INSTITUTE OF PLANT SCIENCES

Sant'Anna
School of Advanced Studies – Pisa

BREEDTECH Student Training Workshop May 5th-9th 2025, Pisa, Italy

Welcome to Pisa

- Can't build towers straight
- University and research hub
- Birthplace of Fibonacci, Galileus

Birthplace 1

Borgo Stretto, 36

Birthplace 2

Via Giuseppe Giusti, 24

Orto Botanico (oldest university botanical garden in the world)

Museo delle Navi Romane

Museo Medioevale San Matteo

Camposanto

Palazzo Blu

Population 90K

University of Pisa
50K undergraduates
700 graduate students

National Research Council (CNR)

Scuola Normale
250 undergraduates
270 graduate students

VIRGO interferometer

Scuola Superiore Sant'Anna
250 undergraduates
370 graduate students

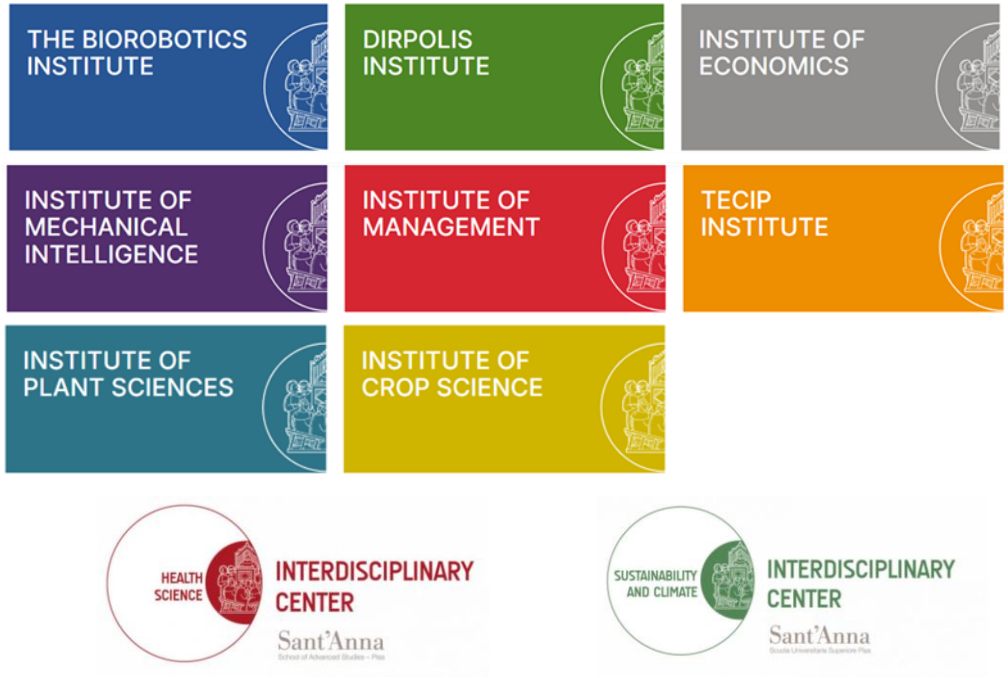
INFN
Istituto Nazionale di Fisica Nucleare

INGV

Two classes, 10 research structures

Social Sciences
- Economics
- Law
- Political Sciences

Experimental Sciences
- Agronomy and biotech
- Engineering
- Health



Focus on applied sciences and interdisciplinarity

Teaching by research

10 PhD programmes, 19+ Seasonal Schools, MSc training

Programs to translate into impact (also in emerging countries)

'Africa Connect

The mission of the Institute of Plant Sciences

To develop fundamental research on plant sciences, contributing to the sustainable intensification of agriculture

Challenges

Fair, equitable food production

Sustainability

Adaptation and mitigation in the climate crisis

Ecosystem services

Predictive models

Strategies

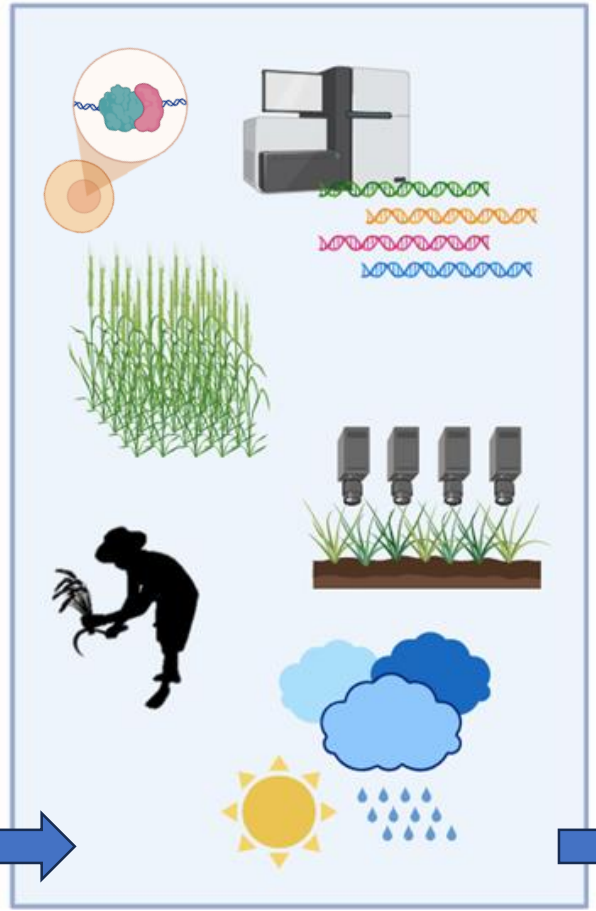
Biotech

Big data analytics

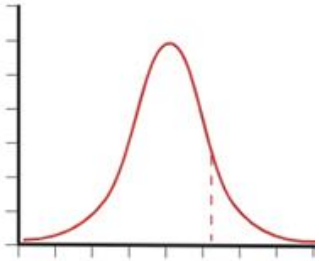
Agrobiodiversity

Vision of the ISP

Agrobiodiversity

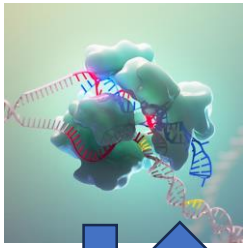


Data-driven synthesis



Optimization

Molecules



Individuals

Systems

TRANSLATIONAL PLANT GENOMICS

Sant'Anna
Scuola Universitaria Superiore Pisa

Matteo Dell'Acqua (**ITA**)

Valentina D'amico (**ITA**)

Leonardo Caproni (**ITA**)

Mercy Macharia (**KEN**)

Svenja Mager (**DEU**)

Afewerki Kiros (**ETH**)

Ettore Riccucci (**ITA**)

Sara Verni (**ITA**)

Bedasa Dosho (**ETH**)

Geon Kang (**KOR**)

Monique Jost (**BRA**)

Robel Takele (**ETH**)

Tobias Recha (**KEN**)

Worku Tekle (**ETH**)

Marta Solemanegy (**MOZ**)

Zeriuhn K Beyene (**ETH**)

Kathy Quispe (**PER**)

G. Mukanamasasira (**UGA**)

R. Gwokyalya (**UGA**)

Eshetu Zewtu (**ETH**)

M. Tilahun (**ETH**)

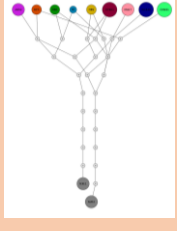
Martina Sechi (**ITA**)

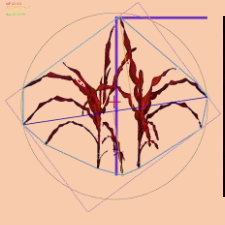
Mario Enrico Pè (**ITA**)

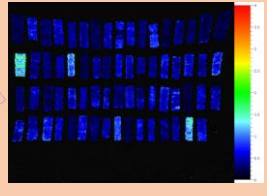
Research directions

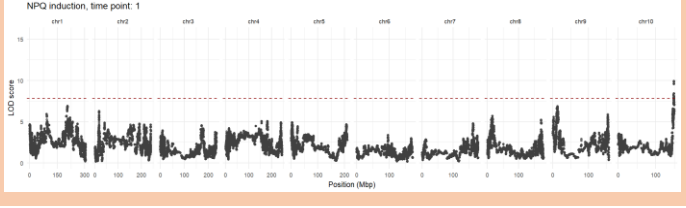
Forward genetics

- Use of **genomics** to characterize DNA and RNA diversity in plant genetic resources
- Developement of **multiparental mapping population** and associated pangenomes
- Identification of **QTL** underlying traits of interest



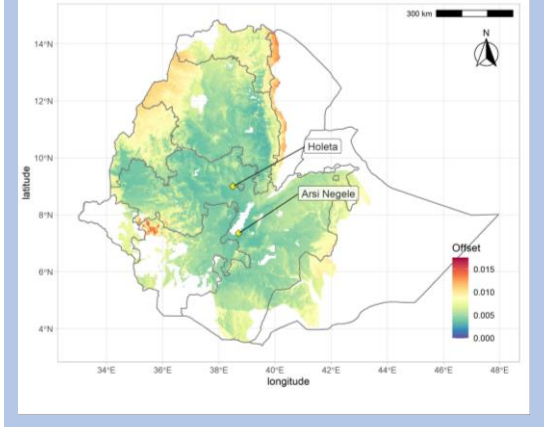






Crop-climate

- Study of the genetic basis of **adaptation**
- Developement of models for **climate change impacts** on agriculture
- Integrating genetic agrobiodiveristy in **crop modelling**



Participatory research

- Design and conduction of **surveys** and **focus group discussions**
- Conduction of large-scale, **crowdsourced selection of varieties** to improve local adaptation
- A data-driven approach to **participatory variety selection** to support pre-breeding decisions

Building Capacity in Plant Breeding and Biotechnology Education and Research through Partnerships in Africa, the Middle East, and Europe for Agricultural Transformation

The Consortium

European partners (Italy, Sweden& Serbia)

Sant'Anna
Scuola Universitaria Superiore Pisa

Pixel
FIRENZE

SLU
Swedish University of Agricultural Sciences

African(Kenya& Ethiopia) and Palestinian Higher education institutes

Al-Quds Open University

EGERTON UNIVERSITY
www.egerton.ac.ke

LAIKIPIA UNIVERSITY

An-Najah National University

ODA BULTUM UNIVERSITY

Haramaya University
Building the Basis for Development

Day	Time	Activity	Facilitator(s) and trainers
Monday 5th May 2025	9:00-9:30am	• Registration • Welcome, introductions of ISP/SSSA and the training team • Ice-breaker: "Tour the Table" – sharing student backgrounds and interests • Summarize the course content and week activities	**Facilitator: Matteo Dell'Acqua** • Registration • Institute of Plant Science (ISP) Director: Prof. Matteo Dell'Acqua
	9:30 – 10:30 am	**Lecture 1** • Basic concepts in genetics; molecular aspects of DNA as genetic material	Mario Enrico Pè
	10:30-10:45 am	**Group photo**	
	10:45-11.00am	**Coffee Break**	
	11:00- 12:30 pm	**Lecture 2** • Genetics continued	Mario Enrico Pè
	12:30-1:00pm	**Questions and Discussion**	Mario Enrico Pè
	1:00 -2.00pm	**Lunch break**	
	2.00-3.00pm	**Lecture 3** • Molecular markers and genetic maps	Mario Enrico Pè
	3.00-4:00pm	**Lecture 4** • Principles of genomic DNA extraction (keep in mind extraction will follow the day after) • PCR, and electrophoresis	Ettore Riccucci
	4:00-4:30pm	**Lecture 5** • Laboratory safety	Afewerki Kiros Martina Sechi

Hostel pick up 8.30 ready to go

Tuesday 6th May 2025	9:00 -9:30 am	• Arrival at the lab • PPE, protocol distribution • Laboratory tour and instruction (safety)	**Facilitator: Martina Sechi** Ettore/Martina/Afi (3-4 students in each group)
	9:30- 11:00am	• Hands-on practical: Genomic DNA extraction from plant tissue using Qiagen kit	Ettore/Martina/Racheal
	11:00- 11:15am	**Coffee break**	
	11:15-1:00pm	PCR set up and run	Ettore/Martina/Racheal
	1:00pm-2:00pm	**Lunch break**	
	2:00-3:30pm	Set up gel electrophoresis	Ettore/Martina/Racheal
	3:30-4:30pm	Run DNA and PCR products	Ettore/Martina/Racheal
	4:30-5:00pm	Check gels under UV	Ettore/Martina/Racheal

Wednesday 7th May 2025	**9:00 -10: 30 am**	Discuss DNA and PCR results and present the results	**Facilitator: Svenja Mager** Ettore/Martina/Racheal
	10:30-11:00am	**Coffee Break**	
	11:00am-13:00	**Lecture 6** • Basic concepts in genomics • Structure of a plant genome (genes, TEs, repeats) • Transcriptomics	Svenja Mager
		• Sequencing tech: Illumina and ONT	Svenja
	1:00-2:00pm	**Lunch break**	
	2:00-3:30pm	**Lecture 7 student seminars** • Discussion: Applications, limitations, and advancements in sequencing platforms • Case study presentation	Svenja Mager Case study 1- Tobias Recha Case study 2 - Bedasa Mekkonen
	3:30-4:00pm	• Questions and Discussion	Afewerki Kiros
	4:00-4:30pm	**Prepare computers for Thursdays hands on.** • Software download: Tassel • Demo Dataset download	Ettore/Afewerki/Tobias

Thursday 8th May 2025	**9:00 – 10:30am**	**Lecture 8** • Introduction to population genomics, allele/genotype frequencies, and evolution. • GWAS	**Facilitator: Afewerki Kiros** Matteo Dell'Acqua
	10:30-11:00am	**Coffee break**	
	11:00-1:00pm	**Data analysis** • Hands-on practical: Using TASSEL for GWAS and data analysis.	Leonardo, Ettore, Afewerki
	1:00-2.00pm	**Lunch break**	
	2:00-4:00pm	Data analysis- continued	Leonardo, Ettore, Afewerki
	4:00-4:30pm	Discussion and wrap up	Leonardo Caproni
	5:30 - onwards	**Dinner /Pizza / networking**	

Walk to tower square and visit to Camposanto, then aperitivo get-together with the group

Friday 9th May 2025	**9:00-10:00am**	**Lecture 9** • Framing GWAS and genomics in breeding pipelines.	**Facilitator: Matteo Dell'Acqua** Matteo Dell'Acqua
	10:00-10:30am	**Coffee break**	
	10:30- 11:30pm	**Lecture 10** • Introduction to genome editing tools (e.g., CRISPR/Cas9).	Leonardo Caproni
	11:30-12:30pm	**Case study** • Paper presentation on CRISPR use in crop improvement	Leonardo Caproni
	12:30-1:00pm	**Questions and Discussion**	Matteo, Leonardo, Afewerki, Ettore, Svenja
	1:00-2:00pm	**Lunch break**	
	2:00-3:00pm	Course wrap-up: Interactive group discussion, feedback, and takeaways	Matteo, Leonardo, Afewerki, Ettore, Svenja
	3:00-4:00pm	Assessment and certificate awards.	Matteo Dell'Acqua
End of day 5 and departure			

Housekeeping

- Please ensure your laptops are fully charged Wednesday and Thursday. Bring chargers – plug points are available but limited
- WiFi Access Network: see printed out sheets in room
- Laboratory protocols will be provided in soft and hard copy copies

- In Case of Emergency / Questions (whatsapp group is also available)
  - Matteo Dell'Acqua: +39 3395496087
- Lunch at the canteen. Coffee break will be provided in the room
- Dinner on your own or at the canteen

Suggestions

- We are all excited having you here. Let’s spend a few interesting days together
- Every Question Matters: No question is too basic or too advanced. We encourage you to ask freely and often
- We value everyone's background and experience: listen actively and support one another. This is an inclusive and respectful place
- Trainers are here to support feel free to approach us anytime. Seize the opportunity!

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BREEDTECH
Empowering Agriculture

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