





**Zurich-Basel Plant Science Center** 

# **PlantScienceNews**

No. 44, Fall 2023



# Editorial

### The impact of plant sciences on our lives

The field of plant science has a long history. In addition to describing the beauty and diversity of the plant kingdom, plant science research has contributed to the general body of scientific knowledge. Many fundamental mechanisms have first been detected in plants, the most famous being the principle of genetic inheritance discovered by Mendel while studying peas. Other significant insights include the role of light in regulating the physiologic responses of higher organisms (phytochromes), the transposition of genetic elements (controlling elements in maize) and the nature of enzymes as proteins (urease). Research on a plant virus contributed to finding the structure of DNA (X-ray diffraction with the tobacco mosaic virus) and helped us understand the role of nucleic acids in the genetic material of all life forms. Recent discoveries in gene silencing are utilized in medicine and research.

This year's 25<sup>th</sup> anniversary symposium on the 8<sup>th</sup> of December will bring together world-leading scientists under the scope: Impact of plant sciences on our lives – food, health, environment and knowledge. The symposium promises to be an educational and enriching event, bringing together friends, colleagues and the partner organizations of the Plant Science Center.

With our Moments of Discovery exhibition, we will be presenting a collection of some of our members' latest discoveries. The talented young illustrator Gaia Codoni has translated these plant science discoveries into artistic compositions, as shown on the cover of this newsletter.

Your presence would add to the enjoyment of the evening, and we look forward to celebrating the success of the Plant Science Center with you.

Thank you for your dedication to and support for the PSC over the last years. We can't wait to share this special event with you.

Sincerely, Manuela Dahinden & Melanie Paschke, PSC Managing Directors AT A GLANCE...... 3 Awards and open call

DATA MANAGEMENT...... 8 E-Specimina

SCIENCE HIGHLIGHTS...... 10 Outstanding publications by our members

NEW MEMBER	14
Rodrigo Cámara Leret	

SCIENCE & POLICY...... 15 Future of land use in Switzerland

PSC EDUCATION...... 16 New initiatives and course offers

INNOVATION	20
Interview with Treeless Pack	

PSC OUTREACH	22
Ongoing programs	

ANNOUNCEMENTS...... 27
Job offers

PSC Managing Office: Manuela Dahinden, Managing director research and outreach | Melanie Paschke, Managing director education and science-society dialogue | Romy Kohlmann, Finances, events and program coordinator | Barbara Templ, Data science project manager | Luisa Last, Coordinator PhD Program Science and Policy & RESPONSE Doctoral Program | Yvonne Möller-Steinbach, Coordinator PhD Program Plant Sciences and outreach at schools | Reka Mihalka, Teaching expert for Al tools | Daniela Gunz, *fem*inno program coordinator | Juanita Schläpfer, Outreach manager | Beatrice Kiser, NACHTAKTIV project coordinator | Dubravka Vrdoljak, Dialog im Quartier project coordinator | Krisztina Balazs, Marketing and executive assistant | Jelena Rajkov, Coordinator Basel.

### Awards

Florian Schiestl (University of Zurich) was awarded the ISCE Silverstein-Simeone Award by the International Society of Chemical Ecology in 2023 for his outstanding achievements in chemical ecology.

www.chemecol.org/silverstein-simeone. shtml

Jaboury Ghazoul (ETH Zurich) has been elected as a Fellow of the Royal Society of Edinburgh. The Royal Society comprises around 1,800 leading experts in the sciences, arts, business professions and the third and public sectors, with links to Scotland.

https://rse.org.uk

**Nina Buchmann** (ETH Zurich) received the Ecology and Evolution in Switzerland Leader Award 2023.

https://research.com/u/nina-buchmann

The ETH BiodivX team made it into the finalist team in the XPRIZE Rainforest competition. The finals will take place in August 2024 in South America or Africa. https://biodivx.org

Maria Santos (University of Zurich) is one of the five winners of the Swiss Re Foundation Challenge: Modelling biodiversity and ecosystem services loss scenarios. Her project examines the current status and the projected future of biodiversity and ecosystem services in all mountain, island and delta socialecological systems at the global level. www.swissre.com/institute/partnerships/ modelling-biodiversity-ecosys-

tem-boost-resilience.html#awardedprojects

Christian Geckeler, Sergio Ramos, Meredith Schuman and Stefano Mintchev are the winners of the Best Paper Award at the workshop "Agri-Food Robotics – From Farm to Fork", organized at the ICRA 2023 conference. The paper is entitled "Plant-EcoAIR: Scalable Airborne Detection of Plant Herbivory using Robotic Volatile Sampling", and marks the first steps in utilizing chemical signals for early stress detection in crops, opening up new avenues for precision agriculture beyond visual remote sensing. This achievement is the outcome of a collaborative effort between the Spatial Genetics lab, led by Meredith Schuman at University of Zurich, and the Environmental Robotics lab, led by Stefano Mintchev at ETH Zurich. The project receives support from the PSC-Syngenta-Fellowship Program.

**Francesca Zuffa**, PhD student in the Molecular Plant Breeding group at ETH Zurich, received the ISHS Young Minds Award of the International Society for Horticultural Sciences for the best poster presentation at the XVI EUCARPIA Symposium on Fruit Breeding and Genetics.

www.ishs.org/young-minds-award

**Chloe Manzanares**, senior researcher in the Molecular Plant Breeding group at ETH Zurich, was honored for the best key note talk at the 35<sup>th</sup> EUCARPIA Fodder Crops and Amenity Grasses Section Conference. In addition, she received the Dirk Reheul's Award in recognition of outstanding achievements in forage and turf research for the group's work on self-incompatibility in grasses.

www.forages-eucarpia.org/fcagmeeting-2023/

# Open call

### **PSC-SYNGENTA FELLOWSHIP PROGRAM**

This funding scheme promotes bottom-up and innovative research in plant sciences focusing on: climate change – challenges and opportunities in agriculture (or crop production). Topics may include: (1) Developing knowledge and tools to better predict the effects of climate change on agriculture systems (at different spatial and temporal scales). (2) Advancing on fundamental & applied plant science to mitigate adverse climatic events and secure crop protection and production. (3) Unearth new discoveries and inventions to feed the innovation process in sustainable crop protection and production. Proposals can be submitted until 1 November 2023. Acceptance of the project includes financial support of CHF 225,000 for a PhD student (with an expected 4-year PhD duration) or CHF 150,000 for a postdoc (max. 18 months). Research costs / consumables need to be co-funded by the applicants. A maximum of CHF 375,000 in funding will be available for this call. Please take into consideration that applicants of approved projects will have to accept the terms and conditions of the agreement between the three PSC partner universities and Syngenta Crop Protection AG.

### Contact: mdahinden@ethz.ch

www.plantsciences.ch/research/fellowships/syngenta.html

### **PSC-JRC Collaborative Doctoral Program**

The PSC-JRC Collaborative Doctoral Program is a hosted by ETH Zurich, University of Zurich and the Joint Research Center (JRC). The JRC's mission is to support EU policy and decision-making. The program started in 2019 and awarded four PhD student fellowships in the topics "Bio-economy and forests" and "Soil and land use change". The PhD students are enrolled in the Science and Policy PhD program coordinated by the PSC.

www.plantsciences.uzh.ch/en/research/ fellowships/jrc.html **Bio-economy and forests** 

### Releasing global forests from human management: How much more carbon could be stored?

According to the Intergovernmental Panel for Climate Change (IPCC), we need to reach carbon neutrality by 2050 to limit global warming to a safe, manageable level. The pathways that have been designed to reach carbon neutrality not only depend on strong  $CO_2$  emission cuts but also rely on carbon sinks to remove some  $CO_2$  from the atmosphere. One of the most important global carbon sinks comes from forests. In the past decades, almost one-third of all emissions were absorbed by vegetation. However, the global impact of management (for example, harvesting) on the carbon budget of forests remains poorly quantified.

During his fellowship, PhD student Caspar Roebroek brought together competences on climate modelling and satellite data analysis skills in line with the European Union's trajectory to becoming net carbon neutral in the coming decades.

One proposed forest-based strategy for climate change mitigation is to reduce forest management – such as logging – in order to increase the amount of carbon stored in forests. As part of his PhD, Caspar worked on defining a theoretical ceiling on carbon storage in trees to estimate how much more carbon they could hold in the complete absence of management. Although hypothetical, this scenario gives us insight into how much such strategies could, at best, contribute to climate change mitigation. Comparing this hypothetical potential carbon storage to the current amount of carbon stored in forests gives us the additional carbon storage potential (CSP), presented in Figure 1 at a global and country scale. The results were published earlier this year in *Science* (Roebroek et al. 2023). In this paper, the authors describe that this strategy would store at most 45 petagrams of carbon, approximately equivalent to 4–5 years of all human CO<sub>2</sub> emissions combined (at the 2019 rate).

Another proposed forest-based climate change mitigation strategy is to increase the amount of land covered with forests, by reforesting previously forested areas or afforesting areas that have not (recently) been covered with trees. However, storing enough carbon to mitigate climate change in a meaningful way requires massive amounts of land. The research team found that to compensate for even a single year of global  $CO_2$  emissions, about 1.6 million km<sup>2</sup> of land is needed. To put this into perspective, this is an area larger than Germany, France and Spain combined. This strategy is complicated by the strong competition for land presented by agriculture and urban expansion, which is especially prevalent given the projected population increase in the coming decades.

Together, storing carbon in existing forests by forgoing management practices and planting new forests has the potential of sequestering  $CO_2$  from the



**Figure 1: Carbon storage potential.** (a) Additional carbon storage potential (CSP) in the hypothetical scenario in which all forests would return to their natural equilibrium if all direct human management was removed from them. The CSP is calculated from the difference between biomass carrying capacity and the expected biomass (the biomass that would occur under local conditions with the given natural disturbance regime and average intensity of human intervention). (b) National statistics of additional CSP for countries where absolute values exceed 0.7 Pg biomass (Roebroek et al. 2023).

atmosphere and compensating for carbon emissions. The scale of these processes is, however, insufficient to really compensate for the current rates of emissions. This carbon sink should instead be used to reach carbon neutrality by compensating for only the emissions of sectors which we currently cannot decarbonize (quickly), such as construction and agriculture, when all other emissions have been drastically reduced. The data and insights produced in this PhD project could be used as a tool to start this conversation. Forests are no silver bullet that we can use to compensate for our (in)actions, but they are a resource that might guide us collectively through a transition phase.



Fellow: Caspar Roebroek

#### Supervisors

Sonia Seneviratne and Edouard Davin, Institute for Atmospheric and Climate Science (IAC), ETH Zurich

Alessandro Cescatti and Gregory Duveiller, European Commission, Joint Research Centre, Ispra, Italy

#### Reference

Caspar T. J. Roebroek, Gregory Duveiller, Sonia I. Seneviratne, Edouard L. Davin, Alessandro Cescatti (2023). Releasing global forests from human management: How much more carbon could be stored? *Science* 380,749–753. https://doi.org/10.1126/science.add5878

 $\langle \langle \gamma \rangle \rangle$ 

This project receives funding from the European Union under the Collaborative Doctoral Partnership Agreement No. 35317 with the European Commission Joint Research Centre and ETH Zurich. Soil and land use change

### Assessing soil microbial diversity across Europe

Soil is a crucial resource involved in the provision of many ecosystem services including food production, climate regulation and cultural and educational services. Consequently, soil ecosystems deserve the same level of protection as water, air and the marine environment. The EU Soil Strategy for 2030 aims to ensure healthy soil conditions by monitoring soil quality and promoting sustainable soil use and restoration. To achieve this, monitoring and protection plans for soil organisms need to be enforced, as they also play a vital role in ecosystem services like food production and climate regulation.

While the drivers of above-ground biodiversity have been extensively studied over the past decades, our understanding of belowground diversity (e.g., microbial diversity) is still limited, especially at large scales like continents. Conducting comprehensive surveys and collecting standardized datasets are necessary actions to assess the factors influencing soil community diversity. Currently, only a few surveys have been conducted at the continental scale, hindering our understanding of how belowground communities assemble and respond to perturbation. To address this, the European Commission introduced a soil biodiversity module to the Land Use/Cover Area frame Survey (LUCAS) in 2018. https://esdac.jrc.ec.europa.eu/projects/lucas

LUCAS is the largest European soil survey for biodiversity; it gathers soil biological data from over 700 sites across different vegetation cover types ordered along an increasing gradient of land-use perturbation, from woodlands to croplands (see Figure 2). The samples were analyzed using DNA metabarcoding methods, and soil properties were measured according to ISO standards. In order to promote research and exchange with researchers at the European Union, a collaborative doctoral partnership was established between the European Commission's Joint Research Centre in Ispra and the University of Zurich to investigate patterns of soil bacteria and fungi for the first time at the European scale under a wide range of soil and climatic conditions. This partnership and the application procedure have been coordinated by the PSC, and a joint PhD was established.

The first results of this project have been recently published in *Nature Communications* (Labouyrie et al. 2023). It demonstrated the effects of land use and patterns in soil microbial diversity across Europe. The work further emphasized the significance of both taxonomic and functional annotations in understanding soil microbial diversity. It showed that more disturbed areas like croplands and grasslands exhibit higher richness and diversity but may also harbor a higher number of undesirable taxa, like potential plant pathogens. Relying solely on taxonomic diversity may thus lead to the misleading assumption that higher microbial biodiversity translates to enhanced ecosystem functioning.

The study also highlighted the diverse responses of soil communities to contrasting environmental conditions. Bacterial diversity was primarily influenced by soil conditions, while fungal diversity was shaped by vegetation cover. We argue that managing vegetation cover alongside other management practices focused on soil can enhance the conservation of soil microbial diversity.

### PlantScienceNews No. 44, Fall 2023



**Figure 2: Sampling design**. (a) Sampling points distribution coloured by vegetation cover type. The number of sites is indicated between brackets. (b) Vegetation cover types ordered along a gradient of increasing land-use perturbation (Labouyrie et al. 2023). © European Union, 2023.

It is crucial to consider different drivers and their impacts on specific functional groups when implementing conservation measures.

Studying the impact of individual factors is valuable, but learning more about their combined effects can help us monitor and preserve soil variety. Identifying clusters of action for implementing suitable monitoring and preservation actions in specific areas could indeed be done by segmenting huge areas into patches depending on environmental characteristics that affect targeted microorganisms. In our next set of activities, we will investigate three-way interactions between pH and land cover as drivers of microbial diversity, produce maps of microbial diversity across Europe and investigate the role of pesticides as drivers of microbial communities across Europe.



Fellow: Maëva Labouyrie

#### Supervisors

Marcel van der Heijden, Professor for Agroecology and Plant-Microbiome Interactions at University of Zurich and research group leader at Agroscope Reckenholz

Alberto Orgiazzi, Land Resources Management Unit (D3), European Commission, Joint Research Centre, Ispra, Italy

Ferran Romero, Plant-Soil Interactions group at Agroscope Reckenholz, Zurich

#### Reference

Maëva Labouyrie, Cristiano Ballabio, Ferran Romero, Panos Panagos, Arwyn Jones, Marc W. Schmid, Vladimir Mikryukov, Olesya Dulya, Leho Tedersoo, Mohammad Bahram, Emanuele Lugato, Marcel G. A. van der Heijden & Alberto Orgiazzi (2023). Patterns in soil microbial diversity across Europe. *Nat Commun* 14, 3311. https://doi.org/10.1038/s41467-023-37937-4

0

This project receives funding from the European Union under the Collaborative Doctoral Partnership Agreement No. 35594 with the European Commission Joint Research Centre and University of Zurich.

# Empowering biodiversity researchers through Open Science and digital innovation

PSC is project partner in a new ORD project funded by swissuniversities. The project is chaired by Reto Nyffeler at University of Zurich and will empower researchers to lead in Open Science and to guide future directions within herbaria research.



In light of unprecedented global change and biodiversity loss, biologists face the challenge investigating how species respond to major environmental drivers such as habitat degradation, climate shifts, invasive species, pollution and overexploitation. Herbarium specimens are preserved historical records of species that hold a wealth of information, including genetic information and ecological data.

A new research collaboration entitled E-Specimina is funded by swissuniversities for 18 months and aims at leveraging preserved plant specimens to support biodiversity research and to foster Open Science practices.

The two main focal (project) areas are as follows:

Advancing Open Research Data (ORD) practices: By melding ORD with the rich repository of herbarium specimens, we are well positioned to support large-scale biodiversity assessments. We aim to amplify insights by building on existing data, workflows and infrastructure, resulting in a deeper understanding of how global change affects our ecosystems.

**Transforming biodiversity discovery and conservation:** Through innovative digital tools, we seek to transform the way researchers interact with herbarium specimens. Our digital workbench integrates diverse specimen data types, which fosters seamless digitization, curation and data linkages. This not only revitalizes physical specimens with new layers of annotation but also opens up avenues for evolutionary, ecological and conservation research.

**Project partners:** Reto Nyffeler and Barbara Templ from the Institute of Systematic and Evolutionary Botany (ISEB) at the University of Zurich provide the leadership necessary to drive the project's objectives forward. Collaboration is the cornerstone of our venture. Our partners (Simon Aschbacher (University of Zurich); Manuela Dahinden (PSC); Jurriaan de Vos (University of Basel)) embody a diverse range of perspectives and domains within the scientific community.

In focusing on these core objectives, we envision our collaborative efforts to not only shape the Swiss research landscape but also to serve as a model for wider European application. By championing Open Science principles and embracing digital advancements, our project seeks to illuminate the intricate dynamics of global change and biodiversity loss. We stand committed to a future where our understanding of the natural world is enriched through the integration of heritage, data and innovation.

E-Specimina holds significant appeal for various stakeholders within the plant science community, attracting attention from researchers (botanists, plant geneticists, ecologists, biodiversity experts), educators, conservationists and policymakers alike.

www.e-specimina.ch

### **Plenary talk**

### Unlocking the potential of E-Specimens in plant science research

by Reto Nyffeler, Curator of the Herbarium and Botanical Garden at the University of Zurich 19 January 2024 Annual Workshop of SwissCollNet in Bern

This talk promises to provide profound insights into the future of plant science research, addressing the landscape of existing Open Research Data (ORD) standards for organismal data in public databases.

https://swisscollnet.scnat.ch/de/exchange/ workshops/workshop\_01\_2024



# **Biodiversity: vulnerable richness**

### A new exhibition at ETH Zurich on life on Earth and the threats it faces.

Biodiversity is colourful, fragrant and melodious and takes on myriad forms. For centuries, researchers have studied this fabulous richness at different levels, from species and ecosystems right down to individual genes. This exhibition showcases a broad spectrum of insects and plants from natural history collections held by the ETH Zurich and the University of Zurich. Some of the specimens are truly spectacular, with countless fascinating and previously untold stories being revealed. Many deal with the inexorable destruction of biodiversity and the measures we can take to protect this rapidly dwindling treasure trove.

During your visit, you can discover and explore an impressive room full of insects and plants collected over the course of more than 200 years, two interactive slot machines that bring genetic diversity and genetic impoverishment of natural populations to life and a walk-in research station that transports you into the jungle of Madagascar and to the Central African Savannah. The exhibition curated by Alessia Guggisberg and Michael Greeff (ETH Zurich) is open daily from 10.00 to 17.00 until 14 November 2024 at "extract", the new exhibition space in the ETH Main Building. More information, including about guided tours and events, can be found here:

### https://extract.ethz.ch

Discover a diverse selection of literature on biodiversity on ETH Library @ swisscovery: https://eth.swisscovery.slsp.ch

### Nature (2023)

### https://doi.org/10.1038/s41586-023-06440-7

### Native diversity buffers against severity of non-native tree invasions

### Camille S. Delavaux, Thomas W. Crowther, Constantin M. Zohner, Niamh M. Robmann, Thomas Lauber, Johan van den Hoogen et al.

Determining the drivers of non-native plant invasions is critical for managing native ecosystems and limiting the spread of invasive species. Tree invasions in particular have been relatively overlooked, even though they have the potential to transform ecosystems and economies. Here, leveraging global tree databases, we explore how the phylogenetic and functional diversity of native tree communities, human pressure and the environment influence the establishment of non-native tree species and the subsequent invasion severity. We find that anthropogenic factors are key to predicting whether a location is invaded, but that invasion severity is underpinned by native diversity, with higher diversity predicting lower invasion severity. Temperature and precipitation emerge as strong predictors of invasion strategy, with non-native species invading successfully when they are similar to the native community in cold or dry extremes. Yet, despite the influence of these ecological forces in determining invasion strategy, we find evidence that these patterns can be obscured by human activity, with lower ecological signal in areas with higher proximity to shipping ports. Our global perspective of non-native tree invasion highlights that human drivers influence non-native tree presence and that native phylogenetic and functional diversity have a critical role in the establishment and spread of subsequent invasions.

### Nature Communications (2022)

https://doi.org/10.1038/s41467-022-35368-1 Recent speciation associated with range expansion and a shift to selffertilization in North American *Arabidopsis* 

Yvonne Willi, Kay Lucek, Olivier Bachmann & Nora Walden

The main processes classically evoked for promoting reproductive isolation and speciation are geographic separation reducing gene flow among populations, divergent selection and chance genomic change. In a case study, we present evidence that the additional factors of climate change, range expansion and a shift in mating towards inbreeding can initiate the processes leading to parapatric speciation. At the end of the last Pleistocene glaciation cycle, the North American plant Arabidopsis lyrata expanded its range and concomitantly lost its reproductive mode of outcrossing multiple times. We show that in one of the newly colonized areas, the selffertilizing recolonization lineage of A. lyrata gave rise to selfing A. arenicola, which expanded its range to subarctic and arctic Canada and Greenland, while the parental species remained restricted to temperate North America. Despite the vast range expansion by the new species, mutational load did not increase, probably because of selfing and guasi-clonal selection. We conclude that such peripheral parapatric speciation combined with range expansion and inbreeding may be an important but so far overlooked mode of speciation.

### Nature Communications (2023) https://doi.org/10.1038/s41467-023-36631-9 Climate-induced range shifts drive adaptive response via spatio-

### temporal sieving of alleles Hirzi Luqman, Daniel Wegmann, Simone Fior & Alex Widmer

Quaternary climate fluctuations drove many species to shift their geographic ranges, in turn shaping their genetic structures. Recently, it has been argued that adaptation may have accompanied species range shifts via the "sieving" of genotypes during colonization and establishment. However, this has not been directly demonstrated, and knowledge remains limited on how different evolutionary forces, which are typically investigated separately, interacted to jointly mediate species

responses to past climatic change. Here, through whole-genome re-sequencing of over 1200 individuals of the carnation Dianthus sylvestris coupled with integrated population genomic and gene-environment models, we reconstruct the past neutral and adaptive landscape of this species as it was shaped by the Quaternary glacial cycles. We show that adaptive responses emerged concomitantly with the post-glacial range shifts and expansions of this species in the last 20,000 years. This was due to the heterogenous sieving of adaptive alleles across space and time, as populations expanded out of restrictive glacial refugia into the broader and more heterogeneous range of habitats available in the present-day inter-glacial period. Our findings reveal a tightly-linked interplay of migration and adaptation under past climateinduced range shifts, which we show is key to understanding the spatial patterns of adaptive variation we see in species todav.

### Nature Communications (2023) https://doi.org/10.1038/s41467-023-37164-x

The core metabolome and root exudation dynamics of three phylogenetically distinct plant species

### Sarah McLaughlin, Kateryna Zhalnina, Suzanne Kosina, Trent R. Northen & Joelle Sasse

Root exudates are plant-derived, exported metabolites likely shaping root-associated microbiomes by acting as nutrients and signals. However, root exudation dynamics are unclear, and thus also if changes in exudation are reflected in changes in microbiome structure. Here, we assess commonalities and differences between exudates of different plant species, diurnal exudation dynamics, as well as the accompanying methodological aspects of exudate sampling. We find that exudates should be collected for hours rather than days as many metabolite abundances saturate over time. Plant growth in sterile, nonsterile, or sugar-supplemented

environments significantly alters exudate profiles. A comparison of Arabidopsis thaliana, Brachypodium distachyon and Medicago truncatula shoot, root and root exudate metabolite profiles reveals clear differences between these species, but also a core metabolome for tissues and exudates. Exudate profiles also exhibit a diurnal signature. These findings add to the methodological and conceptual groundwork for future exudate studies to improve understanding of plant-microbe interactions.

### Cell (2023)

https://doi.org/10.1016/j.cell.2023.04.008

Phylogenomic discovery of deleterious mutations facilitates hybrid potato breeding

### Yaoyao Wu, Dawei Li, Yong Hu, ..., Thomas Städler, Edward S. Buckler & Sanwen Huang

Hybrid potato breeding will transform the crop from a clonally propagated tetraploid to a seed-reproducing diploid. Historical accumulation of deleterious mutations in potato genomes has hindered the development of elite inbred lines and hybrids. Utilizing a whole-genome phylogeny of 92 Solanaceae and its sister clade species, we employ an evolutionary strategy to identify deleterious mutations. The deep phylogeny reveals the genome-wide landscape of highly constrained sites, comprising ~2.4% of the genome. Based on a diploid potato diversity panel, we infer 367,499 deleterious variants, of which 50% occur at non-coding and 15% at synonymous sites. Counterintuitively, diploid lines with a relatively high homozygous deleterious burden can be better starting material for inbred-line development, despite showing less vigorous growth. Inclusion of inferred deleterious mutations increases genomic-prediction accuracy for yield by 24.7%. Our study generates insights into the genome-wide incidence and properties of deleterious mutations and their far-reaching consequences for breeding.

### Nature (2022)

https://doi.org/10.1038/s41586-022-04808-9 Graph pangenome captures missing heritability and empowers tomato breeding

Yao Zhou, Zhiyang Zhang, Zhigui Bao, Hongbo Li, Yaqing Lyu, Yanjun Zan, Yaoyao Wu, Lin Cheng, Yuhan Fang, Kun Wu, Jinzhe Zhang, Hongjun Lyu, Tao Lin, Qiang Gao, Surya Saha, Lukas Mueller, Zhangjun Fei, Thomas Städler, Shizhong Xu, Zhiwu Zhang, Doug Speed & Sanwen Huang

Missing heritability in genome-wide association studies defines a major problem in genetic analyses of complex biological traits. The solution to this problem is to identify all causal genetic variants and to measure their individual contributions. Here we report a graph pangenome of the tomato constructed by precisely cataloguing more than 19 million variants from 838 genomes, including 32 new reference-level genome assemblies. This graph pangenome was used for genome-wide association study analyses and heritability estimation of 20,323 gene-expression and metabolite traits. The average estimated trait heritability is 0.41 compared with 0.33 when using the single linear reference genome. This 24% increase in estimated heritability is largely due to resolving incomplete linkage disequilibrium through the inclusion of additional causal structural variants identified using the graph pangenome. Moreover, by resolving allelic and locus heterogeneity, structural variants improve the power to identify genetic factors underlying agronomically important traits leading to, for example, the identification of two new genes potentially contributing to soluble solid content. The newly identified structural variants will facilitate genetic improvement of tomato through both marker-assisted selection and genomic selection. Our study advances the understanding of the heritability of complex traits and demonstrates the power of the graph pangenome in crop breeding.

### Mol Biology and Evolution (2023) https://doi.org/10.1093/molbev/msac259

Fine-mapping and comparative genomic analysis reveal the gene composition at the S and Z selfincompatibility loci in grasses

Marius Rohner, Chloé Manzanares, Steven Yates, Daniel Thorogood, Dario Copetti, Thomas Lübberstedt, Torben Asp & Bruno Studer

Self-incompatibility (SI) is a genetic mechanism of hermaphroditic plants to prevent inbreeding after self-pollination. Allogamous Poaceae species exhibit a unique gametophytic SI system controlled by two multi-allelic and independent loci, S and Z. Despite intense research efforts in the last decades, the genes that determine the initial recognition mechanism are yet to be identified. Here, we report the fine-mapping of the Z-locus in perennial ryegrass (Lolium perenne L.) and provide evidence that the pollen and stigma components are determined by two genes encoding DUF247 domain proteins (ZDUF247-I and ZDUF247-II) and the gene sZ, respectively. The pollen and stigma determinants are located side-by-side and were genetically linked in 10,245 individuals of two independent mapping populations segregating for Z. Moreover, they exhibited high allelic diversity as well as tissue-specific gene expression, matching the expected characteristics of SI determinants known from other systems. Revisiting the S-locus using the latest high-quality whole-genome assemblies revealed a similar gene composition and structure as found for Z, supporting the hypothesis of a duplicated origin of the two-locus SI system of grasses. Ultimately, comparative genomic analyses across a wide range of self-compatible and self-incompatible Poaceae species revealed that the absence of a functional copy of at least one of the six putative SI determinants is accompanied by a self-compatible phenotype. Our study provides new insights into the origin and evolution of the unique gametophytic SI system in one of the largest and economically most important plant families.

### ISME Communications (2023)

### https://doi.org/10.1038/s43705-023-00282-0 Potential relevance between soybean nitrogen uptake and rhizosphere prokaryotic communities under waterlogging stress

### Tengxiang Lian, Lang Cheng, Qi Liu, Taobing Yu, Zhandong Cai, Hai Nian & Martin Hartmann

Waterlogging in soil can limit the availability of nitrogen to plants by promoting denitrification and reducing nitrogen fixation and nitrification. The root-associated microorganisms that determine nitrogen availability at the root-soil interface can be influenced by plant genotype and soil type, which potentially alters the nitrogen uptake capacity of plants in waterlogged soils. In a greenhouse experiment, two soybean genotypes with contrasting capacities to resist waterlogging stress were grown in Udic Argosol and Haplic Alisol soils with and without waterlogging, respectively. Using isotope labeling, high-throughput amplicon sequencing and gPCR, we show that waterlogging negatively affects soybean yield and nitrogen absorption from fertilizer, atmosphere and soil. These effects were soil-dependent and more pronounced in the waterlogging-sensitive than tolerant genotype. The tolerant genotype harbored more ammonia oxidizers and less nitrous oxide reducers. Anaerobic, nitrogen-fixing, denitrifying and iron-reducing bacteria such as Geobacter/ Geomonas, Sphingomonas, Candidatus Koribacter and Desulfosporosinus were proportionally enriched in association with the tolerant genotype under waterlogging. These changes in the rhizosphere microbiome might ultimately help the plant to improve nitrogen uptake under waterlogged, anoxic conditions. This research contributes to a better understanding of the adaptability of soybean genotypes under waterlogging stress and might help to formulate fertilization strategies that improve the nitrogen use efficiency of soybeans.

### Nature Communications (2023) https://doi.org/10.1038/s41467-023-39572-5

Leaf-level coordination principles propagate to the ecosystem scale

Ulisse Gomarasca, Mirco Migliavacca, Jens Kattge, Jacob A. Nelson, Ülo Niinemets, Christian Wirth, Alessandro Cescatti, Michael Bahn, Richard Nair, Alicia T. R. Acosta, M. Altaf Arain, Mirela Beloiu, T. Andrew Black, Hans Henrik Bruun, Solveig Franziska Bucher, Nina Buchmann, Chaeho Byun, Arnaud Carrara, Adriano Conte, Ana C. da Silva, Gregory Duveiller, Silvano Fares, Andreas Ibrom, Alexander Knohl, ..., Markus Reichstein

Fundamental axes of variation in plant traits result from trade-offs between costs and benefits of resource-use strategies at the leaf scale. However, it is unclear whether similar trade-offs propagate to the ecosystem level. Here, we test whether trait correlation patterns predicted by three well-known leaf- and plant-level coordination theories - the leaf economics spectrum, the global spectrum of plant form and function, and the least-cost hypothesis - are also observed between community mean traits and ecosystem processes. We combined ecosystem functional properties from FLUXNET sites, vegetation properties and community mean plant traits into three corresponding principal component analyses. We find that the leaf economics spectrum (90 sites), the global spectrum of plant form and function (89 sites) and the least-cost hypothesis (82 sites) all propagate at the ecosystem level. However, we also find evidence of additional scale-emergent properties. Evaluating the coordination of ecosystem functional properties may aid the development of more realistic global dynamic vegetation models with critical empirical data, reducing the uncertainty of climate change projections.

### Nature Communications (2023)

https://doi.org/10.1038/s41467-023-39130-z Single-gene resolution of diversitydriven overyielding in plant genotype mixtures

Samuel E. Wuest, Lukas Schulz, Surbhi Rana, Julia Frommelt, Merten Ehmig, Nuno D. Pires, Ueli Grossniklaus, Christian S. Hardtke, Ulrich Z.

Hammes, Bernhard Schmid & Pascal A. Niklaus In plant communities, diversity often increases productivity and functioning. but the specific underlying drivers are difficult to identify. Most ecological theories attribute positive diversity effects to complementary niches occupied by different species or genotypes. However, the specific nature of niche complementarity often remains unclear, including how it is expressed in terms of trait differences between plants. Here, we use a gene-centred approach to study positive diversity effects in mixtures of natural Arabidopsis thaliana genotypes. Using two orthogonal genetic mapping approaches, we find that between-plant allelic differences at the AtSUC8 locus are strongly associated with mixture overyielding. AtSUC8 encodes a proton-sucrose symporter and is expressed in root tissues. Genetic variation in AtSUC8 affects the biochemical activities of protein variants and natural variation at this locus is associated with different sensitivities of root growth to changes in substrate pH. We thus speculate that - in the particular case studied here - evolutionary divergence along an edaphic gradient resulted in the niche complementarity between genotypes that now drives overyielding in mixtures. Identifying genes important for ecosystem functioning may ultimately allow linking ecological processes to evolutionary drivers, help identify traits underlying positive diversity effects and facilitate the development of high-performance crop variety mixtures.

### Nature Communications (2023)

### https://doi.org/10.1038/s41467-023-38375-y An updated floristic map of the world

### Yunpeng Liu, Xiaoting Xu, Dimitar Dimitrov, Loic Pellissier, Michael K. Borregaard, Nawal Shrestha, Xiangyan Su, Ao Luo, Niklaus E. Zimmermann, Carsten Rahbek & Zhiheng Wang

Floristic regions reflect the geographic organization of floras and provide essential tools for biological studies. Previous global floristic regions are generally based on floristic endemism, lacking a phylogenetic consideration that captures floristic evolution. Moreover, the contribution of tectonic dynamics and historical and current climate to the division of floristic regions remains unknown. Here, by integrating global distributions and a phylogeny of 12,664 angiosperm genera, we update global floristic regions and explore their temporal changes. Eight floristic realms and 16 nested sub-realms are identified. The previously-defined Holarctic, Neotropical and Australian realms are recognized, but Paleotropical, Antarctic and Cape realms are not. Most realms have formed since the Paleogene. Geographic isolation induced by plate tectonics dominates the formation of floristic realms, while current/historical climate has little contribution. Our study demonstrates the necessity of integrating distributions and phylogenies in regionalizing floristic realms and the interplay of macroevolutionary and paleogeographic processes in shaping regional floras.

Science Advances (2023) https://doi.org/10.1126/sciadv.ade4954

#### Precipitation is the main axis of tropical plant phylogenetic turnover across space and time

### Jens Ringelberg, Erik Koenen, Benjamin Sauter, Anahita Aebli, Juliana Rando, ..., Niklaus

### Zimmermann & Colin Hughes

Early natural historians – Comte de Buffon, von Humboldt and De Candolle – established environment and geography as two principal axes determining the distribution of groups of

organisms, laying the foundations for biogeography over the subsequent 200 years. However, the relative importance of these two axes remains unresolved. Leveraging phylogenomic and global species distribution data for Mimosoid legumes, a pantropical plant clade of around 3,500 species, we show that the water availability gradient from deserts to rain forests dictates turnover of lineages within continents across the tropics. We demonstrate that 95% of speciation occurs within a precipitation niche, showing profound phylogenetic niche conservatism, and that lineage turnover boundaries coincide with isohyets of precipitation. We reveal similar patterns on different continents, implying that evolution and dispersal follow universal processes.

### Ann. Review of Plant Biology (2023) https://doi.org/10.1146/annurev-arplant-040121-114908

### Where, when and why do plant volatiles mediate ecological signaling? The answer is blowing in the wind

### Meredith C. Schuman

Plant volatiles comprise thousands of molecules from multiple metabolic pathways, distinguished by sufficient vapor pressure to evaporate into the headspace under normal environmental conditions. Many are implicated as ecological signals, but what is the evidence - and how do they work? Volatiles diffuse, are carried by wind and may be taken up by other organisms or degrade with exposure to atmospheric ozone, radicals and UV light; visual signals such as colour are not subject to these complications (but require a line of sight). Distantly related plants - and nonplants - produce many of the same volatiles, yet specific compounds and blends may be distinct. Here, I present a quantitative review of the literature on plant volatiles as ecological signals, illustrating a field that has focused on developing ideas as much as reporting primary data. I discuss advantages and constraints, review recent advances and propose considerations for primary studies to elucidate particular functions of plant volatiles.

#### Current Biology (2023)

### https://doi.org/10.1016/j.cub.2023.03.075 Plant disease risk is modified by multiple global change drivers

### Anna-Liisa Laine

Plant diseases are strongly influenced by host biodiversity, spatial structure and abiotic conditions. All of these are undergoing rapid change, as the climate is warming, habitats are being lost, and nitrogen deposition is changing the nutrient dynamics of ecosystems with ensuing consequences for biodiversity. Here, I review examples of plant-pathogen associations to demonstrate how our ability to understand, model and predict disease dynamics is becoming increasingly difficult, as both plant and pathogen populations and communities are undergoing extensive change. The extent of this change is influenced via both the direct and combined effects of global change drivers, and the latter in particular are still poorly understood. Change at one trophic level is expected to drive change also at the other, and hence feedback loops between plants and their pathogens are expected to drive changes in disease risk both through ecological and evolutionary mechanisms. Many of the examples discussed here demonstrate an increase in disease risk as a result of ongoing change, suggesting that unless we successfully mitigate global environmental change, plant disease is going to become an increasingly heavy burden on our societies with far-reaching consequences for food security and functioning of ecosystems.

### Professor Rodrigo Cámara Leret, University of Zurich





Fieldwork in the Colombian Amazon. © Rodrigo.

In February 2023, Rodrigo Cámara-Leret joined the Department of Systematic and Evolutionary Botany of the University of Zurich as SNSF Starting Grant Assistant Professor. Rodrigo received his PhD from the Universidad Autónoma de Madrid in 2014, working with Manuel Macía. During his PhD, he studied the ecological correlates of palm use in northwestern South America and worked with several dozen indigenous and local communities for 18 months, building collaborative partnerships that last to this day.

Since completing his PhD, Rodrigo has been interested in developing interdisciplinary frameworks to study the drivers of human-plant interactions. In a first postdoc at the University of Aarhus with Henrik Balslev, he introduced trait-based approaches into ethnobotany to understand whether functional traits and species' ranges explain human utilization of tropical palms. Later, he developed the New Guinea Tropical Important Plant Areas program as an Early Career Research Fellow at the Royal Botanic Gardens Kew, where he synthesized 130 years of research on New Guinea's useful plants and applied Rabinowitz's ecological framework to study rarity in plant services. Rodrigo then moved to the University of Zurich in 2019 to work with Jordi Bascompte, where they introduced network science frameworks into ethnobotany to investigate how biological and cultural heritage jointly influence the structure of indigenous knowledge networks and to what degree indigenous medicinal plant knowledge is threatened from language or plant loss. The latter study was highlighted in the essential round-up of science news in Nature for showing that "most medicinal plants are known in only one language, and those languages are at risk of extinction". (www.nature.com/ articles/d41586-021-02590-8)

Rodrigo's work is firmly rooted in natural history and spans the science-policy interface. In 2020, he led a team of 99 botanists from 56 institutions to publish an expert-verified checklist of New Guinea's 13,634 known vascular plant species, revealing it is the most floristically diverse island in the world. That study was awarded the Marsh Directors Choice Publication Award for "it represents a huge collaborative effort, an impressive use of collections and datasets, and highlights the importance of fieldwork and botanical science in addressing the challenges of biodiversity loss." In 2022, Rodrigo was invited by the Tairona Heritage Trust and the Kogi people of Colombia to participate in the Múnekañ Masha ("let it be (re)born") restoration project endorsed by the UNESCO BRIDGES Coalition. The project intends to put Kogi indigenous ecological practices and scientific conservation into dialogue to jointly identify, assess and regenerate degraded lands in the Sierra Nevada de Santa Marta of Colombia.

Currently, within the SNSF Starting Grant "INDIGENOMICS", Rodrigo's group is working to link chemistry (from metabolomics) with indigenous knowledge to unravel the phytochemical space used by Amazonian indigenous communities and to predict how much phytochemical diversity may vanish as global change accelerates. His highly interdisciplinary group includes botanists, chemists, and pharmaceutical scientists as well as elders and apprentices of the endangered Matapí people who are conducting indigenous-led research to strengthen biolcultural conservation in the Amazon.

rodrigo.camaraleret@uzh.ch www.rcamaraleret.com

### Future of land use in Switzerland



On 26 September, PSC organized a fireside chat event in collaboration with the Franxini Project (https://franxini.reatch.ch). PSC scientists and representatives from governmental and non-governmental organizations discussed what it would mean for land use in Switzerland if the biodiversity targets formulated at COP15 were implemented throughout Switzerland. Among other things, we asked: What challenges and solutions to the biodiversity crisis are emerging? How can we protect species and habitats despite the increasing demand for land for food, feed and energy production, as well as housing?

At the 15<sup>th</sup> UN Biodiversity Conference (COP15 in 2022) in Montreal, Canada, all 195 countries agreed that 30% of land and water areas should be reserved for habitat and species protection. The envisioned time horizon for implementation is 2030. Two expert contributions provided an overview of where Switzerland stands today. Maria Santos (University of Zurich) presented international biodiversity targets and discussed implications for national implementation. Eva Spehn (Swiss Academy of Sciences) explained the implementation of the Global Biodiversity Framework (GBF) in Switzerland and potential and land-us conflicts Afterwards, small interdisciplinary groups discussed what Switzerland could look like in 2030 after the biodiversity targets are met and different actions were implemented.

The outcomes of the group discussions and the presentations will be published at: https://blogs.ethz.ch/Science\_and\_Policy

### Award for PSC Alumna

For the second time, a PSC alumnus of the PhD Program in Science and Policy has received a prestigious Politics scholarship for academics. Congratulations to **Selma Cadot**. Selma did her PhD in the group of Marcel van der Heijden at the University of Zurich on the topic of soil biodiversity and ecosystem functioning. Sema will work for the Parliamentary Services in Berne and support parliamentary legislative committees for about a year. **www.politikstipendien.ch** 

ं

This event was part of the RESPONSE Doctoral Program and received funding from the European Union's Horizon 2020 research and innovation program under the Marie Sklodowska-Curie (MSC) grant agreement No. 847585.





Impressions from the event. Our RESPONSE fellows presented their research and its relevance at the interface of science and policy as well as to achieving selected COP15 targets in a poster exhibition. Thanks to Alberto Linares, Fabian Hess, Paul Donadieu, Monika Goralczyk, Simon Landauer, Matthew Cooper, Xeniya Kim, Nathalia Pérez Cardenas, Roberto Rebollo Hernández, Carles Quesada Traver and Julie Lestang. © PSC.

## Navigating the future of education

PSC has launched a new Innovedum project: teaching and learning scientific writing with AI.

The project will focus on the use of generative AI tools based on large language models (LLMs), such as ChatGPT, in scientific writing at the Bachelor's, Master's and PhD level. The main goal of the project is to ensure that lecturers have the opportunity to gain an understanding of these new technological developments and apply these tools in their own teaching context. At the same time, we create opportunities for students to work with these tools and improve their digital literacy skills.

The project is coordinated by Melanie Paschke (PSC) and Manuel Sudau, in collaboration with Department of Environmental Systems Science (D-USYS) at ETH Zurich and the ETH Library. Réka Mihálka started the project in August 2023.

For questions please contact: Manuel Sudau manuel.sudau@usys.ethz.ch

Innovedum Focal Project: Assessing the Potential of Al for Scientific Writing



### Manuel, what do you want to achieve with the project?

On the one hand, I would like to actively help our lecturers to effectively use newly available technologies in their teaching, to create teaching materials with them as well as to collect common experiences. On the other hand, I would like to contribute to sharing many practical answers and examples with the ETH community on responsible ways of using AI in education.

Manuel Sudau is an educational developer at the Department of Environmental Systems Sciences and the Department of Educational Development and Technology at ETH Zurich. He has a background in geography, law and social sciences and did his PhD in environmental engineering. He has been teaching for more than a decade now in the fields of spatial and environmental planning, urban development, and scientific working. He enjoys applying new technologies in higher education and working with both students and lecturers to constantly improve the teaching and learning environment at ETH Zurich.



### Réka, what is your goal with the project?

I would like to spread awareness about the wonderful opportunities these tools can offer and also inform lecturers and students about the risks and limitations. With a balanced view (and a lot of practice!), everyone can improve the efficiency of the scientific writing process while maintaining their scientific integrity.

Réka is a lecturer on scientific writing. After acquiring her PhD in English from Eötvös Loránd University, Hungary, she moved to Switzerland and started teaching scientific writing. She has been offering courses at ETH Zurich and the Universities of Zurich, Bern, and Lucerne for almost a decade. She previously led an Innovedum project on the gamification of scientific writing at D-MTEC and on experiential learning about the publication process at D-MATL. Now she's contributing to the Innovedum project at D-USYS, which focuses on the use of generative AI in teaching and learning. Her main interests include gamification, autonomous learning, digital tools for learning and generative Al tools.

# **Monthly MondAls**

Brownbag series for lecturers, focused on the use of generative artificial intelligence in teaching at the Bachelor's, Master's and PhD level at D-USYS.



The events, which take place on the first Monday of each month, include an update, best-practice exchange and exercises to increase lecturers' knowledge of and experience with generative AI. The autumn 2023 series will focus on technologies based on large language models (LLMs), such as ChatGPT, and their use in teaching and learning.

The events include an update on the latest developments, best-practice exchanges, and hands-on training to increase lecturers' knowledge of and experience with generative AI.

Registration is highly recommended: https://doodle.com/meeting/participate/id/avZ13l8a



### 2 October 2023 | 12.00–13.30 Large Language Models for Beginners

An introduction to the use of LLM tools in lectures and workshops. The LLMs we will work with include ChatGPT, Bard and TalkAI. The session will offer introductory guidelines for using LLMs in an adaptive, individualized context as well as provide assistance for effective prompting. The session will include three hands-on exercises on generating assessments, formulating learning objectives and developing (aligned) course materials to showcase the functionality and limitations of such tools. Examples from current D-USYS lectures will be shared where students already use LLMs under supervision as part of the learning process.

### 6 November 2023 | 12.00-13.30

### Scientific Writing and Plagiarism in the Era of Large Language Models

Discussion of the impact of ChatGPT and other AI tools on scientific writing. In this session, we will build on the concept of teaching scientific writing as a step-by-step process and explore where LLMs and other AI tools significantly enrich the scientific writing process. We will also share adaptation measures for correct referencing, plagiarism prevention, and the declaration of originality. The session will present D-USYS best practices and facilitate a conversation on how lecturers can develop guidelines for the use of generative-AI tools in scientific writing.

### 4 December 2023 | 12.00-13.30

### **Research Integrity and LLMs-based tools**

The event will facilitate a conservation about ethical and compliance concerns related to using LLM-based tools in education and scientific writing, including questions around AI and authorship, AI and accountability, AI generating unintended bias or referring to sources of unchecked origin, AI and copyright and IPR violations. The event aims to develop strategies for educating students about critical and competent use of these tools as part of our shared understanding of research integrity at ETH Zurich.

### PhD Program Plant Science

### **Research & Technical Skills**

Scientific Writing I	26.09 / 24.10.2023 (2 days, 1 ECTS)	
Transdisciplinary Seminar on Research: Challenges of Interdisciplinarity and Stakeholder Engagement (ETH VVZ 701-0015-00L)	27.09 / 11.10 / 25.10 / 8.11 / 22.11.2023 (every 2 <sup>nd</sup> Wednesday morning, 2 ECTS)	
Introduction to Light Microscopy and Image Processing (ETH VVZ: 751-1060-00L)	24–26.10.2023 (3 days, 1 ECTS)	
Sustainable Plant Systems (ETH VVZ: 551-0209-00L)	25.10 / 7.12.2023 (2 days, 2 ECTS)	
Colloquium: Challenges in Plant Sciences (ETHZ VVZ: 551-0205-00L)	30.10 / 27.11.2023 (1.5 days days, 2 ECTS)	
Genetic Diversity: Techniques (ETH VVZ 701-1425-01L)	8.11 / 29.11.2023 (2 half days, 2 ECTS)	
Current Challenges in Plant Breeding (ETH VVZ 751-3603-00L)	17.11 / 24.1.2024 (2 days, 2 ECTS)	
Writing a Postdoctoral Grant	12.12 /14.12.2023 (2 days, 1 ECTS)	
Digital Skills		
Value-based design: : Enhancing value-sensitivity in use and development of emerging technologies (ETH VVZ: 751-1070-00L; UZH VVZ 10SMVBD)	5–6.10./ 26.10.2023 (3 half days, 1 ECTS)	
Introduction to Structural Equation Modeling	7–9.11.2023 (3 days, 1 ECTS)	
Intro to UNIX/Linux and Bash scripting (UZH BI0609)	7.11.2023 (1 day, 1 ECTS)	
Next-Generation Sequencing and its Application using Machine Learning 1 (UZH BI0610)	8–9.11.2023 (2 days, 1 ECTS)	
Introduction to Machine Learning for Plant Scientists - Module 1	20–22.11.2023 (3 days, 1 ECTS)	
Introduction to Machine Learning for Plant Scientists - Module 2	23–24.11 / 13.12.2023 (3 days, 2 ECTS)	
Scientific Visualisation Using R	1.12 / 15.12.2023 (2 days, 1 ECTS)	
Introduction to R	19.1 / 26.1.2024 (2 days, 1 ECTS)	

Fore more information and registration: www.plantsciences.uzh.ch/en/teaching.html

ETH webpage for courses and continuing education: https://ethz.ch/staffnet/en/service/courses-continuing-education.html

For additional courses from UZH:

https://lsz-tsc-training.lifescience-graduateschool.uzh.ch/en/page/transferable-and-methodological-skills-courses

PhD Program Plant Science			
Crosslisted Courses			
ETHZ Library https://library.ethz.ch/en/news-and-courses/courses.html	1		
Research Data Management and Related Topics	27.9–22.11.2023 (1–4 h, 8 individual workshops)		
Center for Reproducible Science (UZH) https://www.crs.uzh.ch/en/training.h	tml		
Get R_eady: Dynamic Reporting & Reproducibility in Research (10SMGETR_2)	23.11-07.12.2023 (block course)		
Get R_eady: Introduction to Data Analysis for Empirical Research (10SMGETR)	12–26.10.2023 (Tuesdays 14.00–17.00)		
Good Research Practice (K_GRPe)	3.11/ 10.11.2023 (2 days)		
Open Access Basics (10SMOA_1)	5.10.2023 (1 day)		
Open Access: Funding and requirements	6.10.2023 (1 day)		
Open Data Basics (10SMOD_1)	16.10.2023 (1 day)		
Storytelling Skills for Science Communication (00UFK_STTe)	26–27.9.2023 (2 days)		
Resilience and Well-being in Academia (00UFK_RWAe)	6–7.12.2023 (2 days)		
Functional Genomics Center (UZH-ETHZ) https://fgcz.ch/education.html			
RNA Next Generation Sequencing – A Practical Course (UZH BI0675 Life Sciences)	4–8.12.2023 (5 days)		
Next Generation Sequencing Applied to Metagenomics (BI0638)	11–15.12.2023 (5 days)		
PhD Program Science and Policy			
Introduction to Political Sciences	13.9 / 20.9.2023 (2 days, 1 ECTS)		
Building Political Support	13.11 / 11.12 / 15.12.2023 (3 days, 2 ECTS)		
Stakeholder Engagement	29–31.1.2024 (3 days, 2 ECTS)		
	Events		
PSC course catalogue: www.plantsciences.uzh.ch/en/teaching/coursecatalogue.html Contact:	<b>PhD Program info event:</b> 6.10.2023, online Plant Science: 12.00–13.00 Science & Policy: 13.00–14.00		
psc_phdprogram@ethz.ch	PhD Student Welcome Event: 5.2.2024		

# Harnessing microorganism-based materials for a sustainable future

Interview with Patrycja Kucharczyk and Adam Aleksander Korczak, co-founders of Treeless Pack. Patrycja was a participant in the feminno mentoring program.

# What important environmental and societal problems does Treeless Pack tackle?

Treeless Pack is addressing a critical environmental and societal challenge: the sustainability of cellulose production. Traditionally, cellulose is derived from wood fibers, a process that contributes to deforestation and is environmentally taxing due to its energy-intensive and polluting nature. However, we offer an alternative approach. By harnessing microorganism-based natural fibers through the ingenious utilization of organic waste, we aim to alleviate the pressure on forests and promote resource-efficient solutions for paper, packaging materials, and construction composites. It's a sustainable pivot that not only champions environmental conservation but also seeks to redefine how we interact with nature to meet our industrial needs.

### You have a PhD in Biomedical Sciences and were working in Nephrology. Why switch to materials of the future?

Indeed, my educational journey commenced with a Master's degree in biotechnology, which provided me with a solid foundation in the field. Subsequently, I embarked on a journey to obtain a PhD in Biomedical Sciences, with a specific focus on Nephrology. Throughout this academic journey, my unwavering passion for science continued to grow. As someone deeply immersed in the world of biotechnology and with prior experience working extensively with microorganisms, I developed a profound fascination for the boundless potential that science holds. My journey in academia allowed me to explore various scientific disciplines, and I cherished every moment of this exploration. However, life often presents unexpected opportunities, and one such opportunity led me to make a pivotal career shift. It was a



transition fueled by the desire to contribute to a more sustainable future and address pressing environmental challenges. This passion for science, rooted in my biotechnology background and my experiences with microorganisms, found a new avenue of expression in Treeless Pack.

# You gained quite some attention in the last year. What were the most important milestones?

In the past 18 months, Treeless Pack has achieved significant milestones. We earned the ETH Spin-off Label, a recognition of our pioneering approach. We've also made substantial progress in our production capabilities with the establishment of a pilot vertical farm. This facility allows us to efficiently cultivate our biomaterial, representing a crucial step towards scaling up production. Our dedication to diversification and versatility has been demonstrated through the development of a diverse product portfolio, which includes prototypes for composites, paper and packaging. These prototypes underscore the adaptability of our biomaterial for a wide range of applications. Furthermore, collaborations with academic and industrial partners have accelerated our technology development. These milestones exemplify our dedication to sustainable materials and our mission to revolutionize industry.

### What's your biggest challenge?

Our most pressing challenge currently is securing the necessary investments to scale up our production in an industrial vertical farm. While we've made significant strides, expanding our operations and automating production processes require substantial financial support. This phase is pivotal in our journey, and we are actively seeking strategic partnerships and financial backing to drive our growth.

### Who is your co-founder and how did you meet?

My co-founder, Adam, is an integral part of our team. After completing his Bachelor's degree in Mechanical Engineering at ETH Zurich, he went on to specialize in tissue engineering. This field focuses on the convergence of biomaterials and cellular science to create artificial tissues and organs. Our paths crossed some time ago, and combining our knowledge, we came up with the idea of using biomaterial produced by microorganisms for industrial purposes.

Adam has been involved from the very beginning as a co-founder, contributing to various aspects of the startup. Our roles in the company are adaptable, depending on current tasks, which include biomaterial production, technical development, engaging with partners and conducting market validation with potential customers.

### In what way is feminno supporting you in your endeavors?

When I was in the feminno program, I was at the beginning of our startup journey with Treeless Pack. Being a program designed for females, feminno provided me with a safe and supportive space to openly discuss and explore our entrepreneurial ambitions. It was truly inspiring to be part of a community of like-minded women who shared the same determination and aspirations. During those formative stages, feminno played an essential role by offering invaluable insights and unwavering support. It served as a vital link between my academic background and the practical world of business. Through the program, I gained access to mentorship and valuable connections that played a pivotal role in shaping the direction and success of our startup.

### Interview by Daniela Gunz https://treelesspack.com

# feminno

More information on the *fem*inno mentoring program: www.feminno.ch

### **FEMSPIN REPORT**

### Spin-offs and startups of female academics at Swiss universities: activities and support

FEMSPIN is a collaborative project of the Federal Institutes of Technology at Zurich (ETHZ) and Lausanne (EPFL), the Paul Scherrer Institute, the Universities of Zurich, Basel, Bern and Geneva, as well as the Swiss universities of applied sciences in Western (HES-SO), Southern (SUPSI) and Northwestern Switzerland (FHNW). The recently published FEMSPIN Report aims to encourage reflection, exchange, and knowledge building on female academic entrepreneurship in Switzerland. In Switzerland as a whole, the percentage of women among founders has almost doubled and now amounts to 31.6%, compared to 20 years ago. The proportion of founders with an academic background has also risen sharply. Every second founder now has a university degree; twenty years ago, it was still one in three.

### https://femspin.ch

**Reference:** Liebig, B., & Soltermann, A. (2023). FEMSPIN Report. Spin-Offs and Start-Ups of Female Academics at Swiss Universities: Activities and Support. Olten: School of Applied Psychology FHNW. https://femspin.ch/femspin\_report\_2023/



https://seif.org/en/wp-content/ uploads/2023/06/seifAwards2023\_ Broschure.pdf

Our feminno program was featured in the last SEIF - Driving Impact Innovation report.

Female founders more often found businesses that are not meant to scale; they rather look for sustainability and maybe less for fast growth. And many women become social entrepreneurs.

Daniela Gunz, Program Coordinator

## **NACHTAKTIV** – Scientainment for Youth

NACHTAKTIV combines entertainment, art and science. Every two months on a Thursday evening, PSC organizes a party-style event in a museum or botanical garden for young people (16–30 years). Science activities are led by students of ETH Zurich, University of Zurich and University of Basel. Selected spin-offs enrich the program with their inventions. Each event focuses on a different theme, complementing the current exhibition.

### www.nachtaktiv.ethz.ch

This program receives funding from the Gebert Rüf Foundation.

### Impressions from NACHTAKTIV at the Botanical Garden of the University of Zurich



On 22 June, NACHTAKTIV took place in the Botanical Garden, welcoming 124 visitors. In addition to guided tours through the showhouse domes, there was a lot to learn about the diverse relationships of plants with the environment. From the Information Ecology Zu Group (ETH Zurich), the visitors learned more about the chemistry behind pollination and saw the world through the eyes of insects. They playfully discovered the power of mycorrhizal fungi at the Crowther Lab (ETH Zurich). At the stand of the Sustainable Agroecoystems Group (ETH Zurich), they were able to go on an immersive journey and explore how humans and plants support each other. Furthermore, they learned more about plants' unique mechanisms to prevent inbreeding at the Molecular Plant Breeding Group (ETH Zurich). They were also able to get creative with writing a letter with watercolours from flower petals.

Thank you for your contributions. Caroline Weckerle for hosting the event at the Botanical Garden of the University of Zurich. Camille Delavaux, Linda Müller and Laura van Galen from the Thomas Crowther Lab (ETH Zurich). Simona Winkler-Fishyan from Studio Inkfish. Upper left – Roberto Rebollo Hernández and Flurina Zahn from the Information Ecology Zu Group of Pengjuan Zu (ETH Zurich). Upper right – DJ Cyra (Yris Apsit). Bottom left: Chloe Manzanares and Marius Rohner from the Molecular Plant Breeding Group of Bruno Studer (ETH Zurich). Bottom right – Kenza Benabderrazik and Claude Müller from the Sustainable Agroecosystems Group of Johan Six (ETH Zurich).



### **Call for participation**

On 2 November 2023, PSC invites you to NACHTAKTIV at the Museum Rietberg in Zurich. The evening's theme is "Science Catwalk" and will be about the future of textiles in all their forms and colours, exploring their beginnings as crops and following them as they undergo cutting-edge innovations in the lab and end up on the glamorous catwalk in front of you. If you are interested in participating in the event, please contact us.

We are looking for students who would like to present their work in an entertaining way, preferably with hands-on experiments.

### Contact: beatrice.kiser@usys.ethz.ch

# **Dialog im Quartier**

# With interventions in community centers to promote sustainable food habits

The Dialog im Quartier program continues to raise awareness of sustainable nutrition and to test various interactions and methods for sustainable behavioural changes in households, focusing on nudging, change of norms and planned behavior. This approach supports the establishment of a local food system within our planetary boundaries and the necessary consumption and lifestyle at the individual and household level. After all, the environmental impact of our food (28 %) is greater than that of housing (24%) and mobility (12%).

In the summer of 2023, we organized two networking events with over 20 stakeholders. We trained 12 multipliers and integrated the established methods into six event formats in community centers in Zurich and other public institutions. The multipliers, whether from the local community or citizen initiatives, will lead and sustain events for the next two years. Serving as key figures and role models, they inspire the neighborhood to adopt behavioral changes.

The aim is to create a pool of multipliers, workshops and interventions easily adaptable to various formats in Zurich. On a public platform, interested community centers, NGOs, schools and other public hub locations have easy access to these offers. In collaboration with the city of Zurich's environmental and health protection unit (Umwelt und Gesundheitsschutz Zürich), this platform will be created in 2024 and will be managed by Dialog im Quartier as a first point of contact. To this end, we have founded the NGO "Zukunftstauglich", which will proceed in organizing these events together with citizens and multipliers.

Find our activities and events on our website:

### https://deinquartiernachhaltig.org

Reference: Werkzeugkasten Umwelt. (2017). Meine Wahl bei der Ernährung. www.werkzeugkastenumwelt.ch/meine-wahl-bei-der-ernaehrung

### **Treffpunkt Science City**

### PSC designed an AI workshop for children.

Participants discover a variety of leaves – large and small, round and elongated, smooth and feathery – and explore which trees the leaves belong to with the help of our AI teaching tool called TreeKI. TreeKI was developed together with the University of Teacher Education in Zurich. The aim is to build skills in the areas of artificial intelligence and machine learning as early as possible.

https://ethz.ch/de/news-und-veranstaltungen/veranstaltungen/treffpunkt/ tagesprogramm-19-11-2023.html



# A new game in our toolbox

Carbon footprints are used to calculate  $CO_2$  equivalents over the entire life cycle of products or services that contribute to global warming. With the new climate footprint game, the difference between resource-saving and resource-intensive foods is made visible, and evaluation criteria are used to show which planetary boundaries are exceeded by certain foods.

https://deinquartiernachhaltig. org/werkzeuge-fur-denernahrungswandel-2023/



# **Digital storytelling with plants**

PSC launches a new outreach project to overcome plant awareness disparity. The SNSF Agora project is hosted by Caroline Weckerle at the Botanical Garden of the University of Zurich.



### What do you see first?

In our hectic and technology-driven world, we often overlook plants. Many young people are not able to recognize the diversity of plants, a phenomenon referred to as plant awareness disparity (Burke et al., 2022). It is therefore important to act now and sharpen our perception of the plant world around us.

The SNSF recently awarded an Agora grant entitled "Digital Storytelling with Plants – Multimedia Engagement with Young People in the Botanical Garden" to help overcome the plant awareness disparity. The project will use the knowledge and skills of scientists, gardeners, artists and digital and pedagogical experts to co-create contemporary stories about plants and humanity's relationship with them. The team aims to engage young people through workshops with scientists, artists and storytellers and nurture their stories about plants. The "plant stories" will be shared in social media and interactive displays in the garden.

The innovative power of the project lies in the development and validation of new formats for conveying plant knowledge, enthusiasm for digital technologies and handling social new media. Caroline Weckerle, Celia Baroux and Meredith Schuman at University of Zurich will be contributing to the project with their research facilities and knowledge in ethnobotany, plant development and environmental systems science. The output of participants' knowledge will contribute in a feedback loop to the understanding of plant usage in our society from an ethnobotanical perspective.

https://data.snf.ch/grants/grant/215783

#### Reference

Burke, R., Sherwood, O. L., Clune, S., Carroll, R., McCabe, P. F., Kane, A., & Kacprzyk, J. (2022). Botanical boom: A new opportunity to promote the public appreciation of botany. *Plants, People, Planet*, 4(4), 326–334. https://doi.org/https://doi.org/10.1002/ppp3.10257

#### Project partners

Caroline Weckerle, Department of Systematic and Evolutionary Botany, University of Zurich

Célia Baroux, Department of Plant and Microbial Biology, University of Zurich

Meredith Schuman, Department of Geography, University of Zurich

Yvonne Volkart, The University of Applied Sciences Northwestern Switzerland

Yvonne Möller-Steinbach, Manuela Dahinden & Juanita Schläpfer, PSC

Eveline Hipeli, Zurich University of Teacher Education, Switzerland

Jessica Reust, jessicareust.ch

Bernadette Spieler, Zurich University of Teacher Education



### Join us on 8 December 2023

# The impact of plant sciences on our lives

13.30 Opening by Michael Schaepman, Rector of University of Zurich Bernhard Schmid, Founding member of PSC Bruno Studer, President of PSC, ETH Zurich Manuela Dahinden & Melanie Paschke, Managing directors of PSC

### 13.50 **Food**

Frank Ewert, Leibniz Centre for Agricultural Landscape Research hosted by Nina Buchmann, ETH Zurich

### 14.30 Environment

Yvonne Buckley, Trinity College Dublin hosted by Sabine Rumpf, University of Basel

hosted by Cyril Zipfel, University of Zurich

- 15.10 Health Jürg Gertsch, University of Bern
- 15.50 Coffee break

### 16.20 Knowledge of Science

David Baulcombe, University of Cambridge hosted by Célia Baroux, University of Zurich

### 17.00 Panel Discussion: What's next? Key research questions for the future

moderated by Chris Luebkeman, Head of Strategic Foresight, ETH Zurich

Guests: Christian Wolfrum, Vice President for Research at ETH Zurich; Nina Buchmann, Professor of Grassland Sciences at ETH Zurich; Sara Fabrikant, Professor of Geography at University of Zurich and member of the Swiss Science Council; Philipp Langer, Deputy Director-General EU Framework Programs & ERA, State Secretariat for Education, Research and Innovation SERI

### 18.15 **Moments of Discovery** Artistic poster exhibition & Apéro









University of Zurich Aula and Lichthof



www.plantsciences.uzh.ch/ en/outreach/conferences



# Rigi Workshop 2024

### **Exploring Epigenetics**

The Rigi Workshop 2024 on epigenetics will invite its participants to dive into the intricate mechanisms and implications of epigenetic phenomena. By fostering cross-disciplinary dialogue, the event aims to bridge gaps between different disciplines of epigenetic research. Participants will explore how epigenetics impacts plant breeding, behavioral traits, brain development, evolution, synaptic plasticity, cognition and neurological disorders. The workshop will offer interdisciplinary approaches to investigating and analyzing the societal and technological impacts of epigenetics and will feature lectures delivered by leading experts, group discussions and sharing of group and individual work in the form of poster and oral presentations.

### 28-30 January 2024, Hotel Rigi Kulm (Schwyz)

**For who:** The workshop is aimed at PhD students and postdocs in Biology or Medicine from Swiss research institutions.

**ECTS:** Please contact your doctoral institution for the accreditation of ECTS, which we estimate at 2 ECTS.

Costs: CHF 150 registration fee that covers housing and meals.

**Speakers:** Etienne Bucher, Med Semira Gonseth Nusslé, Ivana Jaric, Luis Lopez-Molina, Isabelle Mansuy

**Organizers:** Irene Adrian-Kalchhauser, Paolo Cinelli, Florian Steiner, Caroline Reymond

### biol.scnat.ch/rigiworkshop24

# Plant Genomes, Systems Biology & Engineering

29 Nov to 2 Dec 2023 Cold Spring Harbor Laboratory

### Organizers

Julia Bailey-Serres, University of California, Riverside

Elizabeth Sattely, Stanford University/ HHMI

Cyril Zipfel, The Sainsbury Laboratory, UK

https://meetings.cshl.edu/meetings. aspx?meet=PLANTS&year=23

# SwissPLANT 2024

17–19 January 2024, Les Diablerets

### Scientific committee

Cyril Zipfel (chair), Simon Aeschbacher, Rie Shimizu-Inatsugi, Florian P. Schiestl, Sara Simonini, Sofia van Moorsel, Tobias Züst (University of Zurich)

### EARLY CAREER MEETING 16–17 January 2024

Organized by Kyle Bender & Narjes Yousefi, University of Zurich

Swiss Society of Plant Biology

### https://plantbiology.ch

University of Zurich<sup>™™</sup>

Faculty of Science Office of the Dean

The Faculty of Science at the University of Zurich (UZH) invites applications for the

#### Assistant Professorship tenure track in Plant Diversity and Macroevolution

We are seeking candidates with an excellent track record and the potential to establish an internationally visible and integrative research program in plant diversity at macroevolutionary timescales (i.e., inter-specific level) to expand current research at the faculty of science. Applicants with experience in phylogenomics, comparative genomics and transcriptomics, comparative morphology, comparative development, macroevolution, macroecology, plant-human interactions, biogeography, systematics, herbarium genomics and/or biodiversity-informatics are encouraged to apply. An integrative approach linking multiple levels of enquiry (from genes to phenotypes and beyond) and leveraging complementary sources of evidence (from genomics to experimental methods) is particularly valued. Topics of interest include, but are not limited to, connecting genomes to phenotypes to explain the evolution of plant diversity and linking variation of plant diversity to climatic and other changes through time.

The successful candidate will join the <u>Department of Systematic and Evolutionary Botany</u> (DSEB), which includes an extensive herbarium collection of over 3 million specimens and a Botanical Garden with both public and research greenhouses. Applications highlighting how such extensive collections can be integrated into cutting-edge research and innovative teaching are especially welcome. The future faculty member will have extensive opportunities for interaction and collaboration with other research groups at UZH and, more generally, in Zurich's rich and diverse research environment. The future professor will contribute to teaching and is expected to develop new courses at both Bachelor and Master level. Target areas for new courses include, but are not limited to, systematic, evolutionary, and organismal botany, biogeography, comparative genomics and morphology, plant-human interactions, plant domestication, bioinformatic methods applied to plant diversity. The professor is expected to supervise Master and PhD theses, as well as mentor PostDocs. Furthermore, active participation in the academic self-administration of the department and University is expected.

UZH provides generous research support, including dedicated funds for personnel, running expenses and competitive start-up packages. Additionally, the successful candidate is expected to acquire external research funding. We see researchers as modern leaders who conduct original research conformant to the Open Science principles, supervise and support junior researchers, and help shape a future-oriented University with innovative research-based teaching. Situated in the open-minded and family-friendly city of Zurich, which combines the vibrant cultural scene of a modern European city with the convenient accessibility to its beautiful natural surroundings, UZH is well integrated in the city's community and research environment.

Assistant professors tenure track are typically evaluated for tenure after 6 years. The employment conditions for this position follow UZH's <u>legal regulations</u>, including part-time options. UZH is an equalopportunities employer, and the Faculty of Science strives to increase the percentage of <u>women and</u> <u>underrepresented groups in leading positions</u>. Therefore, qualified female researchers and others from underrepresented groups are especially encouraged to apply. Care-time interruptions are considered during the evaluation of all applicants.

Deadline for application is 25 November 2023.

Job description:

https://jobs.uzh.ch/offene-stellen/assistant-professorshiptenure-track-in-plant-diversity-and-macroevolution/fd740c82a247-4903-a92a-834c65d8bd72

## New student association

Biolncubate is a student-run incubator created just a few months ago from the Student BioLab organization. It enables multidisciplinary teams of students to develop disruptive biotech solutions for industry challenges or pursue their own startup idea. Students will develop their skills solving real-world problems and workshop their concepts with scientists from industry. Biolncubate aims to showcase biotech's impact and serve as a launchpad for novel startups to emerge in Switzerland.

#### www.studentbiolab.ch

### Head of Forum for Genetic Research at the Swiss Academy of Sciences (60–70%)

The Forum for Genetic Research addresses developments in genetic research and their impact on society and promotes exchange between scientists, decision-makers and members of the public.

#### geneticresearch.scnat.ch

#### Job description:

https://scnat.ch/de/scnat/jobs/ uuid/i/241b7027-572b-5489-9310e3d8bfbf28e1-Leiterin\_Forum\_ Genforschung\_60-70

### Managing Director at the Department of Plant and Microbial at University of Zurich (80–100 %)

The Department of Plant and Microbial Biology conducts fundamental and applied research and teaching on a wide range of organisms using genetic, molecular, biochemical, cellular, developmental, evolutionary, and ecological approaches to understand how plants and microbes function and interact with each other as well as with their environment.

#### www.botinst.uzh.ch

#### Job description:

https://jobs.uzh.ch/offene-stellen/managingdirector-geschaeftsfuehrer-in-for-thedepartment-of-plant-and-microbialipmb/17051cd9-51b5-4f62-855def9e474f2053



The Bioincubate program is very interesting and exciting, especially for students reaching the end of their studies and willing to explore the industrial world. The Forge challenge offers the opportunity to solve a real problem in Biotech and the Startup track provides students a grant that can launch their own idea!

Alexandra Siffert, PSC PhD student and excecutive board member



The Zurich-Basel Plant Science Center is a competence center linking and supporting the plant science research community at ETH Zurich, University of Zurich and University of Basel. The center promotes plant and environmental research, education and outreach. It provides platforms for interactions with peers, policymakers, industry, stakeholders and the public.

#### **PSC MEMBER INSTITUTIONS**

### **ETH Zurich**

Department of Environmental Systems Science Department of Biology Institute for Environmental Decisions

#### **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 Institute of Evolutionary Medicine

University of Basel Department of Environmental Sciences

**Zurich-Basel Plant Science Center, Managing Office** 

### BLOGS

blogs.ethz.ch/Science\_and\_Policy feminno.ch klimagarten.ethz.ch creativelabz.ethz.ch nachtaktiv.ethz.ch deinquartiernachhaltig.ch

### LINKEDIN

Zurich-Basel Plant Science Center

TWITTER @ PlantSciCenter

#### INSTAGRAM

@ plantsciencecenter@ creativelabzurich@ nachtaktiv.live

#### © Plant Science Center (PSC) Newsletter No. 44, Fall 2023

Zurich-Basel Plant Science Center Tannenstrasse 1, ETH Zurich, TAN D 5.2 8092 Zurich, Switzerland

info-plantscience@ethz.ch

### Editor

Manuela Dahinden

Proofreading Gena Olson

#### Text contributions

Rodrigo Cámara-Leret, Allesia Guggisberg, Maëva Labouyrie, Reto Nyffeler, Alexandra Siffert, Caspar Roebroek and PSC staff.

#### Pictures

Courtesy of PSC staff or indicated. Front image: Illustration by Gaia Codoni for the PSC Moments of Discovery Exhibition 2023.

Printing

HELLER DRUCK AG, Cham, 200 copies

