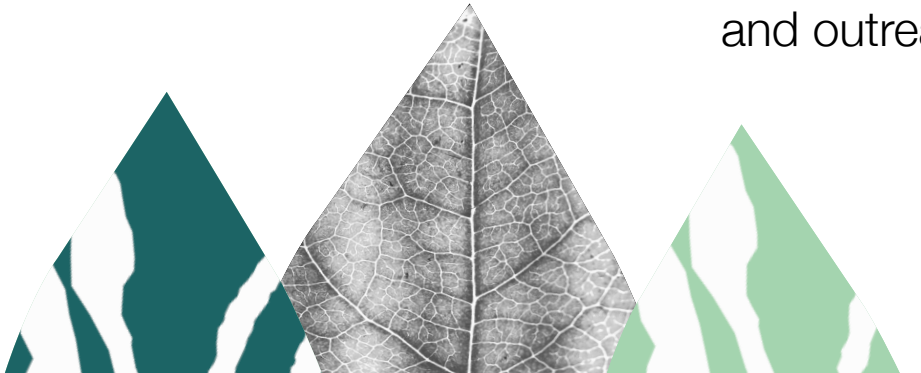
PSC Impact Report. 25 years of plant science research, education and outreach

Zurich-Basel Plant Science Center

IMPACT IMPACT IMPACT REPORT

25 years of plant science research, education and outreach



Impressum
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University of Zurich[UZH] | ETH zürich | University of Basel

Welcome

The Zurich-Basel Plant Science Center (PSC) represents frontier research, education and outreach.

Since the center was launched 25 years ago, PSC has contributed significantly to the field of plant sciences. By creating a highly visible platform, and through innovative collaborations in research programmes, fellowships and educational offering, PSC shows the profound impact that plant sciences can have. PSC facilitates interdisciplinary collaboration and bridges the gap between scientific knowledge and society. This brochure showcases the role of the center in higher education and dynamic research environments, presenting a selection of successful endeavours. We hope you enjoy reading about them.

On behalf of the PSC management team, we would like to thank all our members and partners for their dedication. Together, we will continue to find solutions for global challenges through plant sciences!

Sincerely,
Manuela Dahinden and Melanie Paschke

About us

PSC is a competence centre coordinated by the ETH Zurich, University of Zurich and University of Basel. Founded in 1998, PSC is dedicated to advancing research, education and outreach in the field of plant sciences.

Member institutions

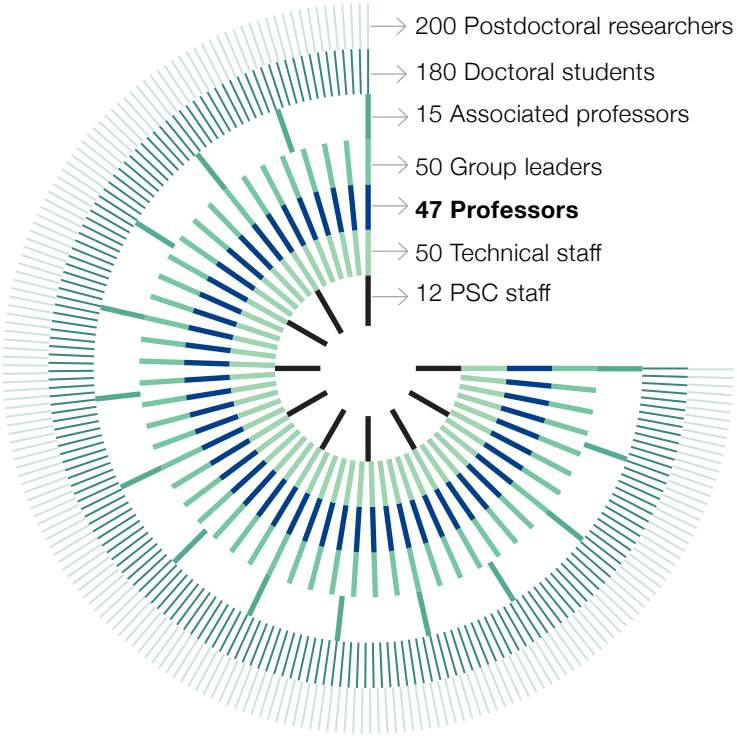
ETH Zurich
Department of Biology
Department of Environmental Systems Science

University of Zurich
Department of Evolutionary Biology and Environmental Studies
Department of Geography
Department of Plant and Microbial Biology
Department of Systematic and Evolutionary Botany

University of Basel
Department of Environmental Sciences

Managing Office

The center



PSC is the largest research network in plant sciences in Switzerland. Here, more than 600 scientists from three universities combine their individual expertise to create an internationally visible profile in plant science research.

PSC membership. PSC provides memberships to full and assistant professors of its partner universities.
In 2023: from the 50 professors, 25 are from ETH Zurich, 21 from University of Zurich, and 4 from University of Basel.

Research management

PSC promotes research in plant sciences across scales from molecules to landscapes. More than 45 different disciplines are represented within the centre. Our vision is to enhance synergies by collaboration in strategic research fields.

Plant research over the past hundred years has contributed significantly to our understanding of biology. Many fundamental mechanisms have first been detected in plants, the most famous being the principle of genetic inheritance discovered by Mendel while studying peas. Recent discoveries in RNA biology are utilised in medicine.

Research in **fundamental plant biology** unveils molecular, genetic and physiological mechanisms governing plant development, adaptation and responses to environmental stimuli. This knowledge is pivotal for food production, climate change mitigation and ecological conservation.

Research in **plant health and productivity** generates findings that are essential for global **food security**. Plant sciences unravel molecular and ecological factors influencing crop productivity. Interdisciplinary approaches, integrating genetics, agronomy and technology, help to enhance resilience against pests and diseases, ensuring sustainable agricultural yields in a changing climate.

Research in **biodiversity and climate change** is vital for understanding and mitigating environmental threats. This involves the integration of multiple approaches and datasets, Including artificial intelligence (AI), genomics, ecology, remote sensing and spatial analyses. The aims are to identify, monitor, understand and priorities vulnerable ecosystem. Plant scientists unravel the mechanisms underlying ecosystem services by addressing the interplay among biogeochemical exchanges, biodiversity, and ecosystem functioning. Understanding these relationships is of paramount importance for developing and deploying targeted conservation and management strategies.

Research in **ecosystem function** and management and an understanding of the socio-environmental factors for sustainable **land use changes** are crucial for environmental balance. By applying transdisciplinary methods, plant and social scientists develop participatory approaches with local communities and practitioners to enhance livelihoods and ecosystem services.

Research in **soil health** is crucial for sustainable development and the implementation of environmentally friendly plant production systems. Plant sciences reveal plant-soil interactions, root-microbe interactions and nutrient cycling, so guiding informed land management. This knowledge ensures food security, ecosystem resilience and environmental conservation.

Fundamental plant biology

Biocommunication
Microbial Physiology
Molecular Plant Biology
Molecular Plant Breeding
Plant Biochemistry
Epigenetics
Plant Development
Plant Ecology
Plant Genetics
Plant Evolution
Evolutionary Genomics
Plant Pathology
Plant Physiology
RNA Biology

Plant health and productivity

Agroecological Transitions
Biocommunication
Crop Science
Environmental Robotics
Epigenetics
Evolutionary Functional Genomics
Microbiology
Microbial Physiology
Molecular Plant Biology
Mutualistic Networks
Molecular Plant Breeding
Plant Biochemistry
Plant Development
Plant Evolutionary Genomics
Plant-Insect Interactions
Plant-Microbe Interactions
Plant Nutrition
Plant-Pollinator Interactions
Plant-Soil Interactions
Plant Pathology
Plant Physiology
RNA Biology
Spatial Genetics
Sustainable Agroecosystems

Biodiversity and climate change

Agroecological Transitions
Biocommunication
Crop Science
Ecosystems & Landscape Evolution
Ecosystem Management
Earth System Science
Evolutionary Functional Genomics
Global Ecosystem Ecology
Grassland Sciences
Information Ecology
Microbiology
Microbial Physiology
Molecular Plant Breeding
Mutualistic Networks
Paleogenetics
Plant Development
Plant Ecology
Plant Ecological Genetics
Plant Evolutionary Genomics
Plant-Human Interactions
Plant-Insect Interactions
Plant-Microbe Interactions
Plant-Pollinator Interactions
Physiological Plant Ecology
Spatial Genetics
Soil Ecology and Global Change
Sustainable Agroecosystems

Ecosystem function and land use change

Biocommunication
Ecosystems and Landscape Evolution
Ecosystem Management
Earth System Science
Grassland Sciences
Global Ecosystem Ecology
Environmental Robotics
Information Ecology
Physics of Soils and Terrestial Ecosystems
Plant Ecology
Plant Ecological Genetics
Plant-Insect Interactions
Physiological Plant Ecology
Remote Sensing of Water Systems
Soil Resources

Soil health

Agroecological Transitions
Ecosystem Management
Earth System Science
Global Ecosystem Ecology
Basics of Soils and Terrestrial Ecosystems
Plant Nutrition
Soil and Global Change
Sustainable Agroecosystems

Research infrastructure

In order to advance knowledge and discovery, a sound research infrastructure in plant sciences is essential. Data technology and collaborative spaces empower scientists to explore plant biology, genetics and ecology – fostering breakthroughs that are crucial for agricultural innovation and environmental sustainability.

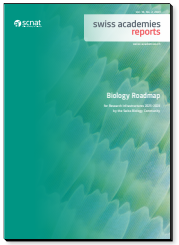
2009–2012, PSC with University Basel as the Leading House initiated and coordinated the Swiss Plant Science Web (SPSW), funded by CRUS/SUK. SPSW includes all plant scientists of the Universities of Basel, Bern, Fribourg, Geneva, Lausanne, Neuchâtel and Zurich, as well as ETH Zurich. It is organised in three regional centres – PSC, BeNeFri, and Arc Lémanique Plant Science (ALPS). SPSW highlights the diversity and excellence of Swiss plant science research and promotes national knowledge exchange.

Three **technology platforms** were established or further developed: the Genetic Diversity Center (GDC) in Zurich, the Neuchâtel Platform of Analytical Chemistry and the Bio-Molecular Analysis (BMA) platform in the Arc Lémanique.

In 2021, the Swiss Society of Plant Biology was founded, retaining the Annual SwissPLANT symposia.

PSC advocates the importance of plant sciences and research through its continuous participation in strategic working groups and reports, and through preparing and distributing portfolios and dossiers on plant sciences across many channels.

In 2020, PSC provided input to the **Biology Roadmap** for Swiss research infrastructures 2025–2028 by identifying the emerging infrastructural needs of our plant science community. The Roadmap explores synergies and provides the State Secretariat for Education, Research and Innovation (SERI) with bottom-up information that helps optimise decision-making on future investments. From the 28 projects submitted, the Swiss Biosites for Sustainable Agriculture and Agroecology (SISAL) was one of the 15 selected.



Brunner D, Durinx C, Erb M, Fischer M, Hari Y, Jazwinska A, Leeb T, Reymond C, Scheidegger C, Stieger P, Studer B, Vergères G, Walter A (2021). Biology Roadmap for Research Infrastructures 2025–2028 by the Swiss Biology Community. Swiss Academies Reports 16 (2) https://doi.org/10.5281/zenodo.4572622

Partnerships with public and private sector

PSC facilitates collaboration at national and international levels. Shared expertise, diverse perspectives, and collective efforts advance our understanding of plant science-driven innovation.

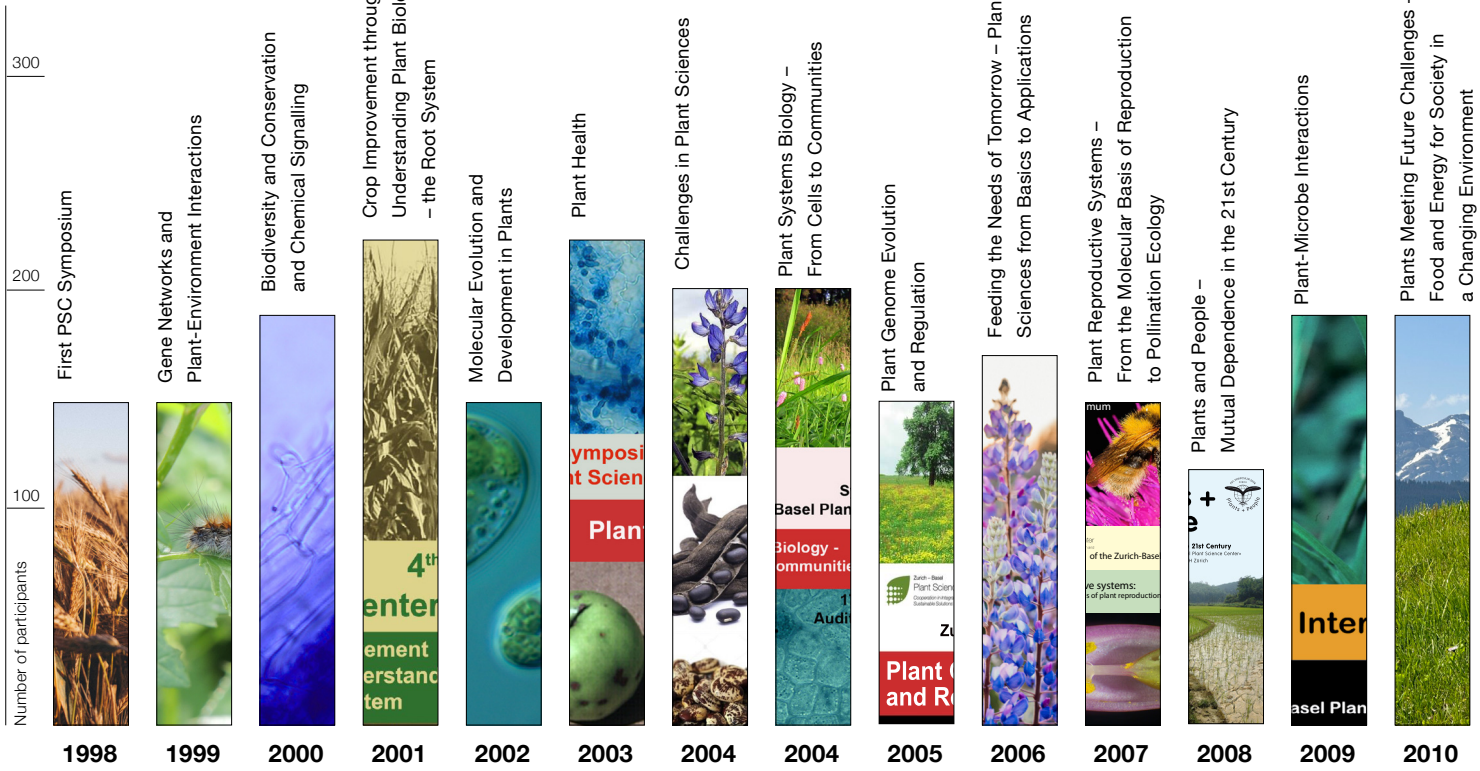
International
Agroisolab GmbH, Germany
Ashoka Trust for Research in Ecology and the Environment (ATREE)
BaseClear BV, The Netherlands
Barenbrug, Germany
Bellona Europa, Belgium
Carlsberg Group, Carlsberg Research Laboratory, Denmark
Deutsche Saatveredlung AG, Germany
DLF Seeds A/S, Denmark
Face the Future, Uganda
German Research Centre for Geosciences
Heliospectra AB, Sweden
International Institute for Sustainable Development (IISD)
International Maize and Wheat Improvement Center (CIMMYT)
International Union for Conservation of Nature (IUCN)
Joint Research Center European Commission (JRC, Ispra)
Mi2-factory GmbH, Germany
Nitidae Association: Landscapes and value chains, France
Organization for Economic Co-operation and Development (OECD)
Photon Systems Instruments (PSI), Czech Republic
Syngenta Crop Protection AG
Southeast Asia Rainforest Research Partnership (SEARRP), Malaysia
WWF

Switzerland
Agroscope
Bitplane AG
Botanical Garden of the University of Zurich
Epibreed AG
Museums in the Canton Zurich
MWSchmid GmbH
Office for Nature and Environment, Grisons, Switzerland
ProSpecieRara, Switzerland
Puregene
RWE Renewables GmbH
Research Institute of Organic Agriculture (FiBL)
Swiss Academy of Sciences (SCNAT), Forum Biodiversity
Swiss Energy Foundation (SES)
Swiss Federal Office of Energy (SFOE)
Swiss Federal Office for the Environment (FOEN)
Swiss Fruit Association
Zurich University of the Arts
Zurich University of Teacher Education

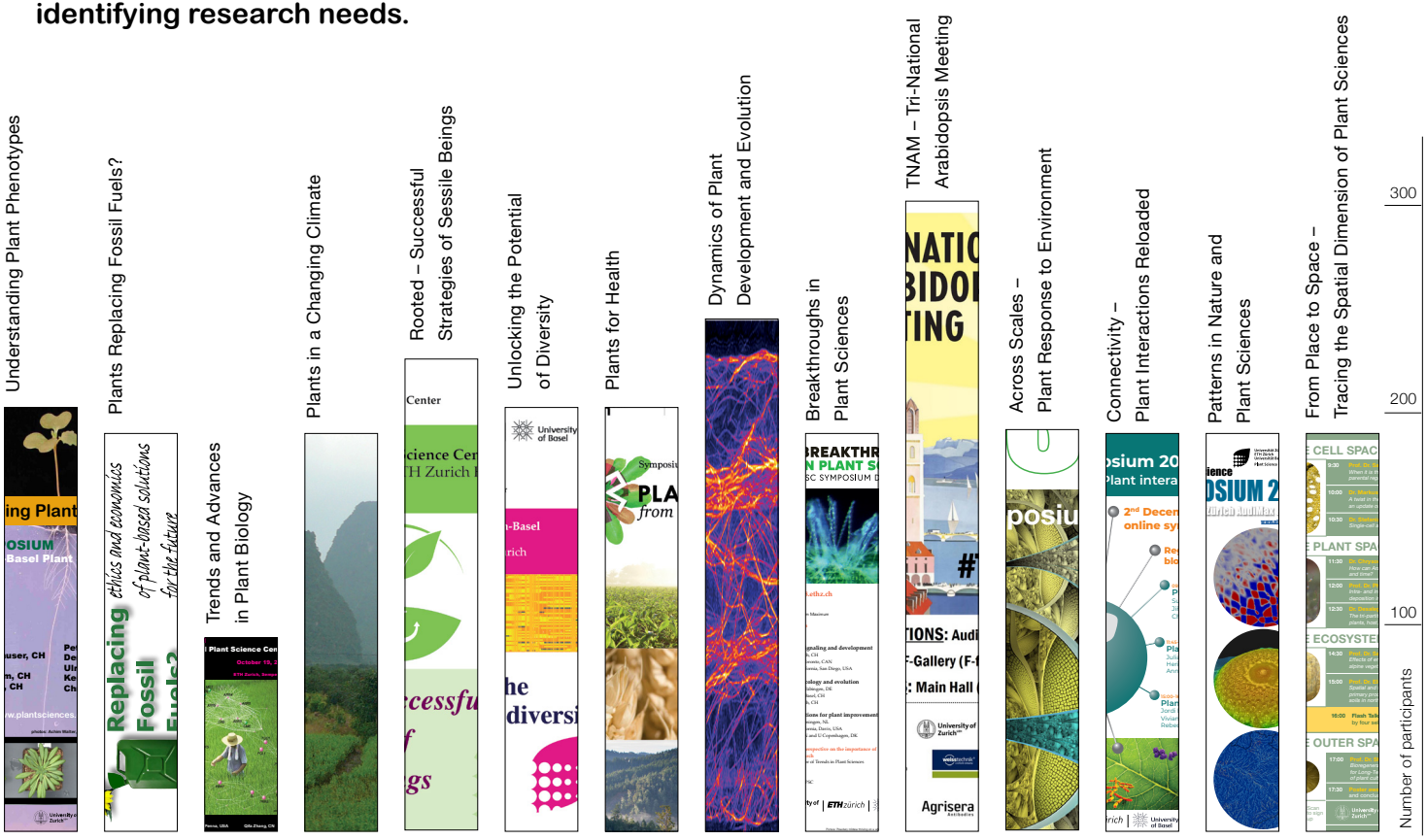
And many more....

Symposia

27 Symposia
6,100 Participants



The PSC annual symposium is a renowned forum for networking, discussing cutting-edge research and identifying research needs.



Fellowships

PSC has initiated and managed several fellowship programmes, most of which are Marie Skłodowska-Curie Actions (MSCA), the European Union's flagship programme for doctoral and postdoctoral training. Our programmes funded a total of 165 doctoral students and postdoctoral researchers.

Current

RESPONSE – This European MSCA Doctoral Programme is co-funding 28 fellowships for doctoral students in sustainable food and energy systems and sustainable land use. (2019–2024)

JRC Collaborative Doctoral Partnership – This European Joint Doctoral Programme with the Joint Research Center (Italy, Ispra) is co-funding 4 fellowships for doctoral students in soil and land use change and bioeconomy and forests. (2019-2024)

Syngenta Fellowships – This research programme is funding fellowships for doctoral students and postdoctoral researchers in crop production and climate change. To date, 43 young researchers (32 doctoral students and 11 postdoctoral researchers) have received funding from this collaboration. (Since 2003)

Previous

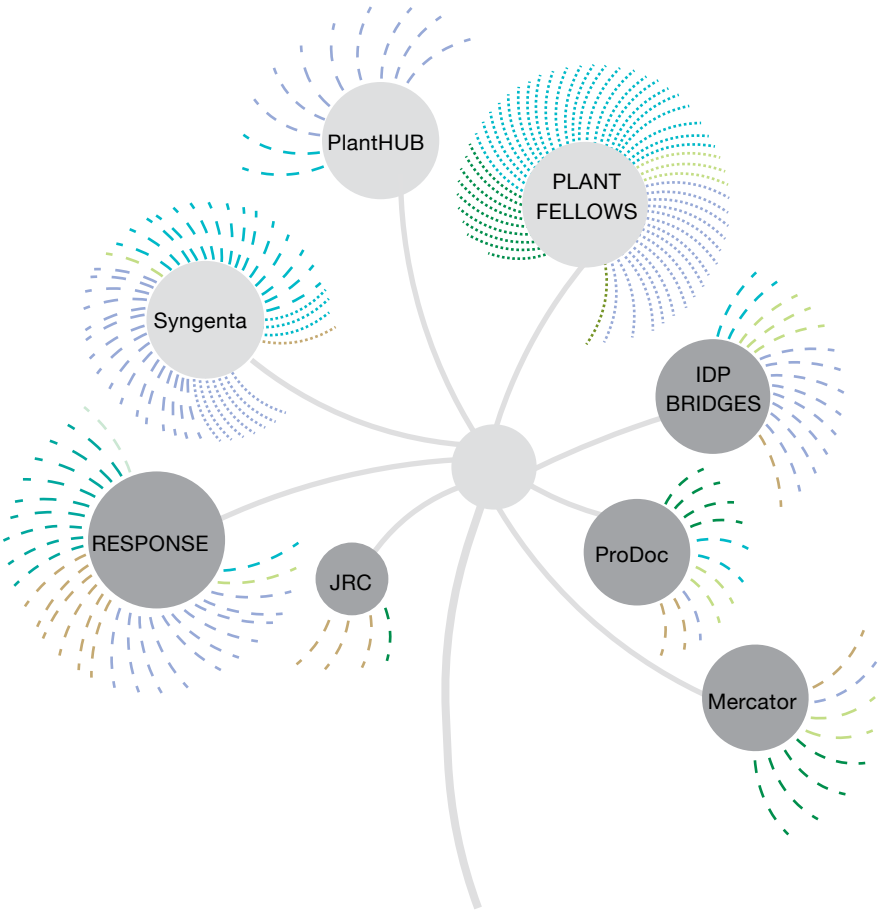
PlantHUB Fellowships – This European MSCA Industrial Doctoral Programme funded 10 fellowships for doctoral students in plant breeding and production. (2016–2020)

Mercator Fellowships – This research programme funded 8 transdisciplinary fellowships for doctoral students in biodiversity conservation and sustainable agriculture. (2011–2021)

IDP BRIDGES Fellowships – This European MSCA Innovative Doctoral Programme funded 14 fellowships for doctoral students enrolled in the Science and Policy PhD programme. (2013–2017)

PLANT FELLOWS – This European MSCA Postdoctoral Fellowship Programme co-founded 51 research projects spanning all fields of plant sciences. (2012–2016)

ProDoc Fellowships – This SNSF Doctoral Programme funded 11 fellowships for doctoral students at the interface of science and policy. (2009–2015)



Research fields

- Biodiversity and climate change
- Ecosystem function and management
- Energy science
- Food science
- Fundamental plant biology
- Food production and plant health
- Land use change

— — Doctoral students
····· Postdoctoral researchers

Science & Policy Fellowships

PSC fellowships and distribution among partner universities.
ETH Zurich: 70, University of Zurich: 60, University of Basel: 18, Internationally: 17.

Education

PSC is advancing the plant science curricula with innovative learning concepts, materials, courses, and doctoral programmes – guaranteeing a new generation of excellent plant scientists.

By scouting new technological developments and responding to the demands of the plant science community, PSC has developed the curriculum of its doctoral programmes at three universities. It works here with the departments and faculties to extend its training to a large population of doctoral students: so far, 666 courses with some 8,000 participants have been carried out. In addition, a partnership with the Life Science Zurich Graduate School is ongoing since 2010.

Transferable skill courses. Since 2003, PSC has built up a curriculum of transferable skills to teach students how to write, present, publish and communicate science, to manage research and projects, and find funding. Responding to the latest needs of the research community, PSC now offers advanced training in research integrity and knowledge on Open Data management. In 2023, PSC launched a new Innovedum project with ETH Zurich to integrate the responsible use of generative AI in the transferable skill courses.

Frontiers in plant sciences courses. 2017–2021: The curriculum development meant that courses were implemented at the frontiers of plant sciences, drawing on the newest technical and methodological developments.

Digital skills. 2021–2024: PSC increased its number of workshops on digital skills, statistical methods, machine learning, and artificial intelligence in the plant sciences – many of which are new developments. Since 2022, the PSC offers training in certain aspects of digital ethics.

Science-policy university training program. Since 2010, PSC has focused on a participatory approach to policymaking, where scientists generate evidence and knowledge in partnership with policymakers, stakeholders and the public. Here all parties provide input for debate and play their part in recognising the problem, and formulating, implementing and assessing policies. Since 2015, the programme has welcomed students from disciplines spanning environmental, agricultural, climate, earth, engineering, energy, food and life science.

Education in Sustainable Development (ESD). As society moves towards a more responsible use of our planetary resources, our students need to continuously develop skills in systems thinking and hone their understanding of transformational practices. Since 2010, we have offered ESD skills training in our courses and summer schools.

Number of students enrolled in the PSC education programmes

PhD Programme in Plant Sciences

Curriculum

	Course category	Course title
Compulsory	PSC Colloquium	Challenges in Plant Sciences
	Research Integrity	
	Other compulsory course(s)	
Elective	Research & Technical Skills	
	Digital Skills & Statistics	
	Transferable Skills	
Elective	Talk or poster: Participation in international scientific symposium	
	Engagement • In Green Labs (UZH only) • Organization of PSC PhD Symposium	
	Other scientific or transferable skill courses	

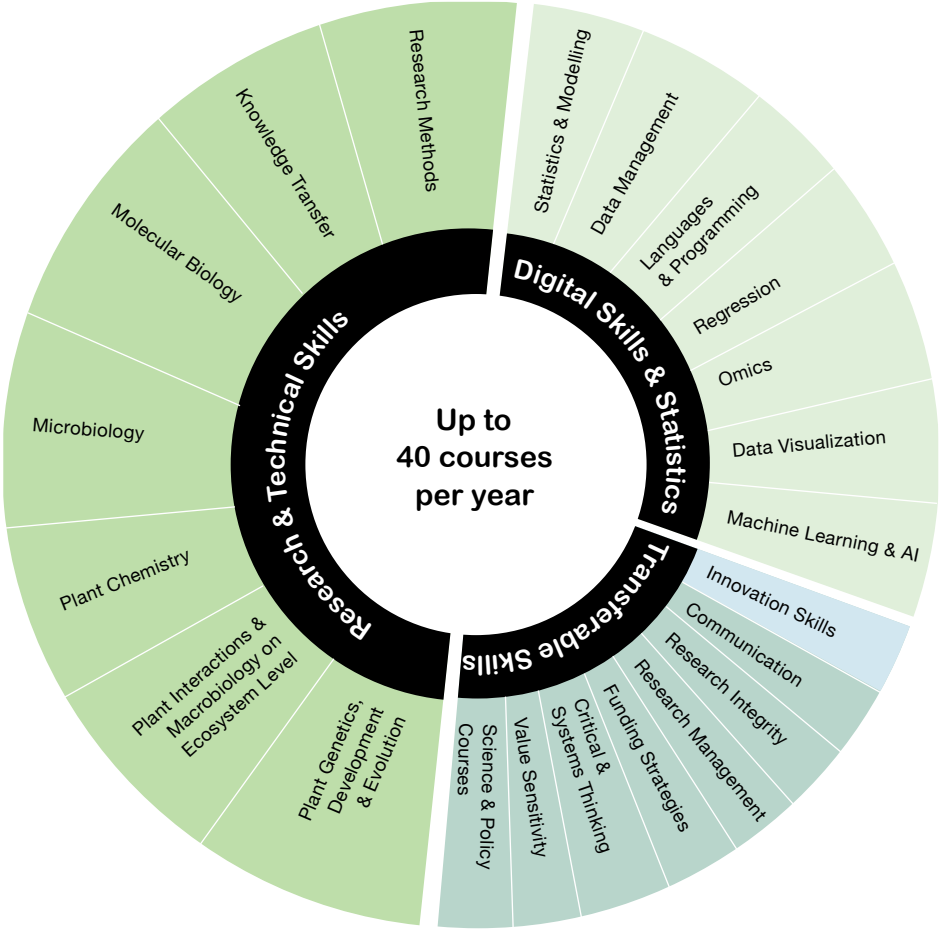
Familiarising students with frontier topics and skills in plant sciences.

Our truly interdisciplinary lectures focus on current and innovative research concepts ranging from molecular and plant biology to ecosystems. Hands-on training, through a series of workshops on digital skills, statistical methods, machine learning and artificial intelligence in the plant sciences, introduces you to the latest research techniques. In our transferable skill courses, you learn to successfully write, present yourself, communicate science at conferences and to the wider public, and to manage your research and projects.

Course catalogue

Number of courses and participants. Since 1998, PSC has offered 140 different courses, including 73 different Research & Technical Skills courses, 37 different Digital Skills & Statistics courses, and 30 different Transferable Skills courses. The graphic on the right indicates the main course disciplines.

In total, 606 courses with 7,270 participants were carried out.



PhD Programme in Science and Policy

Curriculum

	Course category	Course title
Compulsory	Basics of Policy Science	Introduction to Political Sciences
	Policy courses min. 4 out of 6 have to be chosen	• Evidence-based Policymaking
		• Stakeholder Engagement
		• Communicating Science
		• Building Political Support
		• Risk Communication
		• Understanding Policy Evaluation
	Other compulsory course(s)	Please consult the regulations of your university
Elective	PSC elective activities	E.g., Systems thinking & Policymaking
		E.g., Strategic foresight & Scenario building
	Other elective activities	Other technical courses or transferable skill courses or active contributions to international conferences

Training researchers in the life sciences to work effectively at the science-policy interface.

Engaging in the science-policy dialogue means that scientific knowledge is used to generate options for policies. The PhD Programme provides participants with the tools and skills they need to bridge the gap between science and policymaking.

Number of courses and participants.
Since 2009, the PhD Programme in Science and Policy has offered 60 courses to 730 participants.

Workbooks

Downloads by November 2023. Evidence-based policymaking (576), Stakeholder engagement (431), Communicating science through the media (626), Risk and uncertainty communication (271), Building political support (207), Generating impact chains (97), Applying collective inquiry (515). The workbooks have been highly recommended by RRI toolbox of the European Union, Ecsite, the International Network of Science Musems and Science Centers (80,000 readers), EPSO the European Plant Science Organisation (144 institutions) and the Mercator Foundation Switzerland.

Students acquire a portfolio of policymaking competencies and skills:

- **Learn about the policymaking process and ways to engage with evidence-based research.**
- **Learn how to convert research into policy-relevant information.**
- **Improve how they communicate scientific results to policymakers, media and the public.**
- **Learn to involve different stakeholder groups in a participative process.**
- **Build competencies and skills for transition into a science-policy career.**
- **Build a science policy network.**

Melanie Paschke and Karina Zurgilgen (2019). Science-policy boundary work by early-stage researchers. Recommendations for teaching, internships and knowledge transfer. *GAIA* (28/3): 310–315.

Building relationships between science, society and policy

PSC has 13 years of experience in offering science-policy fellowships to PhD students. Since 2013, a pivotal part are internship opportunities in science-policy implementing institutions. Here we present three examples:

Maintaining biodiversity and managing oil palm expansion

Expanding oil palm plantations remain an important environmental issue, given the huge negative impact they can have on tropical biodiversity. John Garcia-Ulloa developed models and scenarios to understand biodiversity change in oil-palm landscapes under REDD+ initiatives (Reducing Emissions from Deforestation and Forest Degradation). During his internship at the International Union for Conservation of Nature (IUCN), he convened stakeholder meetings and developed guidelines to mitigate the impact on biodiversity.

Erik Meijaard et al. (2018). Oil palm and biodiversity: a situation analysis by the IUCN Oil Palm Task Force. https://doi.org/10.2305/IUCN.CH.2018.11.en

Detection tool for illegally transported Malagasy rosewoods

Madagascar is a biodiversity hotspot, whose forests harbour a vast diversity of precious woods. Unfortunately, the ever- increasing demand for timber has led to massive illegal exploitation of rosewood, palisander and ebony species. Sonja Hasshold developed a method whereby genetic material could be isolated from heartwood and analysed in order to set up genetic “barcodes” for each species. During her internship at CITES, Missouri Botanical Garden and the University of Antananarivo, a database for molecular identification of Malagasy rosewood was established.

Sonja Hassold et al. (2018). Creating a base for rosewood identification. ITTO Tropical Forest Update: 27 (3), 4–30. Yokohama: International Tropical Timber Organization. https://doi.org/10.3929/ethz-b-000454212

Maintaining plant biodiversity in cities

Understanding the effects of urban design on the composition of plant species in cities is essential for maintaining biodiversity overall, promoting urban resilience in the face of climate change, and improving the quality of life for residents. Kevin Vega joined forces with landscape architects at the Ostschweizer Fachhochschule Rapperswil (OST) and GrünStadt Zürich to develop an ecological planning tool. Their maps take ecological, creative, and social aspects into consideration and will be used as a baseline for new settlement spaces.

Kevin Vega (2020). Maintaining wildflower biodiversity in cities. ETH Zurich. https://www.research-collection.ethz.ch/handle/20.500.11850/456762. Kevin Vega – received the ETH Medal award 2021 for his outstanding Doctoral thesis.

Science and Policy blog

The blog presents research outcomes of the PSC programme participants at the science and policy interface. The posts highlight results and trends in a number of areas, including sustainable agriculture, land use changes, protecting and managing biodiversity and ecosystems, and sustainable food systems.

blogs.ethz.ch/Science_and_Policy

More than 100 doctoral students have enrolled in the PhD Programme in Science and Policy since its launch in 2009. Eight of these students received a fellowship from the Mercator Foundation Switzerland. When the PSC-Mercator Fellowship Programme was wound up in spring 2021, PSC set out to evaluate its long-term efforts. This best-practice report on trans-disciplinary research serves as a guidance for curricular planning efforts and grant proposals.

Manuela Dahinden, Bianca Vienni Baptista, Melanie Paschke (2021). Going transdisciplinary. How to implement impactful transdisciplinary research and education programs in plant sciences. Evaluation Report. Zurich-Basel Plant Science Center, Zurich. https://doi.org/10.3929/ethz-b-000526113

Eight fellows of the Science & Policy PhD Programme share insights and experiences. The video formed part of the SHAPE-ID Toolkit, a coordination and support action funded by the European Commission under the Horizon 2020 framework programme.

Science and policy dialogue formats

PSC has established various formats for dialogue and debate. Social and natural scientists discuss with practice partners the benefits and risks of new technologies and the ecological, social and economic implications.

Fachtagung Dialog Grün

9 Conferences
949 Participants

Proceedings

2013 Gentechnikfreie Schweiz - (k)ein Scenario für die Zukunft — 129

2016 Neue Technologien in der Pflanzenforschung – eine Alternative zu Pflanzenschutzmitteln? — 120

2016 Erschliessung neuer Ernährungsquellen — 80

2021 De-novo-Domestikation: Erforschung und Erschliessung pflanzengenetischer Ressourcen — 120

2011 Grüne Gentechnologie: Forschung zwischen Anspruch und Wirklichkeit — 100

2009 Koexistenz und Forschungsfreiheit als Nagelprobe für die Grüne Gentechnologie — 100

2008 Feuerbrandbekämpfung in der Schweiz. Traditionelle Lösungen oder Gentechnologie? — 100

2006 Perspektiven der Pflanzenbiotechnologie in der Schweiz — 100

2005 Hat die Pflanzenforschung mit gentechnischen Methoden in der Schweiz eine Zukunft? — 100

Round tables

12 Events
1,110 Participants

2023 50
Future of land use in Switzerland

2022 50
Sustainable Energy System - Who will lead the way?

2021 50
The Need for Climate Resilient Food Systems

2021 85
Skigebiete in der Schweiz 2050. Visionen für die Zukunft.

2019 80
What next after the ECJ judgement on gene editing?

2018 150
Urban Agriculture – Fad or Future: Should tomorrow's cities grow their own food?

2016 350
Innovation *vs.* Regulation

2015 60
Plant Sciences, Patents and Food Security

2014 80
Science in policy on the use of systemic pesticides

2012 25
Working in science or policy – or both?

2011 50
GMO research in Switzerland – Are we standing at the open grave of stakeholder dialogue?

2010 80
Does evidence matter in policymaking?

Summer schools

As a vibrant part of PSC education, the summer schools stimulate competencies such as critical thinking, system thinking, design thinking and skills in machine learning and coding. The participant's case studies are published in the procedure. Since 2010, PSC has organised ten summer schools with more than 180 participants.

Proceedings

Food Security: How can Science and Policy Contribute? Proceedings of the PSC–ETNA Summer School 2011. Andrea Pfisterer (ed.) Zurich-Basel Plant Science Center, Zurich.

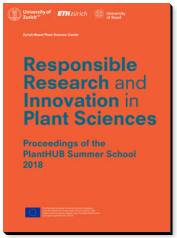
With contributions by: Movilla Blanco, Rhoda Delventhal, Korinna Esfeld, Vidyadhar Karmarkar, Gaia Luziatelli, Marios Nektarios Markakis, Heather McKann, Ezekiel Mugendi, Mohammed Aman Mulki, Elizabeth Owor, Lee Pearson, Norman Warthmann, Helena Wright, David Yawson, Oliver Zemek.

www.plantsciences.uzh.ch/en/teaching/pastsummerschool.html

Concepts for Agriculture Production Systems that are Socially Fair, Environmentally Safe and Economically Viable. Proceedings of the Summer Schools 2014 and 2016. Melanie Paschke (ed.) IDEA Verlag, Palsweis DE.

With contributions by: Philipp Aerni, Gurbir Bhullar, Allan Buckwell, Markus Frank, Marcel van der Heijden, Hans Herren, John Ingram, François Meienberg, Michael Meissle, Melanie Paschke, Martin Schmid, Franziska Stössel, Raphael Wittmer and Gunda Züllich.

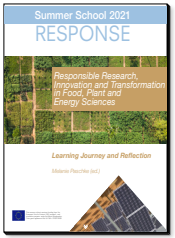
https://doi.org/10.3929/ethz-b-000218321



Responsible Research and Innovation in Plant Science. Proceedings of the PlantHUB Summer School 2018. Melanie Paschke (ed.) Zurich-Basel Plant Science Center, Zurich.

With contributions by: Manuela Dahinden, Gregory Grin,Melanie Paschke, Christine Rösch, Daan Schuurbiers, Foteini Zampati, Camilo Chiang, Franco Conci, Claudio Cropano, Florian Cueni,Seydina Issa Diop, Daniel Grogg, Manuel Nolte, Ina Schlathölter, Giacomo Potente and Maximilian Vogt.

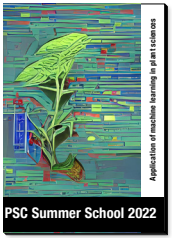
https://doi.org10.3929/ethz-b-000404539



RESPONSE Summer School 2021«Responsible Research, Innovation and Transformation in Food, Plant and Energy Sciences» Learning Journey and Reflection. Melanie Paschke (ed.). Zurich-Basel Plant Science Center, Zurich.

With contributions by: Manuel Belanche Guadas, Linda Brodnicke, Dusan Denic, Danli Fei, Linda Frattini, Laurent Giguère, Reah Gonzales, Monika Katarzyna Goralczyk, Katharina Jung, Xeniya Kim, Simon Landauer, Yuanyuan Liang, Alberto Linares Quiros, Simone Markoff, Bessie Noll, Dabwiso Sakala, Fei Wu, and Francesca Zuffa.

https://doi.org/10.3929/ethz-b-000523545



Application of Machine Learning in Plant Sciences. Workbook of the PSC Summer School 2022. Barbara Templ (ed.). Zurich-Basel Plant Science Center, Zurich.

With contributions by: Christian Ahren, Carol Alexandru, Jan Dirk, Manuel Günther, Gert Kootstra, Madlene Nussbaum, Sharada P. Mohanty, Al Crowd, Andrea Paz, Luca Pegoraro, Fernando Perez Cruz, Michael Rzanny, Thales Sehn Körting, Kentaru Shimizu, Shinhan Shiu, Benjamin Stocker, Aalt-Jan van Dijk, Hai Wang, Niklaus Zimmermann.

www.plantsciences.uzh.ch/en/teaching/pastsummerschool.html

Building capacity for innovation

PSC aims to enhance innovation capacity by offering matchmaking events, innovation skills training and mentoring. Recent trends have included advances in CRISPR gene editing for crop improvement, plant-microbe interactions for sustainable agriculture, innovations in precision farming and remote sensing technologies.

Entrepreneurship education. PSC enables doctoral students and postdoctoral researchers to generate innovative research ideas, and to develop and integrate these into innovation pipelines. They receive advice and gain access to funding opportunities to start their own innovation project, including idea labs and training in entrepreneurship and innovation management.

PSC emphasizes product, services and technology development in the following areas:

- Spatial omics
- Systems biology
- Data mininng and computational biology
- Plant health and protection (e.g., biostimulants)
- Agroecology
- Phenotyping (e.g., non-invasive imaging)
- Multiscale modeling and forecasting (e.g., AI-assisted models)
- Digital tools for biodiversity monitoring and decision-making

Joint doctoral programme with industry. The PlantHUB European Industrial Doctoral Programme (H2020-MSCA-ITN-2016) hosted 10 doctoral students who carried out their studies together with industry from 2016 to 2020. The research projects focused on various angles of innovation in plant breeding and production. The outcomes were new molecular tools for plant breeding, new forage, cereal and oil crop varieties, non-invasive imaging and phenotyping technologies for the breeding sector, intelligent lighting systems for plant growth, new software and services for complex genomic analyses, and enhancement of plant crop productivity. The PlantHUB project partners formulate recommendations for organisers of research and innovation programmes and research policymakers in the field of Responsible Research and Innovation (RRI).

www.plantsciences.uzh.ch/dam/jcr:a0d65016-faf3-46af-9e33-1c17188ff190/PlantHUB_D39_Research%20Brief_722338.pdf

Innovation and career development

Since 2018, the feminno Innovation and Career Development Programme has given 129 female researchers guidance on how they can start and master a successful innovation process. Together with experienced career advisors, coaches, innovation experts and executives from successful life science companies, participants work on finding ideas for innovation projects, as well as developing their career paths and connecting to professional networks.

Personal development

- **Career retreat**
- **Negotiation skills**
- **Leadership skills**

Cross talk

Innovation ecosystem

- **Innovation seminars**
  - License and patents
  - Gender-based perspectives
  - Funding your projects
  - Pitch your innovation
  - Value-based design
- **Company visits**
- **Innovation workshop: create a business model**

feminno alumnae – Start-ups

Digit Soil: www.digit-soil.com
OILS: www.openinnovationlifesciences.com
Babylat: www.babylat.com
One Planet Sustainables: www.op-s.ch
Collabree: www.collabree.com
MyFlow: myFLOW – Neural Control of Movement
Lab Mini Marrow: www.minimarrow.ch

Curriculum of the feminno programme.

A Guideline for Female Scientists in the Life Sciences at Swiss Universities. Ute Budliger and Melanie Paschke (eds.). Zurich-Basel Plant Science Center, Zurich. 2020. https://doi.org/10.3929/ethz-b-000443822

Public engagement

PSC designs targeted outreach programmes to increase plant awareness, science literacy and sustainable action.

In the last twenty-five years, technological developments from genome sequencing to AI-based tools have changed the way plant science is carried out. The PSC outreach team helps scientists to break down complex jargon and to explain and visualise scientific methods and natural phenomena in a language that is inclusive and accessible to a diversity of people. We believe that hands-on and inquiry-based activities capture the interest of the public and foster a deeper understanding of the complex world of plant science. We wish to increase plant awareness by highlighting how plant scientists can contribute to the public discourse in areas such healthy nutrition and sustainable food production, biodiversity conversation and land use change, forest management and urban planning. Scientific literacy is having an understanding of what science is and how to use scientific information in daily decision making.

The innovative PSC outreach programmes have set benchmarks for science communication and education. The outcomes include 30 peer-reviewed publications, books and learning materials, 2 nominations for the K3-Preis für Klimakommunikation, 6 awarded Agora projects by the Swiss National Science Foundation. PSC offers workshops and project weeks for schools and continuing education courses for secondary and high school teachers reaching out to 200 pupils and 50 teachers per year. The PSC outreach team curates public events in botanical gardens, art-science exhibitions for museums and public fairs as the OLMA or Scientifica attracting several thousands of people.

Didactical methods

- Inquiry-based learning
- Creative problem-solving
- Design-oriented science education
- Nature-based education
- Education for Sustainable Development

Education and internships in science communication

Our outreach specialists teach methods and tools in science communication for scientists as well as at Swiss Universities of Teacher Education and the University of Zurich's continuing education programme.

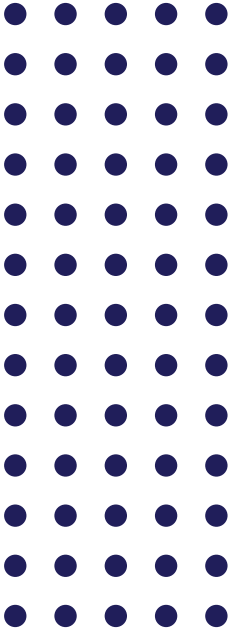
PSC offers internships for Master's and doctoral students as well as a Bachelor's in art education and scientific visualisation. By providing guidance on how to make science communication more effective, we equip scientists to engage effectively with the public. In this way, we are driving behaviour change and enabling people to turn to science when faced with challenges.

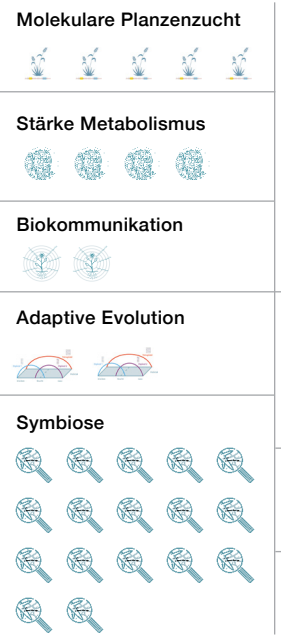
We value partnership to maximise our collective impact in society – PSC is a trusted partner to Zurich University of the Arts, Zurich University of Teacher Education, and museums and botanical gardens.

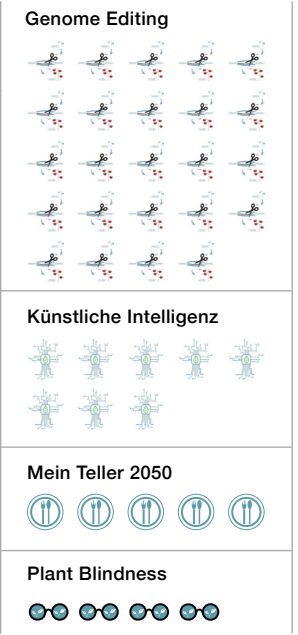
Plant Science at School

Continued education for teachers
65 Events
1,497 Participants

Discovery Workshops for Youth
159 Workshops
2,891 Participants
Since 2016







Continued education for teachers. Topics include plant ecophysiology, molecular biology, phylogeny, artificial intelligence and biotinkering. **School class workshops.** In the SNSF Agora project “PSC Discovery Program for Youth”, PSC developed workshops and learning materials for secondary school level in collaboration with educators at the ETH Zurich MINT Lernzentrum (2015–2018).

NACHTAKTIV

18 Events
1,340 Participants
Since 2021

https://nachtaktiv.ethz.ch

NACHTAKTIV is a scientainment programme for youth. Here, PSC organises a party-style event in a museum for young people between the ages of 16 to 30. NACHTAKTIV conveys and discusses knowledge gleaned from current research including environmental science, future food, engineering, robotics, AI, ethics, architecture, and space travel. The science activities are led by students of ETH Zurich, University of Zurich and University of Basel; selected spin-offs enrich the programme by presenting their inventions. Each event focuses on a different theme, complementing the current exhibition. By embedding the theme evenings in museum landscapes or adventure worlds, we want to connect to a holistic way of thinking about the natural sciences that takes into account socio-cultural aspects.

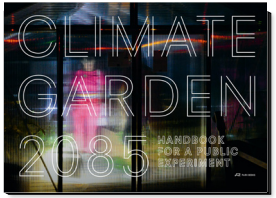
Participating museums
Zurich: FIFA Museum, Kulturama Museum des Menschen, Kunsthaus Mühlerama, Museum für Gestaltung, Museum Rietberg, Schweizer Finanzmuseum, Sukkulenten-Sammlung, Tram Museum, WOW Museum, ZAZ BELLERIVE Zentrum Architektur
Winterthur: Gewerbemuseum
University of Zurich: Science Pavilion and Botanical Garden
ETH Zurich: focus Terra

Participating spin-offs and start-ups
Aisot (ETH Spin-off), Stefan Klauser
Alter Ego Technologies (ETH SPH), Fayçal Mhamdi and Pietro Zulli
Animatico (ETH Spin-off), Christian Schüller and Patrick Karpiczenko
Antefil (ETH Spin-off), Nicole Aegerter
BATVISION (ZHdK Spin-off), Eliane Ziehlmann and Raffaele Grosjean
Bio-Design Hub, Aline Barrero Ochoa
Cropled AG, Stefan Schmutz
CustomSurg (ETH Spin-off), Thomas Zumbrunn
Designerís Club, Gioia Lorenz and Amber Roth
dimpora (ETH Spin-off), Mario Stucki
Goold (ETH Spin-off), Mattia Usuelli
Groam (Pioneer Fellows), Zuzana Sediva and Tomas Kolecar
Incon.ai, Tim Sandy and Cyrill Hedinger
IT is Foundation, Mark G. Douglas
Kuori materials, Sarah Kim Harbarth
Next Guide (ETH SPH), Alexander Bayer, Arvid Gollwitzer and Isha Gupta
No-Touch Robotics, Marcel Schuck
Precious Plastic (ETH SPH), Veronica Contucci, Alina Riabova and Lennart Doppenschmitt
sallea (Pioneer Fellows), Nicole Kleger and Simona Fehlmann
Sustainable Planet, Sven Kaufmann
Treeless Pack (ETH SPH), Patrycja Kucharczyk and Adam Aleksander
URBNC3 (ETH SPH), Linda Wang and Roman Wyss
Vizrt (Start-up Libero Vision), Janick Cardinale
YASAI (ETH Spin-off), Mark Essam Zahran

Climate Garden 2085

41 Events in 24 schools
4 Exhibitions in botanical gardens and public places
40,000 Participants
Since 2016

https://klimagarten.ethz.ch



In 2021, nominated for:

K3-Preis für Klimakommunikation

The *Climate Garden 2085* is a travelling art-science experiment that brings climate change scenarios to a tangible human temporal and spatial scale. It invites the public to personally experience climate scenarios and their predicted effects on agricultural plants. Science and art help in envisioning our future green cities, landscapes and agriculture. Google map of participating schools

Juanita Schlaepfer-Miller, Christoph Kueffer and Manuela Dahinden (2023). Climate Garden 2085: An easily applicable transdisciplinary public art-science experiment for transformative learning about climate change. *Environ Dev Sustain.* https://doi.org/10.1007/s10668-023-03899-2

Dialog im Quartier

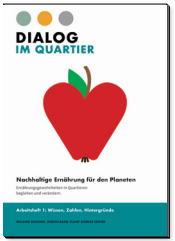
38 Events in 3 towns
2,153 Participants
Since 2021

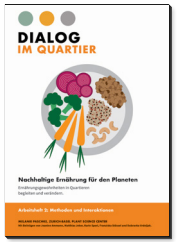
https://deinquartiernachhaltig.org

In 2022, nominated for:

K3-Preis für Klimakommunikation

Dialog im Quartier is an intervention programme to encourage neighbourhood residents to shift their eating habits towards a Planetary Health Diet (PHD). The aim is for participating households to adopt lifestyle and consumer habits that respect the 1.5°C climate target. This is achieved through hands-on activities and workshops, deploying methods that focus on nudging, change of norms and theory of planned behaviour.





Nachhaltige Ernährung für den Planeten: Ernährungsgewohnheiten in Quartieren begleiten und verändern. Arbeitsheft 1: Wissen, Zahlen, Hintergründe. Zurich-Basel Plant Science Center, Zurich (2022). Melanie Paschke. https://doi.org/10.3929/ethz-b-000547709

Nachhaltige Ernährung für den Planeten: Ernährungsgewohnheiten in Quartieren begleiten und verändern. Arbeitsheft 2: Methoden und Interaktionen. Zurich-Basel Plant Science Center, Zurich (2022). Melanie Paschke. Mit Beiträgen von Jeanine Ammann, Matthias Jeker, Karin Spori, Franziska Stössel, Dubravka Vrdoljak. https://doi.org/10.3929/ethz-b-000547601

Science Fairs

- **Scientifica**
  6 Events (Workshops and exhibition both)
  7,860 Participants

- **Treffpunkt Science City**
  4 Events (with 16 Workshops)
  1,720 Participants

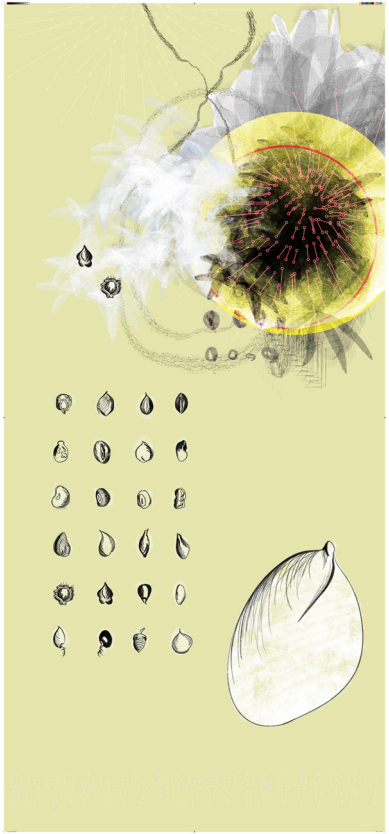
- **Abenteuer StadtNatur**
  2 Events (with 4 Workshops)
  74 Participants

- **Olma**
  PSC organized ETH exhibition in 2018 and 2019
  38,000 Participants

- **International Fascination of Plants Day**
  12 Events
  (Workshops, talks and guiding tours)
  850 Participants

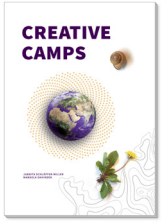
Citizen Science

Where seeds fall. If a piece of uncovered soil is left to itself, plants begin to sprout even in the busiest of city streets. The city air carries seeds that land somewhere, germinate, and become a new plant. The citizen science project “Where seeds fall” examined the survival chances of urban plant populations and their genetic diversity. The goal was to document which plants grow spontaneously in the city of Zurich and how they are influenced by the surrounding biodiversity. The more flowers in the vicinity, the more flowers reach your own garden. We distributed plant trays which participants filled with soil and set out on their balcony or garden. Between 2017 and 2019, around 90 people took part and sent in photos of seeds landing and germinating. These were uploaded to a dedicated page on the citizen science platform “Stadt, Wild, Tier”, which became an exchange hub for participants.



Kevin A. Vega, Juanita Schläpfer-Miller, Christoph Küffer (2021). Discovering the wild side of urban plants through public engagement. Plants, People, and Planet: 3 (4), 389–401. https://doi.org/10.1002/ppp3.10191

CreativeLabZ



28 Holiday camps
8 Project weeks in schools
35 Workshops
1,088 Participants
Since 2017

https://creativelabz.ethz.ch

In 2018, PSC founded the CreativeLabZ to bring its science education offers for youth under one umbrella. The aims are to raise awareness of future technologies and professions, and to foster future skills. The topics include e.g., digital fabrication, biodiversity and the use of plant-based materials in sustainable urban development.
2017–2020: In the SNSF Agora project PSC Creative Camps for Youth, we developed creative and inquiry-based workshop activities for young people aged 8 to 14 years – in collaboration with the Bachelor of Arts Education Department of the Zurich University of the Arts (ZHdK).
2021–2023: In the SNSF Agora project “Biotinkering for Youth”, we combined plant and computer science and sustainable design to create unique learning experiences for young people.
2021–2023: The Making@School project was ranked in the top ten innovation projects of the Digitalization Initiative of the Zurich Higher Education Institutions (DIZH). Together with the Zurich University of Teacher Education, we developed cross-disciplinary learning materials for schools in computational thinking and plant biology.

Creative Camps – Verknüpfung von Kunst- und Wissenschaftsvermittlung.
Juanita Schläpfer-Miller und Manuela Dahinden (Hrsg.).
Zurich-Basel Plant Science Center, Zurich (2020).
ISBN 978-3-907234-04-4
https://doi.org/10.3929/ethz-b-000421727

Expeditions

9 Expeditions
15 Workshops
600 Participants

2012–2015: In the SNSF Agora project “PSC Family Program – Plant Sciences Expeditions”, we organised family outings to research stations, where parents and children experimented together and learned first-hand from researchers about research in plant breeding and global climate and land use changes in the Alps.

The popular expeditions to the ALPFOR Research Station at the Furka Pass continued, organised by Christian Körner and Erika Hiltbrunner at the University of Basel. The expeditions were supported by the Schweizerische Gemeinnützige Gesellschaft SGG in 2015 and 2016, and by the Stiftung zur Förderung der Pflanzenkenntnis in 2017.

Pflanzenwissenschaftliche Experimente für Familien und Schulklassen. Manuela Dahinden, Melanie Paschke (Hrsg.)
Zurich–Basel Plant Science Center, Zurich (2019).
ISBN 978-3-906327-05-1

Finances

The competence center holds a strong fundraising profile, opening doors for plant science research, education and outreach.

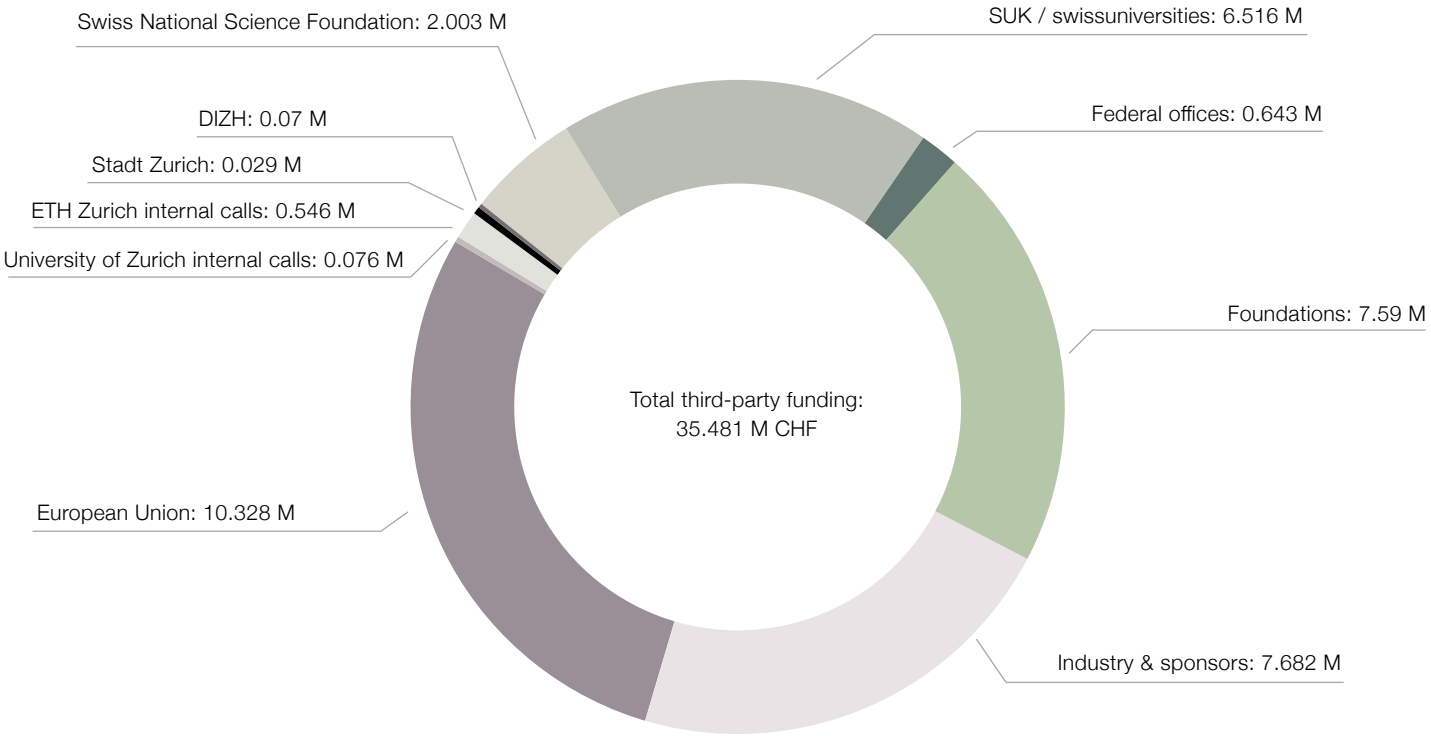
PSC has secured third-party funding amounting to CHF 35.5 million, mainly through the highly competitive European Research Framework Programme FP7 and Horizon 2020, as well as in collaboration with industry and foundations. Our fundraising activities have produced an excellent return on investment for the partner universities, with 12.5% internal contributions to core coordination resulting in 87.5% returns to research, education and outreach.

Core contributions of partner universities to management office:

ETH Zurich:	1.511 M
University of Zurich:	1.456 M
University of Basel:	0.955 M
Membership fees:	0.493 M

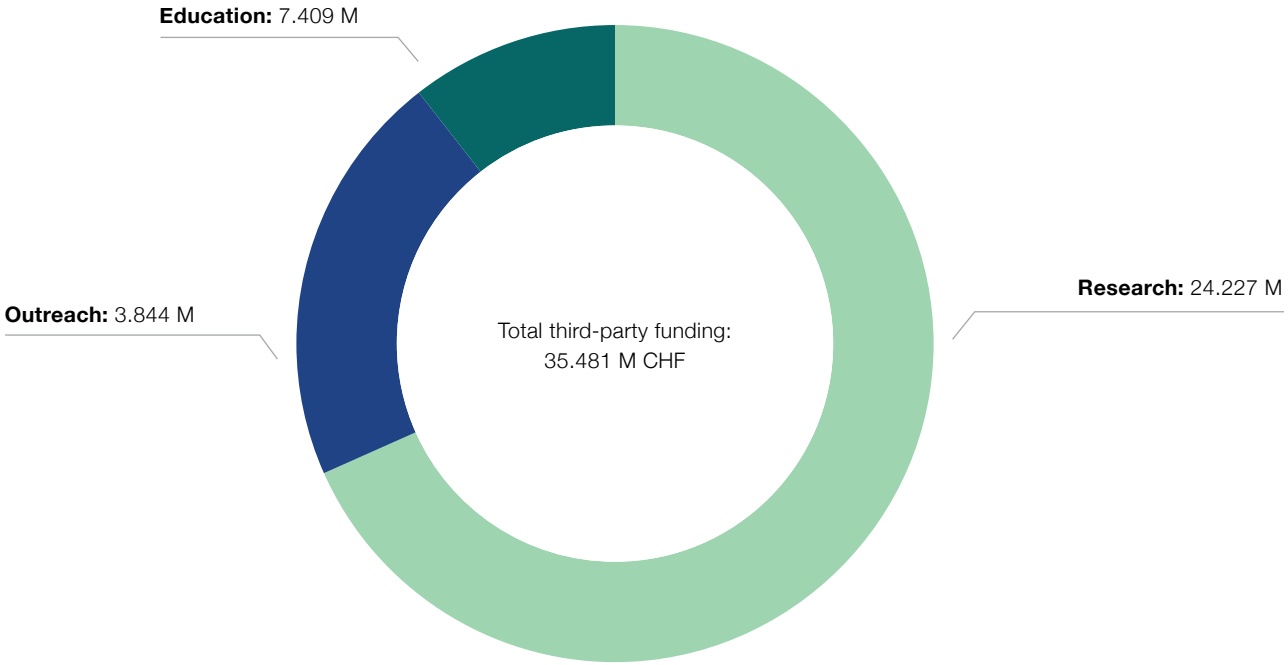
Total contributions of partner universities (2000-2023) are 4.416 M CHF.
In addition, we have received financial support for education by the Life Science Zurich Graduate School.

Sources of third-party funding



Status third-party funding by 30.11. 2023.
Number of research agreements and contracts: 100.

Breakdown of third-party funding



Status third-party funding by 30.11. 2023.

Funding organisations and sponsors

Foundations
3fo Foundation
Christoph Merian Foundation
Cogito Foundation
Drosos Foundation
Gebert Rüf Foundation
Mercator Foundation Switzerland
Paul Schiller Foundation
Schweizerische Gemeinnützige Gesellschaft SGG
Stiftung zur Förderung der Pflanzenkenntnis

Industry & sponsors
Accenture
Actelion
CSL Behring Schweiz
DE BORD INTERNATIONAL
DSM Nutritional Products AG
Ernst & Young Ltd
IBM Research GmbH
Lonza Group AG
Merck (Schweiz) AG
PWC
Roche
Syngenta Crop Protection AG

Swiss National Science Foundation (SNSF)
Agora – Science communication
SOR4D – Solution-oriented research for development programme
ProDoc (Former program for doctoral education)

European Union
7th Framework Programme (2007-2013)
Horizon 2020 (2014-2020)

University programmes
Digitalization Initiative of the Zurich Higher Education Institutions (DIZH)
Innovedum ETH Zurich
Lehrkredit UZH
Life Science Graduate School
SUK/ swissuniversities

Federal offices
Swiss Federal Office for the Environment (FOEN)
Amt für Umwelt und Energie Luzern (AUE)
Swiss Federal Office for Gender Equality (FOGE)

Others
Energiefond der Stadt Zürich
Stadt Zürich

Outlook

PSC addresses today's pressing global issues such as food security, climate change, soil degradation, biodiversity loss and ecosystem services depletion. Our endeavours align with the 17 Sustainable Development Goals set by the United Nations to provide the growing world population with enough nutritious food and to maintain or restore a healthy, sustainable living environment.

Examples of ongoing projects:

Traditional medicine in transition. This impact-oriented research and exhibition project investigates and documents local knowledge and cultural practices surrounding medicinal plant use in Uganda and Switzerland. The project aims to increase the validation and valorisation of TM plant knowledge in Uganda and enhance the sustainable use, cultivation and protection of medicinal plants and biodiversity. Particular attention will be given to exploring museums as a communication and participative research tool in remote areas. Coordinated by Caroline Weckerle – Curator of the Botanical Garden at the University of Zurich. Funded by SNSF SOR4D (Solution-oriented Research for Development Programme).

https://tradmedit.com

Evidence-based dialogue on trade-offs in wicked societal problems. For the ENGAGE initiative, ETH Zurich, EPFL, Eawag, Empa and WSL are joining forces to create a national-level platform for dialogue between science and society. The aim is to promote mutual understanding and develop educational opportunities for researchers. PSC's role here will be to develop and implement teaching formats that train researchers and stakeholders on how to engage in policy dialogues on wicked societal problems in an open, respectful, and solution-oriented manner. Coordinated by Christian Stamm – EAWAG.

Maximise access to and use of natural history collections (NHCs). NHCs are preserved historical records of species that hold a wealth of information, including genetic information and ecological data. The E-Specimina project aims at leveraging preserved plant specimens to support biodiversity research and to foster Open Science practices. The idea is to increase scientific and educational use of digital NHCs by improving interoperability and access to data. A key aspect is raising the awareness of the importance of integrating all organismal research data in line with FAIR principles. Coordinated by Reto Nyffeler – Curator of the Herbarium and Botanical Garden at the University of Zurich. Funded by swissuniversities.

www.e-specimina.ch

More to come....

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