks to lab-on-chip and organ-on-chip technologies, microfluidic engineering will contribute to better diagnostics, reducing the volume of samples, speeding up analyses and guaranteeing accessibility.

In therapy, EPFL will continue to mobilize players in biology, chemistry, materials science and engineering to design new therapeutic approaches, such as targeted drug delivery systems, gene therapies and regenerative medicine solutions. This interdisciplinary synergy will accelerate innovation and improve healthcare in the long term.

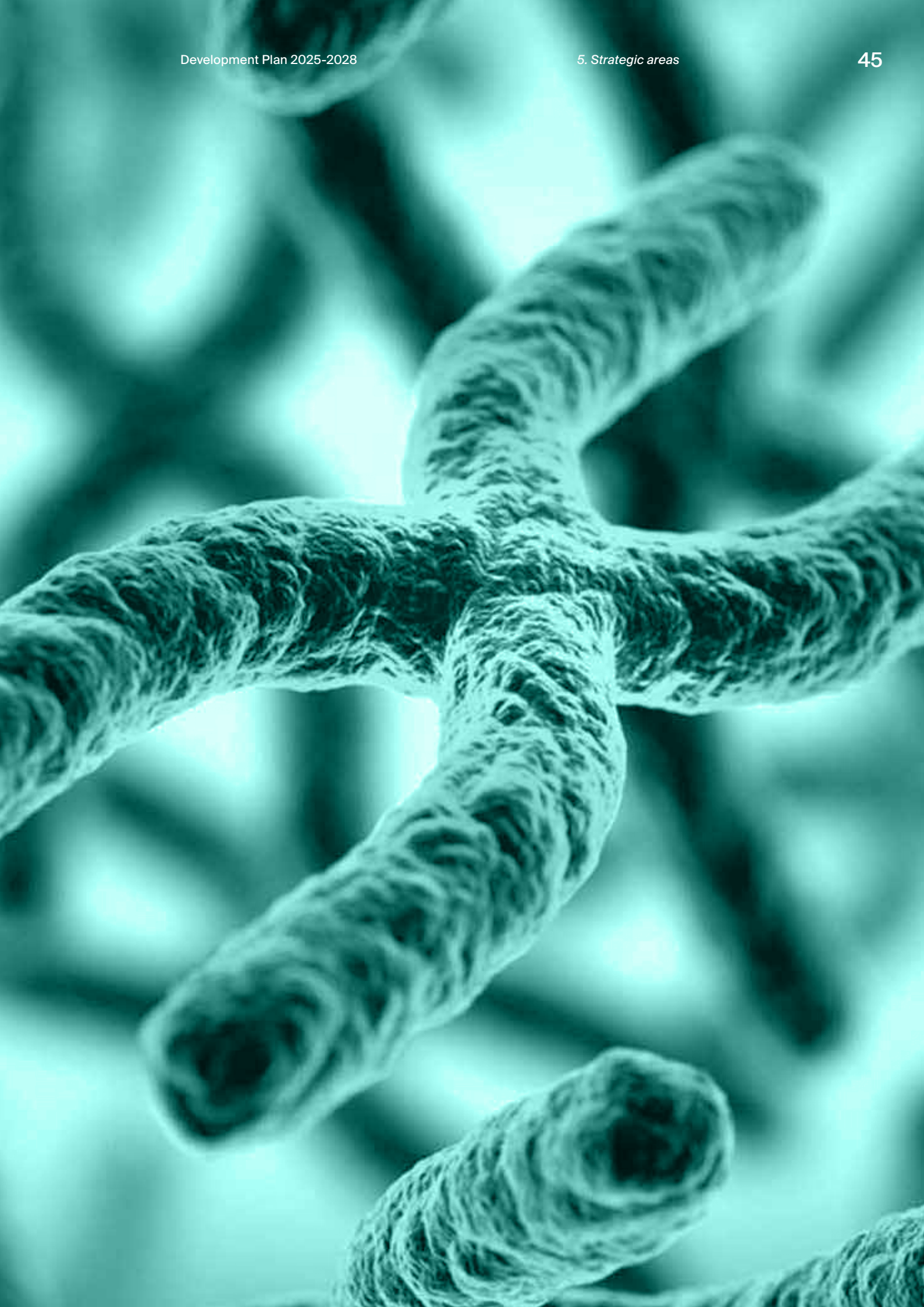
EDUCATION

The Covid-19 crisis has profoundly transformed daily life and revealed inequalities in access to healthcare, influenced by socio-economic and geographical factors. It also highlighted the challenges of public health interventions, in particular vaccine hesitancy and misinformation. This experience should guide the training of the next generation of engineers and scientists, preparing them for integrated and interdisciplinary approaches to health.

EPFL is integrating these issues into its teaching, such as the «Global Issues» course in the SHS program and competitions for health projects based on data. Pedagogical synergies will strengthen interdisciplinary approaches, by bringing together a variety of expertise, as in the Neuro-X Master program, which brings together students from STI, SV and IC, or at ENAC, where architects and civil and environmental engineers work together.

To prepare future engineers and for the challenges of biomedicine, the teaching of biology, biochemistry and epidemiology will be strengthened from the first year. At the same time, life sciences students will be trained earlier in quantitative methods, statistics and AI. New courses will promote communication and interdisciplinary expertise.

EPFL also supports medical training, through the «Passerelle» programs with the Universities of Lausanne and Geneva, and by supporting MD-PhD courses, thereby strengthening the links between engineering and medicine. As part of this dynamic, the EPFL will extend the involvement of doctors in teaching at the EPFL so that they can share their clinical experience and confront students with the realities of the field.



5.8.
Energy, climate and sustainability

EPFL plays a key role in Switzerland's climate and energy strategies, supporting the objectives of sustainability and energy transition. It is helping to strengthen the scientific base, develop essential skills and support Swiss industries in their transformation. To broaden and strengthen its leadership, EPFL will focus on interdisciplinary research, collaboration and international visibility, while transforming its campus into a living laboratory, with the aim of achieving carbon neutrality by 2040.

SUMMARY

EPFL intends to make a key contribution to Switzerland's Climate and Energy Strategies. Its objectives include carbon neutrality and the transformation of the Swiss energy system by 2050. The institution supports Swiss industries in their sustainability efforts, helping to secure essential services (gas, water, electricity) and training a skilled workforce to support the energy transition and meet climate and biodiversity targets.

EPFL will focus its efforts over the coming years on its three fundamental missions. In research, it will promote interdisciplinary and collaborative approaches in the fields of energy transition, carbon neutrality and adaptation to climate change. In education, it will develop innovative teaching programs tailored to the needs of future generations and industries, while encouraging continuing education. To fuel innovation, it will transform the campus into a living laboratory, demonstrating sustainable solutions and strengthening collaboration with industrial and institutional partners. It will also carry out the joint initiatives of the ETH Domain that have been selected in the "Energy, Climate and Environmental Sustainability" strategic area.

EPFL'S AMBITIONS IN ENERGY, CLIMATE AND SUSTAINABILITY

EPFL has unique interdisciplinary expertise that enables it to meet the complex challenges of climate, energy and sustainability. The institution has laboratories dedicated to specific issues such as glacier melt, coral protection and the impact of human activities on ecosystems.

Thanks to its ability to mobilize complementary expertise - from fundamental sciences to applied engineering - EPFL aims to anticipate, understand and mitigate the impacts of climate change, while supporting energy and societal transitions. Our ambition is to generate knowledge that advances public policy, promotes sustainable technologies and strengthens the resilience of ecosystems and communities.

EPFL'S COMPETENCES AND STRATEGIC PRIORITIES

Thanks to its multidisciplinary skills, deployed in the classroom, the laboratory and the political arena, EPFL has the potential to break with the status quo and contribute to a sustainable future. For the 2025-2028 period, strategic priorities will include: (1) energy transition, (2) commitment to carbon neutrality, (3) anticipation and adaptation to climate change, (4) cross-functional priorities, and (5) empowering future food science & engineering.

1. The energy transition :
More than 70% of the world's greenhouse gas emissions come from the use of fossil fuels. EPFL is committed to accelerating the energy transition by developing innovative solutions that reduce our dependence on fossil fuels, while exploring sustainable and efficient alternatives. In particular, we will :

- develop the next generation of sustainable energy technologies and addressing their circularity, including energy conversion, distribution and daily/ seasonal storage. EPFL has a focused activities in hydropower, photovoltaics, high-power, high-energy density and ecological storage technologies, synthetic fuels, nuclear fusion, and technologies involved in the planning and operation of integrated energy systems;

- study the interrelationship of different spatial arrangements (for example, building type, location and layout, renewable energy collection facilities, distribution networks) with energy systems, environmental sustainability, social dynamics and ecosystems;

- develop technologies related to nuclear fission, in particular those linked to waste management and safety.

2. Commitment to carbon neutrality
Despite progress towards renewable and clean energy sources, the energy transition remains slow. Faced with this challenge, and in the context of the Federal Council's mandate to achieve carbon neutrality by 2050, innovative and disruptive approaches are essential to accelerate the development and implementation of the necessary solutions. EPFL is focusing its research efforts on key initiatives to mitigate climate change, such as :

- developing carbon dioxide management technologies. This includes capturing unavoidable emissions (such as from cement, waste, chemicals), as well as capturing them directly from the air and transporting them to sinks for use or storage;

- improving the energy efficiency of industrial processes. This involves innovation in large-scale advanced and additive manufacturing, as well as optimizing existing processes;

- creating carbon-neutral communities. Developing low-carbon construction materials and processes for building operation and maintenance, and circular approaches to urban wastewater treatment. These efforts also include decarbonized mobility, community recycling, rational management of urban heat and water, and analysis of the behavioral, social and political dimensions of the transition.

3. Anticipating and adapting to climate change
EPFL's priority research activities aim to :

- develop advanced climate models and in particular quantitative models based on modern approaches to dynamic systems and techniques for reducing non-linear models, to better anticipate climate change;

- design environmental detection technologies and intelligent networks, providing near-real-time data using advanced sensors and intelligent communication systems to improve modelling and support rapid, effective decision-making;

- adapt current housing to the inevitable effects of climate change, design resilient territories and cities, reducing heat islands, optimizing mobility, and integrate analysis of the social practices of local populations to align infrastructures with sustainability objectives;

- develop circular infrastructures for natural resources and waste and set up efficient recycling systems for key resources such as water, phosphorus and rare earths;

- study the link between climate change and natural hazards, by analyzing the impacts of droughts, landslides and other events in order to design more resilient urban and rural adaptations for towns and villages.

4. Cross-functional priorities
Based on these three strategic areas and their interconnections, EPFL will develop innovative solutions in the following areas:

- monitoring and managing flows of energy, resources, products and waste. Information technology will play a central role in collecting, analyzing and

translating data into knowledge that can be used to design a regenerative socio-economic system;

- the development of sustainable IT systems. EPFL is focusing its efforts on the design of IT systems with a low environmental impact, and on the development of analytical tools to measure and quantify their ecological footprint;

- sustainable materials and processes: EPFL will give priority to the design of sustainable materials and processes adapted to societal and environmental applications, and to the systematic assessment of their life cycle, integrating their economic and ecological impact, to guarantee solutions that are both efficient and environmentally friendly;

- environmental health and biodiversity. Climate change, urbanization and pollution are compromising biodiversity, environmental health and human well-being. EPFL is committed to developing methods for assessing and understanding the impacts on biodiversity and to proposing concrete solutions for combating biodiversity loss and improving environmental health.

5. Empowering Future Food Science & Engineering

In the face of pressing global challenges including climate change, hunger, and health crises, food has emerged as a central issue that touches every aspect of human life. Recognizing the pivotal role that food production and engineering plays in the future of our planet, EPFL will assess how to strengthen its role in this field by :

- exploring the potential for new initiatives with the goal of identifying how its expertise can best contribute to addressing immediate and systemic problems plaguing our food systems, ranging from sustainability and distribution to nutrition and health. This assessment builds on EPFL's existing strengths across fields such as nutrition & metabolism, sustainable engineering and artificial intelligence, among others;

- fostering collaboration among researchers, industry partners, and policymakers. A particular focus will be placed on three strategic research themes - (i) Food System Sustainability, (ii) Nutrition, Metabolism, and Health, and (iii) Intelligent Technologies for the Food System;

- defining a strategy outlining a path for academic development, industry collaboration and public engagement, underpinned by the development of an educational framework;

- committing to identify how to best contribute to addressing the complex challenges of the global food system. This effort reflects EPFL's broader mission to advance scientific understanding and technological innovation in this area but also to play a key role in shaping the future of food.

ACTIONS IN ENERGY, CLIMATE AND SUSTAINABILITY IN THE SERVICE OF SWITZERLAND

- **Policy.** EPFL's activities play a central role in the implementation of Switzerland's long-term Climate and Energy Strategies. EPFL also contributes to Switzerland's Biodiversity Strategy and International Cooperation Strategy, the latter aimed at reducing inequalities, promoting equal rights and preserving natural resources abroad. Through its technologies, EPFL seeks to meet the needs of vulnerable populations, offering innovative solutions that generate economic opportunities for developing countries, create new markets for Switzerland and thus strengthen its international profile.

- **Industry.** EPFL actively contributes to the sustainability objectives of Swiss industries, providing solutions for key sectors such as the chemical industry, which alone accounts for around 5% of Swiss GDP and 45% of its exports. Although the sector is the country's largest manufacturing contributor, it is also one of the largest consumers of oil and gas and the second largest emitter of greenhouse gases. The challenges are clear: around 95% of the 300,000 chemical substances produced in Switzerland are of fossil origin. The chemical industry therefore needs innovative

solutions to reduce its carbon footprint and waste. EPFL researchers will play a crucial role in the development of technologies that will enable the manufacture of carbon-free chemicals and a transition to waste-free production processes; for example, the Coalition for Green Energy and Storage (CGES) initiative with political, industrial and scientific partners.

- **Swiss population.** EPFL is putting its expertise at the service of the essential needs of the Swiss population, such as the supply of water, gas and electricity. An effective energy transition requires the flexible integration of renewable energies into the Swiss energy system, capable of managing variability ranging from fluctuations of a few seconds to seasonal changes. Around 75% of Switzerland's hydroelectric power stations, which cover some 58% of the country's energy needs, will need to be renovated over the next 30 years. EPFL is committed to mobilizing its expertise to modernize these essential infrastructures, optimize operating processes and overcome the technical and economic obstacles to this transition.

- **Education.** The energy transition and climate change challenges require a new generation of scientists and engineers with interdisciplinary knowledge adapted to a changing world. EPFL is responding to this need through innovative programs such as the Master in Energy and continuing education initiatives to develop a skilled and flexible workforce, through open dialogue with society to raise public awareness of the importance of sustainability measures and inform economic and political decision-makers and through support for industry, giving it access to emerging technologies.

WHY EPFL IS WELL POSITIONED WHEN IT COMES TO ENERGY, CLIMATE AND SUSTAINABILITY

Over the past four years, EPFL has launched several important sustainability initiatives, demonstrating its ongoing commitment to a sustainable future. Among these initiatives was the presentation of its first Climate and Sustainability Strategy in 2023, which set the stage for a more ambitious and comprehensive approach. This strategy reflects an intensification of sustainability efforts at EPFL, aimed at integrating these principles more systematically and thoroughly into all its teaching, research and innovation activities.

At the heart of research at EPFL are several transdisciplinary Centers and players working on issues related to sustainability and energy transition, covering a broad spectrum from energy and the environment to sustainable cloud computing and humanitarian action.

EPFL has several platforms and supports demonstration projects focusing on sustainability: a hydraulic machinery platform, a heating and cooling system for the Lausanne campus using water from Lake Geneva, heat recovery from a data center, a mini-electricity grid, a solar power plant and energy demonstrators in Valais focusing on energy conversion and CO_2 capture.

Two programs, Teach4Sustainability and Solutions4Sustainability, mobilize interdisciplinary teams of educators and researchers to develop integrated solutions and demonstrators aimed at reducing the energy dependency and carbon footprint of the EPFL Campus.

Finally, EPFL's Make projects are an educational tool designed to raise awareness among students and train them to tackle concrete challenges. They encourage participants to design tangible solutions while integrating sustainability approaches and principles. These projects cover themes such as accelerating the identification of biodiversity, preserving the oceans or carbon capture.

MEASURES TO BE TAKEN

EPFL is positioning itself to influence world opinion, transform mindsets and prepare the next generation of innovators with the skills needed to achieve the energy transition and a sustainable global future. To achieve these goals, EPFL is committed to a number of strategic actions:

The recruitment of new talent will be based on the needs of

the priority areas, integrated into the planning of Schools and Colleges.

EPFL will actively encourage interdisciplinary collaborative projects focused on the challenges of sustainability and climate change. It will stimulate coordination and cohesion between existing EPFL actors (e.g. Centers, Schools and Colleges as well as laboratories) to address environmental issues in a holistic manner. To this end, it will develop strategies to optimize the use of local resources (e.g. EPFL Centers, local industry and academic institutions) with a view to reducing the carbon footprint and will seek to attract more external funding to enhance levels of technological readiness.

These efforts will increase the likelihood that sustainable technologies developed at EPFL will go beyond the laboratory stage to have a positive and tangible impact on society and the environment.

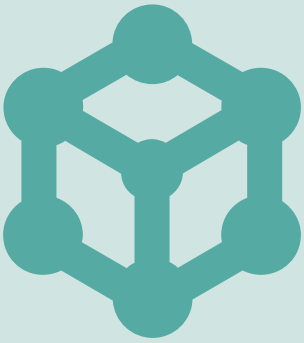
EPFL is committed to systematically integrating sustainability into its educational offering. Since 2024, all bachelor students have benefited from courses that integrate sustainability principles. Sustainability courses specific to each field of study will be introduced in all sections by 2028.

EPFL will also be developing continuing education courses in sustainability to support Swiss companies and NGOs in their transition to more sustainable practices.

EPFL will continue its awareness-raising programs for Swiss schools, offering training to teachers on integrating sustainability into their courses and organizing themed open days focusing on specific aspects of sustainability.

EPFL is committed to transforming its campus and organizational culture to reflect its commitment to sustainability. EPFL has set itself the ambitious target of achieving carbon neutrality for its campus by 2040. To make progress towards this goal, EPFL will draw on its Climate and Sustainability Strategy, which proposes various approaches to reducing the campus' carbon footprint.

A campus culture sensitive to climate and sustainability issues will be fostered at all levels, as well as more sustainable practices. Collaboration with the wider EPFL community and a participatory, respectful and stimulating approach to engaging the community as stakeholders in sustainable transformation will be crucial. The institution will also explore ways to support the well-being of its community in the face of current environmental challenges.



5.9. Materials science and engineering

EPFL emphasizes the importance of continuous innovation in materials science and technology for sustainability and technological progress. It will focus on existing strengths and expand into new areas relevant to technology and society, such as sustainable building materials, flexible materials and energy-related materials. The institution aims to create hub for the discovery of high-performance materials to support its research objectives and engage with the 'pipeline' of young people and society, with a particular focus on the sustainability of materials.

SUMMARY

Continued innovation in materials science and technology is essential for a sustainable and prosperous future and for technological improvements in a wide range of areas. EPFL has become a center of excellence in many areas of materials science and technology. In the coming period, EPFL will continue to build on its strengths in these areas and expand into new areas that have become important in the light of technological and societal trends. The proposed areas of interest are as follows:

- sustainable building materials
- durable flexible materials (e.g. plastics and polymers)
- materials for energy and energy storage
- materials for future information technologies
- materials for biology and medicine
- materials and technologies for the advanced manufacturing of precision systems
- metamaterials

These areas have a considerable impact on Swiss industry, on sustainability and on the future of Swiss competitiveness. It is therefore essential to invest in the areas identified so as to maintain Swiss excellence while paving the way for a sustainable future.

To this end, we will create a focal point for high-throughput computational and experimental materials discovery. This will ensure the rapid and efficient development of knowledge covering all the thematic areas mentioned above, serving as a springboard to ensure EPFL's continued excellence and progress in new high-priority research areas. The success of these efforts will necessarily depend on the support of society and the commitment of an emerging workforce. These efforts will serve as a lever for dialogue with the 'pipeline' of young people and with society, particularly by focusing on the sustainability of materials.

DESCRIPTION OF THE STRATEGIC AREAS

Continuous innovation in materials science and technology is crucial for Switzerland to provide a strong engine for the Swiss economy. EPFL has become a center of excellence in many areas of materials science

and technology, including the development of new materials, the exploration of materials for a sustainable future, the development of materials and processes for precision industries and research and development at the intersection of materials and advanced manufacturing. Over the coming period, EPFL will continue to build on its strengths in these areas and expand into new fields that are becoming technologically and socially important. More specifically, the following themes are of particular importance in this respect:

- **Sustainable building materials.** More than 50% by volume of everything produced by human beings is made from cementitious materials; no other material or chemical process reaches this scale of production. Consequently, building materials have a crucial societal impact on a more sustainable future. For example, the production of cementitious materials accounts for 8% of global CO_2 emissions. EPFL is already a world leader in the field of construction materials, particularly cement-based materials. It will continue to develop this field through fundamental research and innovation, including the development of low-carbon cementitious materials, reduction in the intensity of material use through the deployment of new materials, recycling, alternative building materials from renewable resources for advanced applications, new construction processes, including large-scale advanced and additive manufacturing, as well as intelligent and functionally integrated material solutions, for example for maintenance, thermal management and energy production.

- **Durable flexible material.** Global plastics production continues to grow exponentially. Only a small fraction is recycled, and most plastics end up in landfill or escape into the environment (around 85% of annual production). As a result, microplastic pollution can be seen in all ecosystems and the food chain. For example, polybutadiene microparticles from car tires are the most common contaminant in the soil at the bottom of Lake Geneva. 40% of plastics are used in single-use packaging, making a significant contribution to the waste stream. EPFL has already invested in research into sustainable plastics in various Schools. This will include the development of new polymers and composites (for example, biodegradable), modifications of environmentally-friendly or efficient materials, new circular product designs, sustainable processing and synthesis approaches, new methodologies for life cycle assessment and value chain analysis and interdisciplinary research at the intersection of tribology, wear and degradation.

- **Materials for energy and energy storage.** With an increasing focus on renewable energy solutions, EPFL will invest more broadly in materials for energy production, conversion and storage, from microdevices and mobile computing to vehicles and community production systems. Strategic areas include materials for high power and high energy density energy storage, devices based on sustainable materials and materials for energy-to-fuel technologies. In addition, EPFL has considerable strength in photovoltaics and will be placing greater emphasis on the development of materials for energy production. At the same time, EPFL lacks expertise in energy storage, even given Europe's interest in this sector, and will be working to fill this gap to enable Switzerland to be a leader in this field. Given the energy mix available in Switzerland, the development of materials for grid-scale energy storage is essential, which will have an impact on mobility and transport. This will also enable us to take advantage of EPFL's expertise in the computer-aided design of materials.

- **Materials for future information technology.** With the exponential growth in computing needs, there is a considerable increase in the energy demand for computing infrastructure and associated data storage, which will only increase with the widespread adoption of AI and machine learning. At the same time, the emergence of quantum computing is expected to have a significant impact on various aspects of computing. Hence the need for new materials and systems for more energy-efficient computing. EPFL has already made considerable

investments in quantum science and technology, which it will extend to focus on materials for quantum computing, with the aim of producing more usable materials at practical operating temperatures to enable a more scalable and sustainable quantum future. More generally, EPFL will enhance research into new materials platforms for quantum computing as well as functional metamaterials, optical materials, nanomaterials and data storage materials to meet the needs of computing in a sustainable future. EPFL is well placed to tackle this area, with significant in-house expertise in physics, chemistry, materials science and engineering and quantum science and technology. In addition, EPFL will invest in neuromorphic computing, including associated materials.

- **Materials for biology and medicine.** Switzerland is a world power in the field of medical devices and pharmaceuticals. To maintain this strength and move into new areas of biotechnology, EPFL will invest in several opportunities to play a central role. These include the development of new tissue-building materials for regenerative medicine, which could at the same time reduce the need for extraction and animal testing. With the rapid emergence of devices that rely on human-machine interfaces, there is a need for materials that enable stable and robust interfaces between the inorganic and biological worlds. Finally, the sustainability of medical systems will be addressed by developing new methods for producing and guaranteeing the sterility of medical devices and tools. Given the ageing population and the huge medical industry in Switzerland, the local and global impact will be spectacular in this respect.

- **Materials and technologies for the advanced manufacturing of precision systems.** Switzerland (particularly Western Switzerland) has maintained a strong microsystems manufacturing base while retaining a high-wage economy. With the emergence of new manufacturing paradigms such as additive manufacturing and micro-assembly, there is considerable upheaval in these areas. Currently, there is a mismatch between the new manufacturing paradigms and the needs of precision microsystems. New materials and new materials and processing routes are needed to bridge this gap, enabling the precision manufacture of complex microsystems while replacing the subtractive and unreasonable techniques currently used. This will be a key focus for EPFL. This will help Swiss industry to continue to innovate through the democratization of manufacturing, which will be important if Switzerland is to maintain its globally competitive industry.

- **Metamaterials.** This is a broad, highly interdisciplinary paradigm that refers to materials designed at scales longer than the atomic scale and that combine different material components, thereby creating properties that are impossible to achieve in their initial unstructured counterparts. EPFL already has a strong position in this field and will continue to build on it. Given the intrinsic interdisciplinarity and breadth of the field, further expansion in this direction should create numerous synergies both between EPFL groups and with external academic and industrial partners. In this area, EPFL will invest in the development of expertise and characterization facilities, to enable a more detailed understanding of the emerging properties of these systems. In addition, EPFL will invest in establishing expertise and links between basic science and engineering, to facilitate the development of local expertise covering the entire knowledge chain, from physics to applications.

EPFL will create strengths in the above themes by investing in people and in strategic resources. Many of the topics identified are likely to have strong support from local industry.

These themes will all benefit from the development of new methodologies that take advantage of the transdisciplinary excellence that exists at EPFL. More specifically, EPFL has already achieved excellence in the discovery of

computational materials. EPFL also has expertise in machine learning, which is beginning to be deployed in applied machine learning and AI4Science. There is therefore a significant opportunity to leverage this excellence to foster new methods in materials science and engineering, as follows:

- **High-throughput computational/experimental materials discovery.** Given the complexity of new materials systems, there is a huge benefit in reducing the number of physical experiments through the use of simulation and in-silico discovery. On the other hand, the state of knowledge in this area continues to evolve to the point where there is an opportunity for cross-fertilization in all the areas mentioned above with a focus on (1) computational discovery, including that of materials with novel properties, but also critically that of their synthesis and processability, (2) techniques and infrastructures to facilitate the rapid synthesis and characterization of materials to improve computational predictions, (3) learning curation to exploit machine learning extraction from the huge body of existing but related scientific learning literature and observations, and (4) the use of AI to rapidly analyze results from simulations and experiments to accelerate the discovery process. All these elements draw on EPFL's areas of expertise, but to date their synergies have not been adequately exploited, which represents an opportunity for EPFL and for society in general. EPFL will invest in the creation of a campus-wide resource on these topics.

- The success of all these efforts will necessarily depend on the commitment of an emerging workforce. With this in mind, these efforts will serve as a lever for dialogue with young people and society, as follows:

- **Student population.** There is a general shortage of students, particularly Swiss students, pursuing a degree in materials science and engineering. Given the importance of the above themes, EPFL will commit to demonstrating at pre-university level the value and attractiveness of a career in materials. The dynamism of local industry in this regard will provide a strong incentive for students to enter the field. The development of pedagogical methods to teach materials science at an early stage and in an attractive way will be developed.

- **Sustainable materials as a culture:** sustainability is necessarily linked to many of the above points. By taking advantage of this situation, EPFL has a tremendous opportunity for societal engagement. As far as the curriculum is concerned, we will be instilling a culture of seeing materials in the context of a circular and regenerative socio-economic system. There is also a need to think about the discovery of materials from the ground up, with circularity in mind. The campus itself can serve as a playground in this regard; for example, campus construction can take advantage of campus innovations, to provide both field validation and a means of engaging students and society at large.

6.
SCHOOLS AND COLLEGES

Our five Schools and two Colleges are at the heart of our strategy to meet the challenges outlined above. Their mission is to advance knowledge, innovation and education, while seeking societal impact. They develop innovative solutions to anticipate future challenges and prepare students for leadership roles. The Schools and Colleges engage in dialogue with society, participate in public debate and contribute their expertise, while promoting interdisciplinary collaboration.

6.1. ENAC | School of Architecture, Civil and Environmental Engineering

MISSION

ENAC is the EPFL School dedicated to the natural and built environment. Bringing together architecture, civil engineering and environmental engineering in a unique way, ENAC aims to develop scientific understanding of the environmental and societal issues facing humanity, such as climate change, increasing urbanization and environment-related health problems. It strives to design innovative and sustainable solutions to anticipate and adapt to tomorrow's challenges and to equip future generations with the knowledge, skills and tools needed to steer future developments.

CHALLENGES AND OPPORTUNITIES

We are facing a global crisis that affects both the environment and human beings. The effects are visible: firstly, climate change, pollution and landscape changes have affected ecosystems and biodiversity at all levels (from glaciers to coral reefs, for example.). Secondly, unsustainable consumption patterns have led to a shortage of resources. Finally, increasing population density in urban areas, extreme weather events and declining biodiversity will have a range of impacts on human well-being, including increased temperature-related mortality, food shortages, increased transmission of zoonotic diseases or increased risk of flooding. The effects are unevenly distributed - vulnerable populations already are and will be disproportionately affected in the future. In Switzerland, as elsewhere, issues such as infrastructure maintenance and renovation and urban sprawl (with its impact on natural resources) need to be addressed holistically, taking into account the social and technological challenges

ENAC, which brings together architecture, civil engineering and environmental engineering, is well placed to tackle this problem holistically. Its position within a technology-focused institution is a valuable asset, as it continually recognizes technology as a mediator between humanity and the built and natural environment. It is precisely this consideration of the human and natural environments and their interfaces that prepares ENAC for its mission to meet the major challenges of today and tomorrow. During the 2025-2028 period, ENAC will build on its current internationally recognized position by focusing on three strategic areas: (1) climate change, (2) urban system transformation and (3) monitoring and mitigating the effects of the environment on human health. To capitalize on these strategic areas, ENAC will develop its skills in digitization, equity and design.

In the coming years, ENAC will focus on making better use of environmental sensing in both natural and built environments. More specifically, ENAC researchers will make increasing use of (1) remote sensing technologies, including satellites and drones, (2) wireless sensor networks and (3) geographic information systems (GIS). These various methods will produce data that will be analyzed using the machine learning and artificial intelligence methodologies mentioned below. Secondly, the creation of real test beds or living laboratories will build bridges between science and society. These test beds, which will be developed and operated by ENAC researchers (and open to researchers from all over EPFL), will include sensing platforms for water management, sustainable transport, construction materials and energy management, and will combine them with survey data, statistical data, etc. The test beds will also be used to test the impact of new technologies on the environment. This unique concept will enable essential interdisciplinary collaboration with professionals and will enable ENAC to meet society's expectations in terms of research, education, technological innovation and knowledge transfer.

RESEARCH

1. Anticipating, mitigating and adapting to climate change

Climate change, combined with the loss of biodiversity and changes in land use, is having a profound impact on Earth systems and societies at almost every level and at an ever-increasing rate. In recent years, in particular, the

increasing number of natural disasters, extreme events and the proliferation of diseases, all of which have the effect of reducing basic resources such as water, arable land and clean air, have raised global awareness, calling for urgent scientific support to better anticipate climate change, adapt to it and mitigate its effects.

ENAC brings to EPFL a combination of expertise to address the major challenges of climate change through technology- and process-driven research, links with relevant stakeholders and policymakers and interdisciplinarity. ENAC will pursue its «Climate Change» strategic priority implemented during the 2021-2024 period, through three main pillars:

- Strengthen ENAC's leadership in assessing the current environmental impacts of climate change and predicting future impacts. ENAC will build on initiatives such as ENAC's Alpine and Polar Environment Research Centre (ALPOLE), the Transnational Red Sea Research Centre (TRSC) and expertise in environmental sensing and data processing. ENAC aims to make significant scientific advances on the drivers of and responses to current environmental changes in environments such as the poles, mountains, cities, the Mediterranean and the Red Sea.

- Developing sustainable solutions to detect and adapt to the impacts of climate change. The effects of climate change affect both urban and natural systems. ENAC aims to develop integrated tools to develop solutions for managing emerging conflicts in water use, mitigating urban heat islands, combating air quality degradation and delineating the interdependencies between the environment and human health. Knowledge from all three disciplines will be brought together through a real-world test bed based on monitoring and detection, enabling stakeholder participation and policy development.

- Develop solutions to minimize the impact of climate change and mitigate its effects. ENAC will first build on its research into the energy transition by optimizing the mix of energy production technologies, building on the drivers of energy consumption and enhancing the flexibility of demand and supply. Secondly, it will continue its efforts to develop negative-emission technologies such as geological CO_2 sequestration, while minimizing the impact on the landscape and aquatic and terrestrial biodiversity.

These three pillars will be underpinned by key actions over the period 2025-2028, including better integration of technology into each of the research areas, its adoption by users and the evaluation of its usefulness. In addition to promoting Alpole and TRSC, we plan to strengthen these pillars over the coming period with new faculty hires. The emphasis will be on setting up test beds in real-life conditions in Swiss cities and mountainous regions. We plan to collaborate with other EPFL Schools as well as with academic partners of the Federal Institutes of Technology throughout Switzerland, while engaging with stakeholders from the public and private sectors.

2. Transformation of urban systems

The built environment, its transformation and the lifestyles it implies are the main sources of greenhouse gas emissions, energy consumption, waste production and extraction of raw materials on Earth. In regions with ageing infrastructures and rapid urbanization, mitigation strategies are as urgent as they are difficult to implement effectively. ENAC aims to :

- innovate for circularity and carbon neutrality. The focus will be on extending the range of sustainable circular constructions through design, reuse, adaptive reinforcement or the evaluation of alternative materials. Building on its existing expertise, ENAC is also ideally placed to propose new standards which modify the current processes that shape the built environment, while preserving existing resources and ensuring equity for all;

- strengthen the Smart Living Lab. Opportunities for new developments in intelligent detection, digital modelling and machine learning will be seized. The Smart Living Lab, EPFL's research center on the future of the built environment in Fribourg, responds precisely to this mission by also making it possible to use its own building as a living laboratory and by reaching out to other institutions and sectors to support behavioral change in the energy transition;

- develop a new human-centered paradigm for sustainable mobility. Emerging technologies and services, such as autonomous vehicles and on-demand transport, offer new prospects for reshaping urban mobility. Building on current developments in AI and machine learning, ENAC aims to develop a new human-centered paradigm for densely-populated urban areas and their suburbs, for both passengers and freight logistics. The long-term vision is that sustainable mobility requires understanding, adapting and possibly modifying real mobility needs. To develop these pillars, ENAC will undertake (1) to encourage collaboration on detection, energy efficiency and the use of space, (2) to contribute to the EPFL-wide Center for Worldwide Sustainable Construction project in order to create a leading entity for research and teaching in the field of sustainable construction, (3) to develop closer and more effective collaborations with implementation partners, including the private and public sectors and (4) to increase continuing education offerings (within the EPFL Extension School) in the fields of sustainable architecture, construction and civil engineering in order to accelerate the adoption of sustainable processes and technologies developed at ENAC.

3. Monitoring and mitigating environmental effects on health

Climate change, the loss of biodiversity and the encroachment of urban areas on rural and natural landscapes are having an impact on the environment, human well-being and health. These negative effects are illustrated by heat stress and declining air quality, the spatial expansion of vector-borne diseases and increased allergen loads. This strategic focus exploits EPFL's strength in the use and development of air and water pollution detection and in the simulation of urban and natural processes relevant to health, to address environmental impacts on well-being. ENAC's strategy is to anticipate rather than correct negative effects on health, to support preventive action and thus to promote human well-being. Emphasis will be placed on two pillars:

- Understanding and monitoring the effects of global change on human well-being. This pillar focuses on the impact of future living conditions on human health. What are the risks associated with temperature or the rate of spatial expansion of vector-borne diseases? How does the increased frequency of extreme events (for example, floods) affect disease transmission? Robotic and sensing technologies, stochastic and process-based models and advanced surveillance networks (including citizen science) will be essential to predict, identify and mitigate the above effects.
- Developing engineering solutions to improve urban environmental health. This pillar aims to develop new urban planning strategies using fact-based solutions linked to digital tools. Integrating detection results (see above) into urban planning makes it possible to identify scenarios likely to lead to health effects due to environmental degradation and to plan mitigation measures. Urban planning and building design should focus on climate-smart strategies, including the reduction of urban heat islands, the development of sustainable mobility (walking and cycling paths) and the introduction of energy-efficient building control systems and blue and green infrastructure. Digital tools and sensor networks will support strategies to mitigate environmental risks to urban health, particularly in conjunction with the real-life test bed.

Although ENAC researchers are conducting research in this area, this represents a new strategic pillar to be established. ENAC will exploit existing knowledge in disease ecology, spatial epidemiology, pathogen and pollution monitoring and sensor development. ENAC will promote existing collaborations with EAWAG on monitoring diseases in water and will establish new collaborations with EAWAG and WSL in the field of blue and green infrastructure to mitigate the effect of urban heat islands.

CROSS-FUNCTIONAL STRATEGIC AREAS

The transversal axes play a decisive role in the pursuit of the three strategic axes. They show the tools used and the underlying values pursued at ENAC.

1. Scanning

ENAC recognizes the importance of digitization in monitoring resource use, adaptation to climate change, urbanization and environmental impacts on health. It aims to bridge the gap between theory and practice by using and developing cutting-edge technologies for digital twinning, integrating AI and process-based models, and creating methodologies for reliable simulations and forecasts.

During the 2025-2028 period, ENAC will leverage its strengths ranging from the development of innovative digital technologies to information processing and process-based modelling to pursue innovation from acquisition to data fusion with machine learning and computer vision. ENAC will develop a methodological framework for a variety of innovative human-centered actions to increase sustainability, efficiency, safety and resilience. ENAC will continue and encourage fruitful collaborations with other EPFL Schools and within the ETH Domain and build on the collaboration in the Urban Twin and Bluecity projects. ENAC will also contribute to and support EPFL's AI Centre.

2. Equity

Global changes exacerbate inequalities by disproportionately affecting disadvantaged communities. For example, armed conflict, climate emergencies, pandemics and energy crises all contribute to increasing social inequalities and risk slowing or even reversing progress towards diversity, equity and inclusion (DEI). As ENAC researchers strive to find solutions to climate change, environmental impacts on health and the profound transformation of the urban system, equity must be seen as an essential and increasingly recognized element. Therefore, the advancement of DEI practices must become a guideline for all research, education and innovation practices.

Between 2025 and 2028, ENAC will build on the success of its Diversity Office and integrate equity issues into research and education. As a result, ENAC will address these issues in its research projects and solution proposals, re-evaluate its programs and practices to address prejudices and misrepresentations. It will enable critical reflection on the impact of design, technology and engineering on DEI and society at large, and create an environment at ENAC that encourages it.

3. Design

Global changes are confronting us with complex, multidimensional problems that require the development of new tools and approaches to deal with them effectively. In this context, rational design is emerging as a valuable resource for finding viable solutions to the necessary transformation. Throughout the process, the rules of resolution are both defined and subject to change, forcing us to work with a degree of uncertainty. Instead of looking for singular solutions, our aim is to identify options that reconcile different forces and constraints from different sources. The relative importance of these constraints depends on the hierarchy we establish between them. This approach, which has proved effective for centuries in solving complex and multifaceted problems, would benefit greatly from more in-depth debate among ENAC members.

For the 2025-2028 period, ENAC is committed to fostering exchanges between ENAC teachers and to promoting project-based initiatives aimed at developing transformative solutions for our cities and habitats. By integrating research-by-design methodologies (exploiting the experience and capabilities of architecture) and fundamental research, we will develop global strategies that will position ENAC as a leading institution for innovation in transformative actions. The research will have two main thrusts: (1) we will look at historical and contemporary design approaches that have proven effective in achieving high performance control of the

atmosphere through passive and low-tech methods; (2) we will draw on this knowledge to develop new design approaches. In particular, technological advances allow us to take advantage of the transcalar and transtemporal characteristics inherent in human interventions, whether in terms of design, physical space, materials, environmental impact or material flows. This cross-cutting theme aims to facilitate an ecologically-responsible transformation of our built and unbuilt environments, rooted in embodied principles of sustainability.

EDUCATION

ENAC is currently reviewing its disciplinary programs to ensure full commitment to future technical and societal needs. It will also strengthen collaboration between its three teaching sections. Responding to the challenges of climate change, limited resources and the socio-ecological transition requires the pooling of in-depth disciplinary knowledge. This is why ENAC aims to train engineers and architects who, on the one hand, excel in their disciplines and, on the other, are open and capable of collaborating with professionals from other fields to solve sustainability problems. This openness is essential and a sine qua non for innovation. The following changes will be implemented in ENAC's training programs for the 2025-2028 period:

- **New Master in Urban Engineering in Transition:** our environments are changing rapidly, and our ability to respond to this change with sustainable and resilient solutions must keep pace. An interdisciplinary approach to spatial development, both urban and rural, has become essential to meet an increasingly complex set of challenges. Given the increasingly urgent need to train qualified urban professionals, EPFL is well placed to offer a Master degree in sustainability and territorial transition. This new Master program, which is currently being drawn up, will be developed within ENAC in collaboration with CDM, CDH and STI. It will include three specializations: (1) Sustainable Transitions in Mobility and Transport, (2) Climate Adaptation in Urban Planning and (3) Circular Economy.

- **Reshaping the minors: ENAC** will focus the existing minors on the priority research areas of Climate Change, Environmental Health Impacts and Urban System Transformation. The crucial area of 'Sustainable Design and Engineering' will be taught in the form of three minors designed as privileged places for dialogue between research and teaching: (1) Minor in Urban Planning and Territorial Development (TDU), (2) Minor in Integrated Design, Architecture and Sustainability (IDEAS), (3) Minor in Engineering for Sustainability. The minors are rooted in the ENAC Sections but are open to all EPFL students and bring contributions from all three disciplines and beyond.

- **New course on sustainability:** ENAC, and more specifically its Environmental Sciences and Engineering Section, is in charge of the new course dedicated to sustainability that will be offered to all EPFL 1st year students. This course aims to introduce the different facets of sustainability, including the social and political aspects, and will involve teachers from EPFL as well as from the University of Lausanne (UNIL).

- **"Projecting Together' and SKIL:** ENAC will continue to shape, expand and strengthen its interdisciplinary 'Projecting Together' program and its SKIL (Student Creativity and Innovation Laboratory) program. The teaching aims to get students from ENAC's three Sections working together in courses taught by an interdisciplinary teaching team.

INNOVATION

Over the 2025-2028 period, ENAC will continue to innovate in the field of science and technology, to transfer knowledge to society (including awareness-raising activities), to work with the private and public sectors and to contribute to the sustainability of cities and regions, particularly through its FUSTIC association. The main objectives and measures are as follows:

1. Impactful, innovative research
ENAC will promote cutting-edge research into pressing environmental issues, giving priority to interdisciplinary projects and developing initiatives to promote innovation and emerging technologies while reducing the use of resources.

2. Technology and knowledge transfer
ENAC intends to promote different financing options for innovation and entrepreneurship projects, through its own seed grants for innovation and Innosuisse POC (Proof of Concept) grants, encouraging social and environmental utility.

3. Partnerships with industry and the public sector
ENAC will strengthen partnerships involving private and public sector partners through the first two actions. Interdisciplinary and transdisciplinary educational initiatives such as ENAC's 'Projecting Together' program or the SIE Design projects will foster student collaboration with the private and public sectors.

4. FUSTIC Association
ENAC's FUSTIC (Future Sustainable Territories, Infrastructure and Cities) association will strengthen the involvement of faculty members in applied research projects, joint conferences and workshops and public policy dialogues, particularly in shaping the sustainable future of cities and territories.

6.2. IC | School of Computer and Communication Sciences

MISSION

The IC School is a world-leading center for education, research and innovation in computing and communications. We teach the fundamentals of an exciting and disruptive field and conduct research that pushes the boundaries of knowledge. We develop commercial applications for our technology and encourage entrepreneurship among our faculty and student community. We also engage with Swiss society by participating in public debates on technical issues and consulting with the public sector.

CHALLENGES AND OPPORTUNITIES

One of the biggest challenges we are currently facing is the continuing increase in the student/teacher ratio within IC. Over the last decade, the number of students has increased significantly (from 9677 in 2015 to 14012 in 2024). To meet the urgent needs of Swiss society, we have considerably expanded our range of courses and are now involved in six Master programs, compared with two in 2015. However, our budget has remained relatively unchanged over the past 10 years, which has put a strain on our teaching staff, especially our assistant professors.

In response to these pressures, we have taken steps to hire more teaching assistants and plan to recruit additional teaching staff (non-teaching positions). This approach is designed to support the increased workload resulting from the rise in student numbers.

In addition, we are facing increasing international competition. IT departments around the world have undergone significant expansion and development, making it difficult to maintain our competitive position both nationally and internationally in these circumstances.

In the face of these challenges, it will be crucial for us to develop strategies and implement measures that ensure the quality of education and research while managing growing demand. Exploring innovative solutions, seeking new funding opportunities and promoting collaborations can play a crucial role in overcoming these challenges and maintaining IC's reputation in the field of computing.

EDUCATION

We have recently implemented major structural reforms in our two Bachelor of Science (BS) programs. The reform involves reducing the number of courses while deepening them, while fostering collaboration between faculty members in course management. The new program began in Autumn 2023 and will be phased in over a two-year period. The aim of this reform is to reduce the need for students to move from one context to another, eliminate unwanted course overlap, clarify prerequisite chains and facilitate program management.

We have also expanded our educational offering, notably by venturing into new and exciting subjects. Our Master of Science (MS) programs in Data Science and Cybersecurity, in partnership with ETH Zurich, have been a great success and meet the crucial requirements of Swiss industry. The new Master programs in Neuroscience and Quantum Science and Engineering represent a forward-looking approach. In particular, these programs differ from our usual practice in that they are run jointly with two other EPFL Schools. We firmly believe that these new Master programs will benefit greatly from the diversity of our student populations, while giving our students the opportunity to explore emerging fields.

Over the 2025-2028 period, we will focus on improving our educational offerings. Although we will not be introducing new Master programs, we will endeavor to optimize our existing programs and fill any identified gaps.

More specifically, we plan to improve the preparation of our Bachelor-level student community for the new Master programs in quantum science and engineering and Neuro-X by introducing core courses accessible to all students on campus.

In addition, we aim to encourage entrepreneurship among our Bachelor students by introducing additional courses and modules focusing on value creation and start-ups. This initiative will be carried out in collaboration with the VPI and the CDM, and we will be looking for external candidates to support and implement these actions.

Another key mission of the IC School in the coming years will be to promote AI innovations across the campus. We have already broken new ground in machine learning/AI, with courses involving the whole campus through research projects involving over 100 laboratories and over 500 students each year. Similar initiatives are underway, such as exploring the implications of ChatGPT on EPFL's educational offering. We expect AI to strongly influence all educational offerings and research directions at EPFL, and the IC School will ensure a smooth transition and capitalize on scientific innovations in AI.

In order to equip our students with the tools to meet the challenges of new technologies, we plan to integrate ethics, law and public policy more centrally into our course programs. This may take the form of separate courses or closer integration with existing courses, which is currently being discussed internally.

Finally, we recognize our role in continuing education, particularly through Centers such as C4DT. However, there is room for improvement in the field of AI/machine learning, and we want to strengthen our contribution in this area.

SEARCH

An important objective for the IC School is to initiate larger and more ambitious research projects, moving beyond the current focus on small-scale projects funded and staffed by individual laboratories. While this approach has yielded positive results and is in line with School preferences, participation in larger, interdisciplinary projects addresses larger and more complex problems, attracts more funding and increases the visibility and impact of our School. The National Centre of Competence in Research on Mobile Information and Communication Systems (NCCR MICS) and Nano-Tera have already provided good examples of projects of this scale. Scala, another major research project that originated in a single laboratory, has given rise to its own open-source research community and the Scala Center. Encouraging faculty members to think big and pursue bold research aspirations is crucial to our future growth.

Several areas within IC lend themselves well to ambitious research programs at EPFL or Swiss level. We have recently recruited lecturers specializing in security, privacy, programming languages and formal methods. Combining our strengths in verifiable software, security and privacy with healthcare applications could create a powerful research program in medical technology. Another promising area is the priority given to protecting Switzerland's critical infrastructure from cyber-attacks.

The rapid evolution of AI capabilities, particularly large language models (LLMs), presents both significant opportunities and profound questions. As a disruptive technology, those who act decisively and recognize the opportunities will have a competitive advantage. AI and LLMs have the potential to influence all areas of science and industry. IC aims to enhance our AI capabilities and ambitions through collaboration across campus and nationally. These actions must be funded primarily by Swiss companies, the important objective being to ensure Switzerland's competitiveness in AI and to retain control of our digital destiny as a country.

Biomedicine is another specific area of application where IC has already made significant progress in collaboration with the School of Life Sciences (SV). This will remain a priority for the next planning cycle. Closer collaboration with the Centre hospitalier universitaire vaudois (CHUV) and Unisanté in Lausanne can enrich biomedical research projects by exploiting data from these institutions.

The emergence of AI not only offers opportunities but also poses risks.

Some risks are obvious, such as AI-based systems taking on more and more tasks and making autonomous decisions. Ideally, these systems should be deployed deliberately, allowing sufficient time to study and understand their implications, and allowing legal and societal frameworks to keep pace. However, this ideal scenario is unlikely to materialize.

Some of the risks are directly linked to the fact that EPFL is a university. It is likely that the role of academia will have to change significantly over the next planning period. This starts with what we should be teaching students in the future to stay relevant, but also how research will be conducted in the future.

Taking different computing paradigms into account, from traditional platforms such as CMOS to quantum computers and chemical or biological processes, will also be essential for our future growth and will therefore be high on our list.

Finally, maintaining leadership in the field of learning sciences is essential for EPFL and should remain a priority in the next planning cycle.

INNOVATION AND SOCIAL IMPACT

Over the past seven years, IC has seen a significant increase in its societal impact, largely due to advances in machine learning and natural language processing (NLP) in the field of computer science. These developments have increased our visibility and relevance to society's needs. We are actively engaged with Swiss society on a number of fronts. Firstly, we share our expertise and ideas in the media, enabling the public to gain a better understanding of IT-related topics. Secondly, we contribute to the education of the public sector and the general public. Thirdly, our awareness-raising activities are targeted at a variety of groups. Fourthly, members of our teaching staff take on leadership roles in prestigious organizations such as the Red Cross and the Swiss Science Council. In addition, our alumni hold leading positions in major Swiss companies, demonstrating the impact of our education and research. In addition, we have developed new master's programs tailored to pressing societal needs, and we encourage entrepreneurial initiatives to promote value creation and start-ups.

We are committed to further enhancing our visibility and societal impact, with a particular focus on machine learning/AI and cybersecurity, which are the subject of intense public debate. To complement our educational offering in these areas, we will integrate discussions on ethics, law and public policy into our classes.

Sustainability is a crucial issue, and we have been researching the efficient use of IT resources through initiatives such as EcoCloud. Given its growing importance, we will continue to invest in this area, knowing that fundamental scientific discoveries can often lead to unexpected breakthroughs in solving sustainability problems. For example, our research into graphics rendering, commonly used in games and films, has proved useful for climate modelling, underlining the benefits of diverse research activities.

To broaden our technology transfer capabilities, we plan to encourage more students to engage in innovation and entrepreneurship. We see considerable untapped potential in this area and we will be leveraging our strong alumni network to support these efforts.

Recruiting people with 'real world' experience through the newly created 'Professor of practice' titles will be a valuable strategy to further strengthen our societal impact. Their knowledge and expertise can bridge the gap between academia and industry, creating a positive influence on our research and education initiatives.

Last but not least, RTS's move to the EPFL campus will be an excellent opportunity to further strengthen our relationship with this public service medium. Our teachers are in great demand as experts in explaining rapid technological developments to the general public. This will make it even easier to meet this demand.

In summary, IC aims to seize opportunities to maximize its societal impact, focusing on critical areas such as machine learning/AI, cybersecurity, sustainability, technology transfer and leveraging external expertise through 'Professor of practice positions. By pursuing these avenues, we aim to make a lasting contribution to Swiss society and beyond.

6.3. SB | School of Basic Sciences

MISSION

The School of Basic Sciences cultivates intellectual excellence and provides a state-of-the-art infrastructure, creating an exceptional environment for learning and discovery in mathematics, physics, chemistry and chemical engineering. Our mission is to equip students with a solid foundation in these fundamental sciences, preparing them for leadership roles in academia and industry. Through pioneering research and the development of innovative tools, we foster technological advances and encourage knowledge transfer on a global scale. Our collaborative, interdisciplinary approach ensures that cutting-edge solutions are created and implemented.

RESEARCH

The basic sciences are essential for a technological institute and are characterized by curiosity-driven research fueled by imagination and creativity. Work in the basic sciences aims not only to deepen our understanding of the universe, but also to find answers to the challenges facing society.

Research in the basic sciences often demonstrates its long-term value, with unforeseen implications. Maryna Viazovska, winner of the 2022 Fields Medal, is a case in point: her solution to a four-century-old mathematical problem has been used to create error correction algorithms and advanced communication codes.

So, at SB, we focus not just on topical issues or trends, but also on areas of curiosity and the pursuit of long-term research efforts that attract the most innovative and creative researchers. We foster a stimulating intellectual environment with a strong spirit of collaboration and interdisciplinarity. SB is an ambitious School and we are continually striving to strengthen our strategic areas (see examples below) and forge new ones.

The departure of a number of teaching staff will provide an opportunity to refocus our scientific efforts. The move towards quantum physics and sustainable catalysis has already solidified our future, and other strategic adjustments will follow.

Often, the most exciting opportunities in the basic sciences arise at the intersection of traditional fields or by combining traditionally disjointed methods within the same field. As a result, we are increasingly focusing on recruiting lecturers who embrace a collaborative and dynamic approach, including cross-faculty lecturers, for example with the STI and IC Schools. In the future, SB will play an increasingly important role in meeting the most pressing societal challenges.

SB School members are very active in several EPFL-wide interdisciplinary research clusters, including the Centre for Quantum Science and Engineering (QSE) and the Bernoulli Centre for Fundamental Studies. They participate in a number of NCCRs, including Marvel, SwissMap, QSIT, MUST, SPIN and Catalysis.

1. Mathematics (MATH)

Mathematics is guided by its internal dynamics and the progress made in the fields in which it is applied. The previous trend towards fragmentation in the field is being replaced by a trend towards convergence. In this respect, the recently inaugurated Bernoulli Centre for Fundamental Studies offers a unique opportunity to increase interaction between fields and to attract international scientists who enrich the graduate program.

In the field of education, we must ensure that our teaching program is coherent, rich and advanced. The creation of stimulating new courses will increase the international visibility and attractiveness of our master's programs. The increased visibility of pure mathematics at EPFL and the momentum in our strongest areas such as number theory, analysis, probability and computational mathematics provide important opportunities to attract talented and motivated students, particularly at the Master level. With the increase in numbers and diversity of first-year students, additional efforts will be needed to bring them up to the level expected to succeed at EPFL. At the Master level, we will continue to encourage one-to-one interaction with teaching staff and integrate students into laboratories to

gain research experience. Continuing education and consulting services to Swiss industry, which are becoming increasingly important, will also be strengthened.

In terms of research, it is essential to maintain and strengthen excellence in the fundamental areas of algebra, geometry, analysis and probability, with a greater emphasis on computational mathematics, data science and statistics, which opens up new opportunities for innovation. In addition, we intend to expand our expertise in cryptography and dynamical systems and will encourage further interactions between different areas of mathematics and other EPFL Schools. These measures will enable MATH to better contribute to major scientific initiatives such as quantum computing, artificial intelligence and imaging, and to connect to EPFL's strategic areas such as health, drug discovery, plasma physics, renewable energy, sustainability and materials science and engineering.

The Bernoulli Centre for Fundamental Studies helps bring inspiring scientists to EPFL to solve key problems and raise the global profile of theoretical science at EPFL. Regular visiting programs will help to attract the world's best talent in the future.

2. Physics (IPHYS)

IPHYS builds on the core disciplines of physics - quantum physics, biological and statistical physics, particle physics, nuclear physics and astrophysics - and is strengthening its synergistic interdisciplinary activities with other EPFL Schools.

The objective of strengthening quantum science has been successfully achieved, with IPHYS being a pillar of EPFL's QSE Centre. Strong synergies have been created between several experimental groups working on hybrid quantum devices. These efforts are now supported by a strong theoretical group, strengthened by the theory of open quantum systems and cold atom clocks.

In the next phase, research into quantum materials and functionalized devices will move into the field of equilibrium overshooting, exploiting EPFL's LACUS Centre and PSI's free electron laser. Priority will be given to metamaterials and advances in digital materials and AI. These theoretical advances will be accompanied by physical implementation in semi-automated fab-labs, to demonstrate new functionalities and develop devices exploiting topology, entanglement and non-equilibrium states.

Biophysics has recently been extended to cover the interaction between theory and experiment. With state-of-the-art cryo-electron microscopy imaging (Dubochet Center for imaging) and a realignment of magnetic resonance imaging, IPHYS contributes to both the interface between fundamental physics and applied engineering. In the same way that information theory has been used to advance our understanding of quantum phenomena, statistical physics will increasingly be used to study the functioning of living matter (from sub-cellular structures to complex organisms) from the perspective of how information is gathered, processed and leads to phenotypic responses.

In Switzerland, fusion research is based at EPFL's Swiss Plasma Center (SPC) and fission research is coordinated by a joint professorship with PSI. It is essential that we provide Switzerland with ongoing expertise in the latest developments in nuclear energy and reactor physics, and that we be able to conduct interdisciplinary research into the cogeneration of electricity and heat.

In terms of sustainability, determining the mix of nuclear, hydro and wind/photovoltaic power for Switzerland will be essential in the transition to carbon neutrality. In particular, the SPC which hosts the Swiss Fusion Hub is playing an increasingly important role in European and international fusion efforts, drawing on expertise beyond fusion applications, including plasma processing for materials, life sciences and applied superconductivity.

3. Chemistry and Chemical Engineering (ISIC)

ISIC will integrate advances in research into its programs, with an increasing focus on sustainability, nanoscience, therapeutics and computational and digital chemistry. Among the strategic areas on which future efforts will be concentrated are the conversion and storage of renewable energies, sustainable chemical production and the discovery of new treatments. Chemistry and chemical engineering address two fundamental emerging areas that are likely to see major developments over the next few years, namely precision engineering at the atomic level and digitization. The ability to

observe, predict and control structures at the molecular level has accelerated thanks to advances in computing, characterization, nanoscale science and synthetic biology. These methods will play an increasing role in a wide variety of applications, such as catalysis, detection, biotechnology, storage or separation, all of which contribute to the health of the planet through the development of renewable energies and sustainable products, as well as improving human health. Ongoing advances in computing, AI and machine learning are rapidly transforming chemical sciences and process development. This is why we will strengthen computational design and AI in materials discovery, reaction development and process synthesis over the next few years.

Two major initiatives led by ISIC will play a key role in the future of chemistry and chemical engineering and need to be consolidated and strengthened. The NCCR Catalysis aims to revolutionize the optimal production chain for chemicals by developing carbon-neutral value-added processes based on catalysis and digitalization. The Swiss Cat+ project will foster the transition from chemical synthesis and production to a fully autonomous and data-driven chemistry laboratory, with a major impact on the development of new active catalysts for energy conversion and storage, the reduction of the environmental footprint of industrial synthesis or the identification of new bioactive substances.

EDUCATION

SB ensures that it covers all the key areas of mathematics, physics and chemistry, including emerging topics. This also applies to EPFL students, many of whom are taught by SB faculty members, as well as to students from the University of Lausanne for basic science courses. Despite the challenges imposed by the high teaching requirements of the SB faculty members, MATH has launched a new Master degree in Statistical Sciences in 2022 and is actively involved in the new Master degree in Quantum Science and Engineering.

By 2025-28, all areas of the ETH Strategic Plan will be integrated into the School programs. We will strengthen our collaboration with the University of Geneva to enrich our astrophysics training. As a polytechnic, we will update certain experimental platforms that are necessary for teaching purposes. In addition, we will continue to encourage cross-disciplinary skills and creativity through project-based learning and active participation in discovery learning laboratories on campus.

SB is one of the few schools in the world that combines chemistry and chemical engineering within the same Institute, which is undoubtedly an asset and makes our graduates highly employable. We will be exploring ways of increasing interdisciplinarity in the Maths and Physics programs, such as adding minors to enhance employability. In addition, we will adapt doctoral programs in line with the recommendations of an ongoing audit.

INNOVATION

Despite being a basic science school, SB produces many patents and is creating a growing number of start-ups. SB start-ups receive less initial funding due to their lower technological maturity, but they are often very successful in the long term, with one reaching unicorn status. We therefore intend to facilitate pre-start-up concepts by providing more support for entrepreneurship. Analysis of SB 's patent portfolio shows that it is possible to create more companies and take more risks, hence our efforts to encourage students and postdocs to become entrepreneurs.

Strengthening links with established industries is another key objective that will facilitate innovation. We currently have many collaborations with a diverse set of industrial partners, which represent a significant source of funding. However, we hope to increase the number of strategic industrial partnerships at Institute level or above (by expanding the Gaznat and Lonza endowed chairs) and explore other possible models of collaboration with industrial partners.

INFRASTRUCTURE

SB's Institutes operate a number of research facilities for the benefit of the entire EPFL community. The main examples are the crystal growth and materials characterization platforms at IPHYS and the nuclear magnetic resonance, X-ray diffraction and surface analysis facilities at ISIC. MATH runs a statistical consulting service. These shared facilities are much appreciated, and we are exploring models for introducing new ones or supporting multi-use instrumentation, thereby optimizing the use of our resources. Several SB faculty members are affiliated to the Paul Scherrer Institute, offering access to unique facilities. This strategic partnership will be strengthened and better coordinated, particularly in the field of functional materials.

Our proximity to CERN also offers unique opportunities in particle physics, which we intend to strengthen with new opportunities in quantum, fundamental and particle physics. IPHYS plays a key role in the ETH Domain's inter-institutional nuclear engineering program. A key initiative is to modernize our experimental facility used to train nuclear engineers and to integrate it with sustainability projects such as synthetic fuel demonstrators and the generation of radioisotopes for medical imaging - the latter potentially in collaboration with the CHUV. This will make the fast-growing master's degree in nuclear engineering even more attractive and relevant. IPHYS is leading Switzerland in the international Square Kilometer Array Observatory project, which will reveal the role of cosmic magnetism in the evolution of the Universe. Over the coming period, we also intend to strengthen our collaboration with the University of Geneva in astrophysics and to set up an outreach center at the Sauverny Observatory in order to improve the diversity of our cohort of undergraduate students.

At the same time, the new Advanced Science Building will enable SB to deploy scientific excellence in experimental physics and physical chemistry, while offering the opportunity to renovate our existing buildings. State-of-the-art laboratories and infrastructure are essential if SB is to continue to thrive.

6.4.
STI | School of Engineering

MISSION

The engineering discipline is undergoing transformations in research and teaching. These changes will create new types of jobs for our students and industry, require adjustments to our education and research strategies, and have a major impact on the well-being of our society. In line with these developments, STI 's mission is:

1. training students who are well prepared for careers in industry, research or the public sector
2. innovating in engineering education, strengthening the foundations and promoting teamwork
3. advancing research discoveries in the engineering sciences
4. promoting innovation, technology transfer and transposition
5. contributing to the development of effective engineering solutions to societal challenges.

The number of teaching staff has remained relatively stable since 2017, while the number of students at Bachelor and Master level in engineering has risen steadily, and even more so in the popular microengineering and mechanical engineering Sections, with an overall increase of 31% since 2017. STI has responded to the challenges of increasing enrolments by recruiting teaching staff in mechanical engineering, funded from its budget and reserves, but these hires are not keeping pace with student growth. The School is therefore encouraging recruitment using its own funds and has adopted a policy of cross-sectional teaching. In 2021, it merged the Electrical Engineering and Microengineering Institutes, strengthening mechanical engineering. However, efforts are still needed to adapt the educational offer, reduce redundancies and improve the coordination of doctoral programs.

CURRENT TRENDS IN THE ENGINEERING DISCIPLINE

Four major trends are defining the field of engineering today and guiding our strategy.

Firstly, multidisciplinary and complexity have become the norm, requiring research in a variety of disciplines to solve problems such as health, climate or digitization.

Secondly, systems integration has reached new levels, opening up fields of exploration such as neurotechnology, space or quantum technology thanks to miniaturization and electronic, biological and material integration.

Thirdly, the fusion of the physical and digital worlds with embedded intelligence is revolutionizing sectors such as manufacturing and health, creating autonomous systems and requiring new approaches to teaching.

Finally, society is demanding solutions that are sustainable, energy-efficient, privacy-friendly and fair, particularly in the context of the growing use of data-driven technologies.

A THREE-PRONGED STRATEGY

To respond to these trends, STI has adopted a three-pronged strategy:

1. we encourage social commitment and initiatives that favour innovation, entrepreneurship and translational science
2. we focus on a solid foundation in education to ensure that students continue to learn in a rapidly changing environment with steady advances technology and science
1. we focus on excellence in strategic areas of research. Given our size, we cannot spread our efforts too thinly but strive to make an impact in areas of great societal value.

1. Raising awareness in society and industry

STI is committed to strengthening its engagement with industry and society in general.

A key partner of Swiss industry, STI contributes to entrepreneurship and translational activities at EPFL, with almost 40% of its budget coming from external sources. It is responsible for half of EPFL's start-ups and

patents. The School organizes an Industry Day, attracts 2,000 applicants each year to its engineering excellence program (E3) and plays an active role in awareness-raising events such as EPFL Open Days and high school activities.

In addition, in collaboration with the College of Management of Technology (CDM), STI has introduced a course innovation and entrepreneurship in engineering.

The School is also in the process launching a series of seminars on engineering and society, organizing Engineering Research Days and actively participating in initiatives to promote open science and open research data.

2. Enriching the educational experience of engineering students

STI is strengthening the teaching of the fundamentals and offering project-based learning. It is working to reduce course overlap and increase its students' exposure to the strategically important field.

Engineering students need to be more aware of the impact of their technologies on society and the wider environment. With this in mind, all undergraduate engineering programs are introducing courses on sustainability, as well as on machine learning/AI in engineering design.

The experience of the pandemic has demonstrated the need to develop effective educational technologies to deliver teaching using digital and virtual tools. The main challenges and benefits are (1) enable more natural student-teacher and student-student interactions, (2) develop models and animations to visualize complex phenomena, (3) develop experimental modules that can be run remotely, (4) help solve the difficulties arising from large classes and (5) provide more personalized teaching. STI aims to promote digital education by integrating tools based on AI and virtual reality for virtual and online engineering teaching, as well as for remote laboratory experimentation.

3. Strategic engineering research themes

In terms of research, STI has formulated five major strategic research themes that involve all its Institutes across the board and also create numerous opportunities for interaction with related Schools on campus and with satellite campuses.

More specifically, our research activities provide effective engineering solutions in the following areas:

- Health and life sciences
- Intelligent systems and AI
- Sustainability and energy sciences
- Digital transformation

FUNDAMENTAL RESEARCH

In recent years, the School has strengthened its faculty to support these themes by recruiting topics in smart robotics, sustainable materials, advanced manufacturing, cancer engineering, neural devices, computational modelling, materials discovery and characterization, learning and data science. The School also supported the launch of the new Institute of Neurotechnology (Neuro-X), and the launch of new Centers on imaging, intelligent systems, quantum science and engineering and advanced manufacturing. The School is also working with the IC School to launch a new EPFL AI Centre to bring together all AI-related activities in research, education, innovation and outreach.

The School will need to strengthen complementary areas of research to remain at the cutting edge and meet the needs of Swiss industry and society. Ten areas for growth have been identified, some of which require adequate laboratory space. Planning will also have to take account of inflation in the price of consumables and competition from EU subsidies.

1. Living materials

These materials would self-repair, grow under stress and eventually reproduce when needed. Endowing human-made materials with life-like properties would have a transformative impact on a wide variety of applications ranging from neural implants and tissue engineering to exoskeletons and flexible robotics. The physics of living materials (a form of non-equilibrium thermodynamics) is an exciting new area of physics and would be a potential point of contact with SB.

2. Circular materials and processes

We need to reduce the environmental impact of

materials and increase their reuse and recycling. Progress in this area would help to identify sources of new materials and to recycle large quantities of materials such as plastic, concrete, metals, ceramics and even food waste. There is interaction with ENAC and CDM.

3. Biosystems technologies
Many technologies have been developed for medical applications, such as biosensors, biomaterials, immunotherapies, neuroprostheses, machine learning for diagnosis and organoid technologies. Although these technologies are individually promising, they are often incompatible and their degree of integration is limited. This field faces a systems integration problem similar to that faced by the semiconductor industry fifty years ago. There are synergies with SV and IC.

4. Energy and carbon neutrality
Adopting an integrated approach carbon-neutral technologies by strengthening our presence in the key areas of hydroelectricity, photovoltaics, energy storage technologies, synthetic fuels and biofuels. One of the components of this approach will be the promotion of living labs, which are testing grounds for implementing sustainability-focused initiatives in the areas of education, research, and energy transition. There are synergies with SB and ENAC.

5. Quantitative climate modelling
Climate change is a major challenge facing humanity. Due to the chaotic nature of the Earth system and the fact that climate models are non-linear, multi-scale systems, there is a lack of reliable forecasting methodologies to guide mitigation strategies. However, the convergence of tools from modern non-equilibrium physics and dynamical systems theory, together with advances in data-based modelling, can be exploited to advance understanding of climate modelling. Partnership opportunities exist with ENAC, IC and SB.

6. Space engineering
There is currently a paradigm shift in space technology, with more emphasis on smaller, lighter satellites. We need to train the next generation of space engineers in subjects related to space logistics, systems engineering, ecological propulsion systems, solar sails, sustainability aspects and extreme environmental compatibility. There are synergies with SB.

7. Quantum technologies
Quantum systems are emerging as essential building blocks for the revolutionary technologies for the future in healthcare, finance, encryption and sustainability. We need to develop integrated quantum systems with millions of low power quantum devices that are as reliable as current CMOS technology. Such an achievement will have an even greater impact than the low-power electronics of the 1980s and will help to advance the status of EPFL and Switzerland in the field of quantum technologies. There are partnerships with SB and IC in this field.

8. Ubiquitous integrated systems
We need to promote a holistic approach to new classes of hardware based on the integration of electronics, optics, neuromorphic and quantum technologies as well as AI/machine learning capabilities. Switzerland has always been one of the main players in integrated circuit design. Today, it is in danger of losing this position, given the investments made by the United States and the EU as part of their legislation on chips.

9. Data science and engineering
Data is often obtained by sensing in applications such as precision manufacturing, robotics, electronics, biotechnology and pharmaceuticals. However, for most AI systems, the data is generally noisy, incomplete and imperfect. There is a significant opportunity here to pursue scientific research focused on data discovery and engineering. The combination of AI and science can enable scientific discoveries and unprecedented advances in engineering design. There are convergences with IC in this area.

10. Neurotechnologies
The increase in neurological disorders and the ageing of the population require clinically relevant technological innovations to help find new treatments for neurodegenerative diseases, memory loss and trauma. There are complementarities with SV and IC.

6.5. SV | School of Life Sciences

MISSION

The School of Life Sciences aims to understand the fundamental mechanisms of life and to use this knowledge for the benefit of health, medicine and society in an ethical manner. At SV, research, education and innovation take place at the intersection of biology and medicine with physics, chemistry, engineering, computer science and environmental sciences. As such, SV aims to become the hub of life and health sciences at EPFL. Quantitative, computational and engineering approaches to generating, understanding and exploiting diverse biological data are at the heart of the School.

CHALLENGES AND OPPORTUNITIES

Over the 2025-2028 period, environmental and societal changes will lead us to face three major challenges on which SV can have an impact:

1. The accumulation of pollutants and climate change are leading to new diseases. These may be directly linked to mutagenic and inflammatory chemical substances of human origin present in the environment, or to the spread of endemic diseases, such as dengue, due to the effect of temperature, or to the emergence of new viruses, such as SARS-CoV-2, due to the destruction of natural ecosystems.

2. The ageing of the population in most developed countries is increasing the incidence and costs of age-related diseases, particularly cancer and neurodegeneration. The links between exposure to chemicals or pathogens and these diseases are becoming increasingly obvious, as is the link with a deregulated metabolism.

3. Using energy and chemical raw materials from fossil fuels is a major risk to sustainability, but renewable alternatives are still underdeveloped. Synthetic biology approaches can play an important role.

To meet these challenges, we believe that SV can exploit four key areas:

1. The explosive growth in computing capacity, the «AI revolution», applied to biological studies, linking the molecular level to the population level. Here are a few examples of questions that could lead to this approach: how can proteins be designed to perform arbitrary chemical and mechanical tasks? How do cells process information? How does the brain work? How can community medical records be used to discover new therapeutic approaches?

2. The increasing costs of experimental animal models and society's concerns in this respect, due to the continuing development of stem cell and organoid model system technology.

3. The interface between biological and instrumental systems, including the integration of therapeutic neural implants and the development of intelligent imaging systems.

4. The interaction of nutrition, metabolism and inflammation with cancer and neurodegeneration at the molecular and systemic levels.

These challenges and areas of operation form the common thread running through the strategic orientations described below.

EDUCATION

Graduates of SV 's Bachelor and Master programs in Life Sciences Engineering and Neuro-X are certified engineers with unique quantitative and conceptual skills. This sets them apart on the job market and enables them to make a significant contribution to innovation and research in both the public and private sectors. Over the next strategic period, we will continue to integrate computational thinking into the core curriculum, as well as rolling out a Master option in Physics of Biology in collaboration with the Institute of Physics (SB). We will develop an interdisciplinary project course in cancer bioengineering, in collaboration with the CHUV and other members of the SCCL (Swiss Cancer Center Léman), enabling Master students from across EPFL to work on real problems of cancer prevention, detection and treatment.

STRATEGIC GUIDELINES

Plans for the development of our five Institutes and four cross-functional initiatives are currently being prepared, outlining SV over the 2025-28 strategic period.

These overlap with the activities of several Institutes but are not limited to the biological theme of any one of them, which serves to underline the role of SV as a hub for biological and health sciences at EPFL.

INSTITUTES

1. Brain Mind Institute (BMI)

Neuroscience discovery research at the BMI aims to understand brain systems at every scale, from theory to molecules, cells, circuits and behavior.

This work is aimed at acquiring fundamental knowledge, the foundations of new therapies for human brain disorders, as well as developing intelligent machines and understanding the processes of our own minds. BMI researchers develop and deploy technologies ranging from mathematics and simulation to micro-imaging and gene therapy using model systems such as organoids, fruit flies, mice and humans. Knowledge they have generated is being harnessed for revolutionary applications, from artificial intelligence to new biomedicines. The key themes for 2025-2028 are dynamic imaging approaches to study circuit-level behavior in health and disease and a biophysical approach to a theory of the brain.

2. NEURO-X INSTITUTE (INX)

Technological innovation promises solutions for diagnosing, treating and even preventing neurological disorders.

The creation of INX in 2022, as a partnership between SV, STI and IC, sets out an ambitious roadmap for research and innovation, both to fill the major knowledge gaps in neuroscience and to develop corresponding cutting-edge technologies for the clinical application of effective and feasible therapeutic approaches to the assessment and treatment of neurological disorders in patients. To carry out this program, close links have been established with the hospitals in Sion (CCR), Lausanne (CHUV) and Geneva (HUG).

For INX to reach a critical mass over the 2025-2028 period, the aim is to focus on lesions of the human central nervous system or cognitive decline and establish collaborations with the CHUV and the HUG, which should enable better integration and faster impact of new translational efforts.

3. Swiss Institute for Experimental Cancer Research (ISREC)

Deciphering the origin, evolution and resistance of tumors to treatment is a priority for ISREC who will take an interdisciplinary approach, recruiting and interacting with scientists from engineering, informatics and clinical fields. To this end, ISREC has launched EPFL's Cancer Science and Engineering Initiative (EICSE). ISREC is also a founding member of

AGORA and the Swiss Cancer Centre Léman (SCCL), with ongoing collaborations with the CHUV and the HUG. Expertise in cancer organoids and computational oncology has grown and the recent appointment of the Paternot Chair, in collaboration with the Dubochet Center for imaging (DCI), represents a major investment in the structural biology of cancer treatments. Next steps for 2025-2028 include strengthening computational approaches in collaboration with the Biomedical Data Science Centre (BDSC) and expertise in cancer bioengineering, cancer metabolism and cancer cell plasticity.

4. Institute of Bioengineering (IBI)
IBI's vision is to explore and exploit the vast interface between engineering and biology. Fundamental discoveries in biology mutually fertilize new engineering concepts and possibilities. IBI members harness the technical expertise of their Schools. IBI was EPFL's first interschool Institute, and its teaching staff are mainly affiliated with SV or STI. Expertise in biological data science has recently been expanded in collaboration with IC. For 2025-2028 the priority themes are quantitative approaches to metabolism, green synthetic biology (in collaboration with the Institute of Chemical Science and Engineering (SB and Lonza), bio-imaging and bio-instrumentation and the strengthening of AI for biomedicine.

5. Institute for Infectious Diseases (GHI)
Research at the GHI focuses on the fundamental processes of health and disease, with an emphasis on infectious diseases and immunity. This involves the pathogen as well as the host's defenses. Although the rate of infectious diseases in developed countries has fallen, progress is now threatened by several factors: the emergence and spread of new pathogens, the increase in the number of immunocompromised people due to ageing, metabolic diseases and cancer treatments and the foreseeable pandemic of antimicrobial resistance. Consequently, the priority areas for GHI research and applications in 2025-2028 will be: 1) immune defense mechanisms and therapeutic agents, (2) antimicrobial resistance, (3) genetic and genomic approaches to distinguish health from disease and (4) physiology and health. Knowledge in these areas will be essential for prevention strategies, developing new treatments and preparing for pandemics.

INITIATIVES AT SV AND EPFL LEVEL

1. AI for medicine
Artificial intelligence, in particular machine learning, and 'big data' biomedical technology such as single-cell sequencing have made enormous strides in recent decades.

AI for Medicine aims to integrate these fields to make fundamental discoveries in biology that will have an impact on human health and to stimulate innovation in computer science in response to the new types of problems posed by biology.

In the field of biomedical technology, recent high-throughput approaches have revealed the biological composition of cells and their pathological states for individual patients. Combined with advances in more traditional medical imaging on a larger spatial scale, such as angiography or fMRI, this promises an extraordinary level of description health status and disease. However, analyzing this voluminous and complex data and integrating different modalities into existing medical records is a challenge for existing methods. In the field of machine learning, extraordinary progress is being made in data categorization and inference. There are numerous possibilities for applying existing approaches to the biomedical field. In addition, the structure of biological data represents an interesting opportunity for the field.

However, integration between fields with the aim of improving human health remains poorly coordinated. The integration of teaching, research, innovation

and continuing training in this area is only taking place in academic institutions.

EPFL enjoys an international reputation in biomedical technologies via SV and machine learning via IC. It has close links with a network of healthcare institutions in the Lake Geneva region, such as the CHUV and the Ludwig Institute, and a fertile innovation ecosystem, of which Mindmaze and Sophia Genetics are outstanding examples. Last year, EPFL focused on developing the intellectual space between life sciences and computer sciences, with joint research and multiple hires. There is vast untapped potential at EPFL, involving existing researchers and exploiting the link with healthcare institutions and the SDSC, which this initiative could promote.

2. Computer discovery of medicines

The discovery and delivery of new medicines remains a key approach to improving human health. This initiative aims to overcome the technological constraints associated with traditional drug discovery by aligning and applying advances in structural biology, chemistry, materials, imaging and machine learning to develop rapidly-produced, lower-cost therapeutic agents to address a range of targets impacting human health, in a context within which they can be rapidly innovated and deployed.

Traditional drug development has focused on inhibitors (small molecules) that bind to and block the active site of enzymes. More recently, the application of machine learning to molecular design and image analysis offers the opportunity to transform the traditional screening process with in vitro, cell-based and model organism-based assays required to validate candidate molecules, promising many improvements in optimization and streamlining and therefore faster impact.

EPFL has leading experts in many key technologies, including structural and systems biology machine learning, biological chemistry optics and instrumentation and materials science, as well as world-class facilities for cryo-EM, cell and organoid testing, cleanrooms and more. Recent and ongoing research has focused on cryo-EM, organoid testing and sustainable biosynthesis. EPFL is closely linked to a network of healthcare institutions in the Lake Geneva region, such as the CHUV and the Ludwig Institute, as well as to a fertile innovation ecosystem, with Cellestia and ND Biosciences as spin-offs, supported by a dynamic VPI. Nevertheless, EPFL has vast untapped potential to coordinate, extend and promote this axis, as most of the activities related to the subject are carried out in a fragmented way. More importantly, such a focus would enable longer-term, sustained research into certain aspects of the pipeline in a way that commercial constraints would not allow industry to do. These include the selection of ‘unprofitable’ diseases, research into cutting-edge technologies and the complexity of data generation and integration.

3. Imaging biological dynamics

Recent advances in optics and image have made it possible to describe the dynamics of biological systems with unprecedented spatial and temporal resolution. This initiative aims to promote research and innovation at the crossroads of instrumentation, image processing, sample preparation and robotics. It should enable a new generation of imaging modalities designed to study biological systems at the appropriate scales and understand their dynamics.

It is now possible to develop new imaging techniques and combine them into intelligent instruments that not only react to dynamics by changing imaging mode but also learn from them to generate and test models in real time.

EPFL has several key players in the fields of non-linear optics, image processing, instrument manufacture, sensors, fluidics, robotics and intelligent microscopy, as well as a strong ‘clientele’ of quantitative life scientists in SV, with complex models ranging from nervous and immune systems to cancers. There are strong links with local health institutions such as the CHUV, the Agora and the Ludwig Institute. EPFL also has excellent bio-imaging platforms at its Lausanne and Geneva sites, as well as an Imaging Centre specializing in image processing. Above all, EPFL has expertise in biophysics and machine learning, which enables the development of instruments to be linked to relevant theory and cutting-edge algorithms.

4. Bioengineering for sustainability

Rapid climate change poses urgent challenges to health and sustainability. This initiative describes a set of areas that describe a change in disease patterns, bioengineered energy and sustainable production of food and materials using life science and bioengineering approaches.

Climate change and the over-exploitation of resources are signs of an unsustainable way of life, threatening the health and safety of populations. From a biological point of view, two types of intervention are needed. Firstly, we need to anticipate and prepare for climate change in the distribution of diseases. Secondly, we need to develop technologies that will enable us to combat shortages of energy, resources and foodstuffs directly. Recent advances in bioengineering make it possible to address these issues in a sustainable way, by taking advantage of the key capabilities of biological systems: biocatalysis, self-assembly, self-repair and self-replication, energy harvesting, CO_2 fixation and chemosynthesis, redox binding and transformation of metals and the synthesis of refined materials. These emerging approaches have not yet reached maturity, opening multiple possibilities for exploring solutions using bioreactors, biosensors, protein engineering, metabolic analysis, genetic and genomic editing of microbes and hybrid technologies linking these biotic solutions to the abiotic components of our infrastructure. The market in green energy and sustainability is estimated to be worth billions of dollars over the next few decades.

EPFL has strengths in bioengineering, microbial systems, infectious biology, green chemistry, biopolymer engineering, manufacturing, recycling and energy technologies. New hires in synthetic biology are underway and more are planned. EPFL also has environmental monitoring and climate impact programs on the built environment in ENAC, providing complementary and potentially synergistic expertise. EPFL has links with local industrial partners seeking innovative sustainable technologies, such as Nestlé, Lonza and Firmenich. Above all, there is currently no national effort to coordinate this approach; EPFL could lead the way.


EPFL

6.6.
CDH | College of Humanities

MISSION

The College of Humanities (CDH) develops knowledge at the crossroads of science, technology, humanities and arts to invent tomorrow's society. The College offers an education program in social sciences and humanities and a Master degree in Digital Humanities that trains EPFL engineers to become responsible agents of change in Switzerland and internationally. It also develops innovative and attractive exhibitions, cultural programs, residencies and workshops that encourage public debate at the intersection of science, technology and art.

CHALLENGES AND OPPORTUNITIES

The 2025-2028 period will mark a major transformation for AI, with advances in generative AI, particularly in design, education and communication. These technologies promise greater creativity, personalized learning and new digital interactions. However, they pose major ethical challenges: trust, prejudice, misinformation, privacy and malicious use. Proactive and interdisciplinary approaches, as well as progress in regulation, are essential to ensure positive and inclusive impacts.

The humanities and social sciences will play a crucial role in helping us to understand, engage with, lead and even contain the AI revolution that has just begun. However, these fields themselves are also poised for change and their research methods are also likely to be disrupted. As AI becomes increasingly capable of processing and producing natural language and images, it presents both opportunities and challenges for researchers and teachers in the humanities and social sciences, who must adapt to these new technologies while rethinking the basic methodologies of their discipline.

Recognizing the transformative potential of AI for the humanities and social sciences and its importance for society, the CDH has decided to develop a comprehensive plan that places the multidisciplinary study and design of AI systems at the center of its research, education and public engagement initiatives. The aim is to create a self-reinforcing dynamic, where AI transforms the humanities and social sciences and vice versa, enabling an ambitious long-term development plan to be drawn up.

Given the growing role of AI in this field, it seems appropriate to optimize the structure of the CDH while strengthening collaboration with AI players, in particular IC, with which many links have already been forged naturally over time. This will offer the opportunity to develop interdisciplinary projects and attract students from a variety of backgrounds. To ensure smooth and successful integration, it will be essential to preserve the CDH culture. A gradual approach could be to initially create an Institute housed within the IC, while ensuring that the necessary synergies are established to foster fruitful interdisciplinary collaborations. Given the proximity that already exists, the integration of Sections and doctoral schools should be relatively simple to implement.

STRATEGIC AREAS

The strategy is built around two symmetrical programs - AI for Humanities (AI4Humanities) and Humanities for AI (Humanities4AI) - and two complementary impact programs - Education Impact and Campus and Societal Impact.

1. AI4Humanities

The AI4Humanities program will coordinate research and education efforts to develop AI methods and systems to support research and innovation in the humanities and social sciences. It will be a collaboration led by CDH's Digital Humanities Institute, drawing on the expertise of laboratories and research groups at the forefront of digital technology for humanities research. The program will draw on the talents of the Digital Humanities Institute (DHI) in areas such as historical document processing, digitization of tangible and intangible cultural heritage, computational approaches to big data from the past, immersive data visualization, digital history of science,

social computing and digital musicology. AI4Humanities will be developed in close collaboration with the EPFL-wide AI4Science initiative led by EPFL's AI Center and with the Swiss Data Science Center. Students in the DH Master and future minor will contribute to this coordinated effort.

Interdisciplinary and multicultural cultural heritage datasets - essential for training or refining generative AI systems - will be developed and curated, taking advantage of ongoing international collaborations between the DHI and the Cultural Heritage and Innovation Platform. The latter is currently managing several large-scale digitization projects and databases, including the Montreux Jazz Festival archives. The CDH's expertise in regional studies, which grew out of the former Institute for Area and Global Studies, will play a key role in ensuring that training packages are sufficiently culturally informed.

2. Humanities for AI

In addition, the influence of AI on design and creative industries is set to grow significantly over the next few years. To harness this potential, the CDH will collaborate directly with ECAL and HEAD, two internationally renowned art and design schools. These partnerships will explore the capabilities of generative AI systems and examine their applications in industrial, graphic and interactive design. By actively experimenting with and integrating AI into these fields, the group aims to innovate and shape the future of design practice. Humanities for AI

In parallel, the Humanities4AI program will coordinate research and teaching in the humanities and social sciences relating to AI methods and systems. A working group on ethics and law will be set up to broaden the CDH's expertise on these issues. This group will provide advice and develop best practices for responsible artificial intelligence research in the humanities and social sciences, while addressing ethical and legal issues related to AI applications. It will ensure the coherence of courses in these areas and establish direct links with policymakers, civil society and other relevant stakeholders. The integration of the user perspective, through citizen science and other participatory forms of human-centered knowledge production, including younger generations, women and diverse communities, in the development of AI technologies will be encouraged.

The Humanities4AI program will build on the current SHS program, which covers a wide variety of subjects across nearly 150 courses (including philosophy, history, sociology, anthropology, political science, economics, psychology, linguistics, literature, art history, law, etc.). The Humanities4AI program will act as a bridge between current forms of teaching and their potential evolution by consolidating specific knowledge bases for training in generative AI systems. Several pilot courses will be developed to better prepare students to deal with new forms of human-machine collaboration in SHS fields and to address the ethical and social issues linked to the processes of science, technology and innovation, as well as their specific challenges. Several CDH laboratories will also contribute directly to this theme. The SHS Global Issues and Sustainability courses (food, climate, energy, health, communication, mobility) taught to all EPFL bachelor students will be at the heart of the Humanities4AI program. A planned 'Open Access Global Issues Dataspace' will provide key datasets for students to use during their studies. During these courses, students will be introduced to new tools developed using data analysis and AI methods and will have the opportunity to use them in their studies.

3. Education Impact (EI)

The Education Impact program will coordinate research into the opportunities and risks of new technologies for education. To develop this area, CDH proposes to host laboratories and units currently located in other EPFL Schools. The aim is strengthening EPFL's excellence in the fields of learning technologies, digital education, data- and evidence-based approaches to education, computational thinking and digital culture. The program will federate the activities of the LEARN Centre for Learning Sciences (involving over 2,000 teachers), the Centre d'appui à l'enseignement (CAPE), the Centre pour l'éducation à l'ère digitale (CEDE) and the Swiss EdTech Collider (supporting over 100 EdTech start-ups) as well as other relevant educational initiatives at EPFL and in the region. It could be set up in collaboration with ETH Zurich, which would make it possible to take advantage of the joint EPFL-ETH Zurich doctoral program in learning sciences.

4. Campus and Societal Impact (CSI)

The Campus and Societal Impact program will have a positive impact on the campus and society through a series of 'interfaces' targeting several groups of people (children, students, seniors, etc.). The Artist-in-Residence program will focus, among other things, on the development of works integrating AI technologies within the humanities and social sciences, aiming to become a platform with tangible impact for scientific and artistic research by promoting innovative approaches and aesthetic research driven by AI. CDH will also devote some of its activities to highlighting the transformative aspects of AI and to experimental development, including the twice-yearly 'Les Culturelles' week. Specific research and educational collaborations with the City of Lausanne's heritage institutions will continue as part of the Lausanne Time Machine initiative. In collaboration with the IMI (Initiative for Media Innovation), CDH will also take advantage of the opportunity created by RTS's move to the Lausanne campus in 2025 to forge partnerships and develop collaborative projects highlighting the applications and risks of AI in media and information production.

At the point where these different programs converge, a «steering post» will be created to coordinate CDH's actions. This will provide the impetus for self-reinforcement. The ambition is to launch a series of CDH-wide initiatives that dynamically combine interdisciplinary areas of expertise and support fundraising and partnership development, to build a central knowledge repository integrating the CDH's datasets and flows in a format suitable for their future exploitation by AI, and to transparently monitor the progress of the various programs.

The overall ambition is to use a new organization and a new mission for CDH to maximize its impact. At the dawn of the major technological and societal transformation triggered by the breakthrough of AI systems, CDH intends to play a central role in research, education and public engagement in this field. With this in mind, it will be rethinking its current educational offerings, in particular the SHS program developed twenty years ago, but also all the teaching in the humanities and social sciences that is currently provided on campus. By drawing on its unique interdisciplinary expertise - at the crossroads of science, technology, the humanities and the arts - the College aims to become EPFL's interdisciplinary academic hub for thinking about the epistemological and methodological challenges of AI systems in research and education.


EPFL
Digital Humanities
Master
2024

6.7. CDM | College of Management of Technology

MISSION

We create value for business and society by developing change leaders and advancing management theory and practice. As part of a dynamic international campus that attracts world-class students and faculty in science, technology, engineering and mathematics, the College offers unique teaching programs at the intersection of business and engineering, and fosters internationally renowned, high-impact research. It offers a collaborative and respectful environment that attracts and retains bright minds and enables them to develop their full potential.

ORGANIZATION

The College of Management of Technology is home to 15 professorships, 40 doctoral students and 50 other members of staff. It comprises the Swiss Finance Institute and the Institute of Technology Management and Entrepreneurship and is home to the Enterprise for Society Center (E4S). E4S focuses on sustainability and societal issues, particularly in regard to the environment, the need for democratic acceptance of economic and scientific innovations and the social responsibility of companies and entrepreneurs

STRATEGY 2025-2028

Today, artificial intelligence, technological innovation, the ubiquity of data and the power of analysis are transforming the world of business. Our researchers are carrying out projects and our programs are teaching the skills needed for this transformation. What's more, businesses are playing a key role in the fight against climate change, biodiversity loss and the creation of a more inclusive and equitable society. CDM researchers are well placed to educate and advise businesses in these areas.

EDUCATION

CDM is active in education at all levels. It offers a range of Bachelor courses in management, economics and finance. It offers three Master programs and two doctoral programs. It also has a management training unit.

1. Bachelor courses

CDM offers management, economics and finance courses open to all EPFL Bachelor students. These courses help them to familiarize themselves with the business world and to find a job more easily. In addition, when it comes to sustainability and climate change, an economic understanding of the processes is essential to make the link between technological development and its implementation. Over the 2025-2028 period, we aim to double the number of such courses. Several other Schools (e.g. IC) aim to encourage entrepreneurship among Bachelor students, and CDM will also play an important role in this respect.

2. Masters courses

The Master programs in Financial Engineering and in Management of Technology and Entrepreneurship each receive between 200 and 250 high-quality applications from all over the world and host around 35 to 50 of these candidates. By 2023, approximately half of the registered student body will be EPFL Bachelor students. These students receive a more quantitative education than in a traditional business school, which makes them quite unique and means that they are in demand by industry. They can solve complex problems and models, while mastering the language of business and understanding how companies operate.

We aim to increase enrolment to a target of around 75 per program. In addition, more and more EPFL students are taking a minor of 30 ECTS credits (300 students enrolled in 2022), either in the MFE program or in the MTE program.

The new Master degree in Sustainable Management and Technology, offered in collaboration with IMD and HEC Lausanne, is unique in that it trains students to integrate environmental and societal concerns into business models while taking advantage of the promise of new technologies.

It also attracts a different type of student and increases diversity on campus. Over the 2025-2028 period, we aim to extend this program to 50 students, half of whom will have a business background and half an engineering background, and to guide them towards sustainability-related roles within Swiss companies.

Developing these Master programs with high-quality students is good for Swiss business and society, as the graduates have valuable skills that will become even more important between in coming years. However, as with many EPFL programs, the challenge is to maintain the quality of teaching with a constant budget and a growing number of students

3. Doctoral programs
CDM's two doctoral schools train students to become academic thought leaders. Students develop ideas that advance academic knowledge and lead to innovations in business theory and practice. Doctoral students at CDM work closely with faculty to learn how to conduct rigorous research. The College takes great pride in the programs and in helping students succeed (recent university placements include Harvard Business School, Cornell University, IMD and the University of Toronto). Increasing the size of the doctoral program while maintaining the quality of doctoral students and improving the placement rate are the main strategic objectives for 2025-2028.

EXECUTIVE EDUCATION PROGRAMS

CDM offers effective executive education programs, including an Executive MBA and several Certificate of Advanced Studies courses. In executive education, technology, including artificial intelligence, data and business analytics, is becoming increasingly important to companies. As a leading technical university, EPFL is ideally placed to teach and inform participants about the latest developments. For example, the CDM offers a week-long FinTech program, or the TransformTech program, in which business leaders visit laboratories on campus.

RESEARCH

CDM focuses on a subset field of business that can particularly benefit from and bring advantages to a technical university. Our current research areas are entrepreneurship, finance, operations research and supply chain management, business analysis and the economics of innovation, all of which benefit from the EPFL environment. We have recently expanded our activities into the field of public policy and sustainability, taking on a new faculty member who has also taken on a mentoring role within the E4S Center.

We plan to strengthen research in sustainable management by recruiting an additional assistant professor in strategy and technology management. Sustainable finance refers to the process of taking environmental, social and governance (ESG) considerations into account when making real or financial investment decisions, leading to longer-term investments in sustainable economic activities and projects. Given the size of the Swiss financial sector and the large wealth management industry, a leading expert in sustainable finance would not only lead one of the ETH Domain's strategic initiatives, but would also create interactions with the industry, with significant knock-on effects.

EPFL has great strengths in the MINT fields. CDM seeks to build on these strengths through strategic partnerships and interdisciplinary research on issues of importance to business and society over the 2025-2028 period. We committed to strengthening interdisciplinary research through joint recruitment with other Schools. To give two concrete examples that we wish to develop over 2025-2028, a Chair in Health Economics could, in collaboration with the School of Life Sciences (SV), evaluate the cost-benefit analysis of new treatments and make recommendations on what is scientifically possible and economically reasonable for society. A second example, driven by the increasing availability of data and recent advances in machine learning methods, is the increasing application of data science to problems in operations management, supply chain management and revenue management. These advances are giving rise to a new generation of intelligent supply chain systems operating in uncertain, rapidly changing and potentially conflicting environments. Because trading relationships and well-

functioning supply chains, as we saw during the Covid crisis, are of paramount importance to the Swiss economy, research in this area would significantly improve the resilience of the Swiss economy.

INNOVATION AND AWARENESS-RAISING

Social science research rarely leads to patentable results. Yet the CDM, through its research laboratories, E4S Center and executive education unit, is well placed to contribute to the societal and corporate acceptance of engineering solutions developed at EPFL. Closer collaboration with EPFL's five Schools, as mentioned above, increases the visibility of research into energy, climate and environmental issues. Educational activities at both the Bachelor and Master levels help to raise awareness among EPFL engineers, who are the next generation of business leaders, of societal issues and the need for societal acceptance of technological solutions. Continuing education courses at the highest level will reach industry decision-makers and create a link between EPFL, its technological innovations and those who can implement them in industry (for example, the Tech4Impact initiative). We anticipate more interaction with the EPFL start-up community, whether through tailor-made continuing education courses (on, for example, fundraising pitfalls or understanding term sheets) or other forms of cooperation (such as teams of Executive MBA students helping start-ups to develop a commercially viable strategy).

The E4S Center has become highly visible with its outreach programs and third-party funded research initiatives on pressing issues such as the circular economy or sustainable solutions. It has been successfully launched and plans to continue organizing the Showcase 2030 event. This brings together sustainability entrepreneurs, universities,

multinationals, governments and financial companies to harness technological and sustainable innovations (the 2023 edition had 600 participants). The Center is planning action labs to develop sustainable business solutions with leading industrial and public stakeholders (such as green bonds, or the true cost of food). It also envisages a Swiss negative emissions fund that would finance negative emissions projects (e.g. wetlands) that would help Switzerland meet its 2050 carbon target. Planned awareness-raising activities include the further development of the Levo platform, which helps start-ups and SMEs measure their impact on sustainability. It would like to develop a regional decarbonization observatory. A thriving E4S Center, focused on sustainability and awareness-raising, is an important element of the CDM's strategy for the 2025-2028 period.

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