Adapting Photosynthesis to Insure Against an Uncertain Future

April 30 - May 5, 2017

Chairs

Stephen P. Long and Martha Ludwig

Vice Chairs

Joy K. Ward and Martin A.J. Parry

Renaissance Tuscany Il Ciocco

Via Giovanni Pascoli

Lucca (Barga), IT

Conference Description

Advancing and applying our understanding of CO_2 assimilation in plants and algae has never been more important to society than today. The world faces the dual challenges of producing adequate food for mid-century sustainably while adapting and mitigating CO_2-driven climate change. This meeting addresses these challenges from the gene to the globe in discussing emerging advances in our understanding and their application. Topics include: engineering increased photosynthesis for food security and bioenergy, phenomics in accelerating improvement in CO_2 assimilation and yield, overcoming oxygenation at Rubisco, the evo-devo of the CO_2 assimilation apparatus, inter-compartmental fluxes, kinetic modeling of CO_2 assimilation, what is new in carbon concentrating mechanisms, prospects for modifying stomatal responses and mesophyll conductance, adapting to atmospheric change, quantification of global sinks for CO_2, and engineering landscapes to offset climate change.

Funding Notice: The CO_2 Assimilation Chairs are committed to increasing diversity at the GRS and GRC and have therefore set aside funds to support the participation of eligible underrepresented minority students, faculty and scientists. More information including application is available at http://bit.ly/2eL2X4v.

Related Meeting

This GRC will be held in conjunction with the "CO2 Assimilation in Plants from Genome to Biome (GRS)" Gordon Research Seminar (GRS). Those interested in attending both meetings must submit an application for the GRS in addition to an application for the GRC. Refer to the associated GRS program page for more information.

Conference Program

Sunday	
4:00 pm - 8:00 pm	Arrival and Check-in
6:00 pm - 7:00 pm	Dinner
7:30 pm - 7:40 pm	Introductory Comments by GRC Site Staff / Welcome from the GRC Chair
7:40 pm - 9:30 pm	**New Insights into CO_2 Assimilation** Discussion Leader: **Martha Ludwig** (University of Western Australia, Australia)
7:40 pm - 7:45 pm	Opening Remarks
7:45 pm - 7:55 pm	Introduction by Discussion Leader
7:55 pm - 8:20 pm	**Mark Stitt** (Max Planck Institute of Molecular Plant Physiology, Germany) "All Is Flux, Nothing Is Stationary"
8:20 pm - 8:25 pm	Discussion
8:25 pm - 8:50 pm	**Jane Langdale** (University of Oxford, United Kingdom) "C4 Rice - Progress and Problems"
8:50 pm - 8:55 pm	Discussion
8:55 pm - 9:20 pm	**David Heckmann** (University of California, San Diego, USA) "A Resource-Distribution Model of Photosynthesis Reveals Evolutionary History from Present Physiology"
9:20 pm - 9:25 pm	Discussion
9:25 pm - 9:30 pm	General Discussion

Monday	
7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	**Engineering Increased Photosynthesis for Food Security and Bioenergy** Discussion Leader: **Stephen Long** (University of Illinois at Urbana-Champaign, USA)
9:00 am - 9:10 am	Introduction by Discussion Leader
9:10 am - 9:35 am	**Ben Long** (Australian National University, Australia) "Assembled Alpha-Carboxysomes in C3 Chloroplasts"
9:35 am - 9:40 am	Discussion
9:40 am - 10:05 am	**Martin Jonikas** (Princeton University, USA) "Towards a Molecular Understanding of the Eukaryotic Carbon-Concentrating Organelle"
10:05 am - 10:10 am	Discussion
10:10 am - 10:35 am	**Patricia Lopez-Calcagno** (University of Essex, United Kingdom) "Multigene Engineering to Improve Photosynthesis and Yield"
10:35 am - 10:40 am	Discussion
10:40 am - 11:10 am	Coffee Break
11:10 am - 11:35 am	**Tsuyoshi Furumoto** (Ryukoku University, Japan) "Physiological Impact of Metabolic Regulation for Adapting Light Fluctuation via CP12-3"
11:35 am - 11:40 am	Discussion
11:40 am - 12:05 pm	**Katarzyna Glowacka** (University of Illinois, USA) "Accelerating Recovery from Photoprotection to Improve Photosynthesis and Crop Productivity"
12:05 pm - 12:10 pm	Discussion
12:10 pm - 12:30 pm	General Discussion

12:30 pm - 1:30 pm	Lunch
1:30 pm - 4:30 pm	Free Time
3:00 pm - 4:00 pm	**Power Hour** *The GRC Power Hour is an optional informal gathering open to all meeting participants. It is designed to help address the challenges women face in science and support the professional growth of women in our communities by providing an open forum for discussion and mentoring.* Organizers: **Elizabete Carmo-Silva** (Lancaster University, United Kingdom) and **Tammy Sage** (University of Toronto, Canada)
4:30 pm - 6:00 pm	**Poster Session**
6:00 pm - 8:00 pm	**Stomata - How Do They Link to Mesophyll CO_2 Assimilation?** Discussion Leader: **Tracy Lawson** (University of Essex, United Kingdom)
6:00 pm - 6:10 pm	Introduction by Discussion Leader
6:10 pm - 6:35 pm	**Margaret Barbour** (University of Sydney, Australia) "Are Stomatal and Mesophyll Conductances Coordinated? Observations and Potential Mechanisms"
6:35 pm - 6:40 pm	Discussion
6:40 pm - 7:05 pm	**Diana Santelia** (University of Zurich, Switzerland) "Guard Cell Starch Metabolism as a Bottleneck for Efficient Stomatal Control"
7:05 pm - 7:10 pm	Discussion
7:10 pm - 7:35 pm	**Julian Schroeder** (University of California, San Diego, USA) "Molecular Signal Transduction Network Mediating CO_2 Regulation of Stomatal Conductance in Plants"
7:35 pm - 7:40 pm	Discussion
7:40 pm - 8:00 pm	General Discussion
8:00 pm - 9:00 pm	Dinner

Tuesday	
7:30 am - 8:30 am	Breakfast
8:30 am - 9:00 am	Group Photo
9:00 am - 12:30 pm	**Advancing Quantification of the Global Sinks for CO_2 and Adaptation to Change** Discussion Leader: **Carl Bernacchi** (Agricultural Research Service, USDA / University of Illinois at Urbana-Champaign, USA)
9:00 am - 9:10 am	Introduction by Discussion Leader
9:10 am - 9:35 am	**Roslyn Gleadow** (Monash University, Australia) "Predicting the Growth, Resource Partitioning and Nutritional Value of Tuberous Crops in Response to Environmental Challenges"
9:35 am - 9:40 am	Discussion
9:40 am - 10:05 am	**Jonathan Lloyd** (Imperial College London, United Kingdom) "The Physiology of Photosynthesis and the Terrestrial Carbon Sink"
10:05 am - 10:10 am	Discussion
10:10 am - 10:40 am	Coffee Break
10:40 am - 11:05 am	**Dan Yakir** (Weizmann Institute of Science, Israel) "Going Beyond the Sink in Considering Photosynthesis-Climate Interactions in a Drying Climate"
11:05 am - 11:10 am	Discussion
11:10 am - 11:35 am	**Katie Becklin** (University of Kansas, USA) "Photosynthetic Constraints on C3 Plant Responses to Rising [CO_2]: A Legacy of the Past?"
11:35 am - 11:40 am	Discussion
11:40 am - 12:05 pm	**Marjorie Lundgren** (University of Sheffield, United Kingdom) "Despite Phylogenetic Effects, C3-C4 Lineages Bridge the Ecological Gap to C4 Photosynthesis"
12:05 pm - 12:10 pm	Discussion

12:10 pm - 12:30 pm	General Discussion
12:30 pm - 1:30 pm	Lunch
1:30 pm - 4:30 pm	Free Time
4:30 pm - 6:00 pm	**Poster Session**
6:00 pm - 8:00 pm	**Inorganic C Transporters and Increasing Mesophyll Conductance** Discussion Leader: **Susanne Von Caemmerer** (Australian National University, Australia)
6:00 pm - 6:10 pm	Introduction by Discussion Leader
6:10 pm - 6:35 pm	**Wagner Araújo** (Federal University of Vicosa, Brazil) "New Insights into Organic Acid Transport: Connecting to Mesophyll Conductance and Mitochondrial Metabolism"
6:35 pm - 6:40 pm	Discussion
6:40 pm - 7:05 pm	**David Hanson** (University of New Mexico, USA) "Cracking Conductance"
7:05 pm - 7:10 pm	Discussion
7:10 pm - 7:35 pm	**Danny Tholen** (University of Natural Resources and Life Sciences, Vienna, Austria) "A New Look at Isotope Fractionation During Photosynthesis"
7:35 pm - 7:40 pm	Discussion
7:40 pm - 8:00 pm	General Discussion
8:00 pm - 9:00 pm	Dinner
Wednesday	
7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	**Rubiscos and Photorespiration** Discussion Leader: **Robert Sharwood** (Australian National University, Australia)

9:00 am - 9:10 am	Introduction by Discussion Leader
9:10 am - 9:35 am	**Oula Ghannoum** (Western Sydney University, Australia) "Photosynthetic Efficiency in Diverse C4 Grasses"
9:35 am - 9:40 am	Discussion
9:40 am - 10:05 am	**Donald Ort** (Agricultural Research Service, USDA / University of Illinois at Urbana-Champaign, USA) "Lowering the Cost of Photorespiration"
10:05 am - 10:10 am	Discussion
10:10 am - 10:40 am	Coffee Break
10:40 am - 11:05 am	**Martin Hagemann** (University of Rostock, Germany) "Evolution of Photorespiration and Inorganic Carbon Sensing in Cyanobacterial Cells"
11:05 am - 11:10 am	Discussion
11:10 am - 11:35 am	**Grant Pearce** (University of Canterbury, New Zealand) "Comparison of Rubisco Activase Structure and Function Between Different Species"
11:35 am - 11:40 am	Discussion
11:40 am - 12:05 pm	**John Evans** (Australian National University, Australia) "Improving Photosynthetic Rate per Unit Nitrogen in Crops"
12:05 pm - 12:10 pm	Discussion
12:10 pm - 12:30 pm	General Discussion
12:30 pm - 1:30 pm	Lunch
1:30 pm - 4:30 pm	Free Time
4:30 pm - 6:00 pm	**Poster Session**

6:00 pm - 8:00 pm	**CO_2 Concentrating Mechanisms - Metabolites and Regulation** Discussion Leader: **Yu Wang** (University of Illinois at Urbana-Champaign, USA)
6:00 pm - 6:10 pm	Introduction by Discussion Leader
6:10 pm - 6:35 pm	**Doug Allen** (Agricultural Research Service, U.S. Department of Agriculture / Donald Danforth Plant Science Center, USA) "Using Flux Analysis to Assess Photosynthetic Metabolism"
6:35 pm - 6:40 pm	Discussion
6:40 pm - 7:05 pm	**Michael Hodges** (CNRS, France) "Phosphoregulation of Photorespiratory Enzymes"
7:05 pm - 7:10 pm	Discussion
7:10 pm - 7:35 pm	**Dominik Brilhaus** (Heinrich-Heine-University Duesseldorf, Germany) "Reversible Induction of CAM in *Talinum triangulare*"
7:35 pm - 7:40 pm	Discussion
7:40 pm - 8:00 pm	General Discussion
8:00 pm - 9:00 pm	Dinner
Thursday	
7:30 am - 8:30 am	Breakfast
8:30 am - 9:00 am	**Business Meeting** *Nominations for the Next Vice Chair; Fill in Conference Evaluation Forms; Discuss Future Site and Scheduling Preferences; Election of the Next Vice Chair*
9:00 am - 12:30 pm	**CO_2 Concentrating Mechanisms** Discussion Leader: **Martin A.J. Parry** (Lancaster University, United Kingdom)
9:00 am - 9:10 am	Introduction by Discussion Leader

9:10 am - 9:35 am	**Sarah Davis** (Ohio University, USA) "Contrasting Theoretical and Realized CO_2 Assimilation by CAM Plants in Desert Agriculture"
9:35 am - 9:40 am	Discussion
9:40 am - 10:05 am	**Christopher Dupont** (J. Craig Venter Institute, USA) "Systems Biology of CO_2 Assimilation in Marine Diatoms"
10:05 am - 10:10 am	Discussion
10:10 am - 10:40 am	Coffee Break
10:40 am - 11:05 am	**Sascha Offermann** (Leibniz University Hannover, Germany) "Control of Chloroplast Differentiation in Single-Celled C4 Species"
11:05 am - 11:10 am	Discussion
11:10 am - 11:35 am	**Eduardo Zabaleta** (Instituto de Investigaciones Biologicas, CONICET / Universidad Nacional de Mar del Plata, Argentina) "The Carbonic Anhydrase Domain of Mitochondrial Complex I Is Involved in Photorespiration and Is Essential for Life"
11:35 am - 11:40 am	Discussion
11:40 am - 12:05 pm	**Tammy Sage** (University of Toronto, Canada) "Evolutionary Assembly of C4 Leaf Structure"
12:05 pm - 12:10 pm	Discussion
12:10 pm - 12:30 pm	General Discussion
12:30 pm - 1:30 pm	Lunch
1:30 pm - 4:30 pm	Free Time
4:30 pm - 6:00 pm	**Poster Session**
6:00 pm - 8:00 pm	**New Engineering and Investigative Approaches to CO_2 Assimilation** Discussion Leader: **Joy Ward** (University of Kansas, USA)
6:00 pm - 6:10 pm	Introduction by Discussion Leader

6:10 pm - 6:35 pm	**Ron Milo** (Weizmann Institute of Science, Israel) "Sugar Synthesis from CO_2 in *E. coli*"
6:35 pm - 6:40 pm	Discussion
6:40 pm - 7:30 pm	**Howard Griffiths** (University of Cambridge, United Kingdom) "Intelligence on the Design of Leaves: Matching Water Supply to Carbon Demand for a Resilient Crop Ideotype"
7:30 pm - 7:45 pm	Discussion
7:45 pm - 8:00 pm	Closing Remarks
8:00 pm - 9:00 pm	Dinner
Friday	
7:30 am - 8:30 am	Breakfast
9:00 am	Departure

Contributors

Gordon Research Conferences	Carl Storm Underrepresented Minority Fellowship	NSF
International Society of Photosynthesis Research (ISPR)	CONVIRON Building Partnerships | Creating Solutions	ARC Centre of Excellence for translational photosynthesis
Functional Plant Biology	WALZ	LI-COR
BAYER	METER ENVIRONMENT	CEPLAS Cluster of Excellence on Plant Sciences
SEB Society for Experimental Biology		