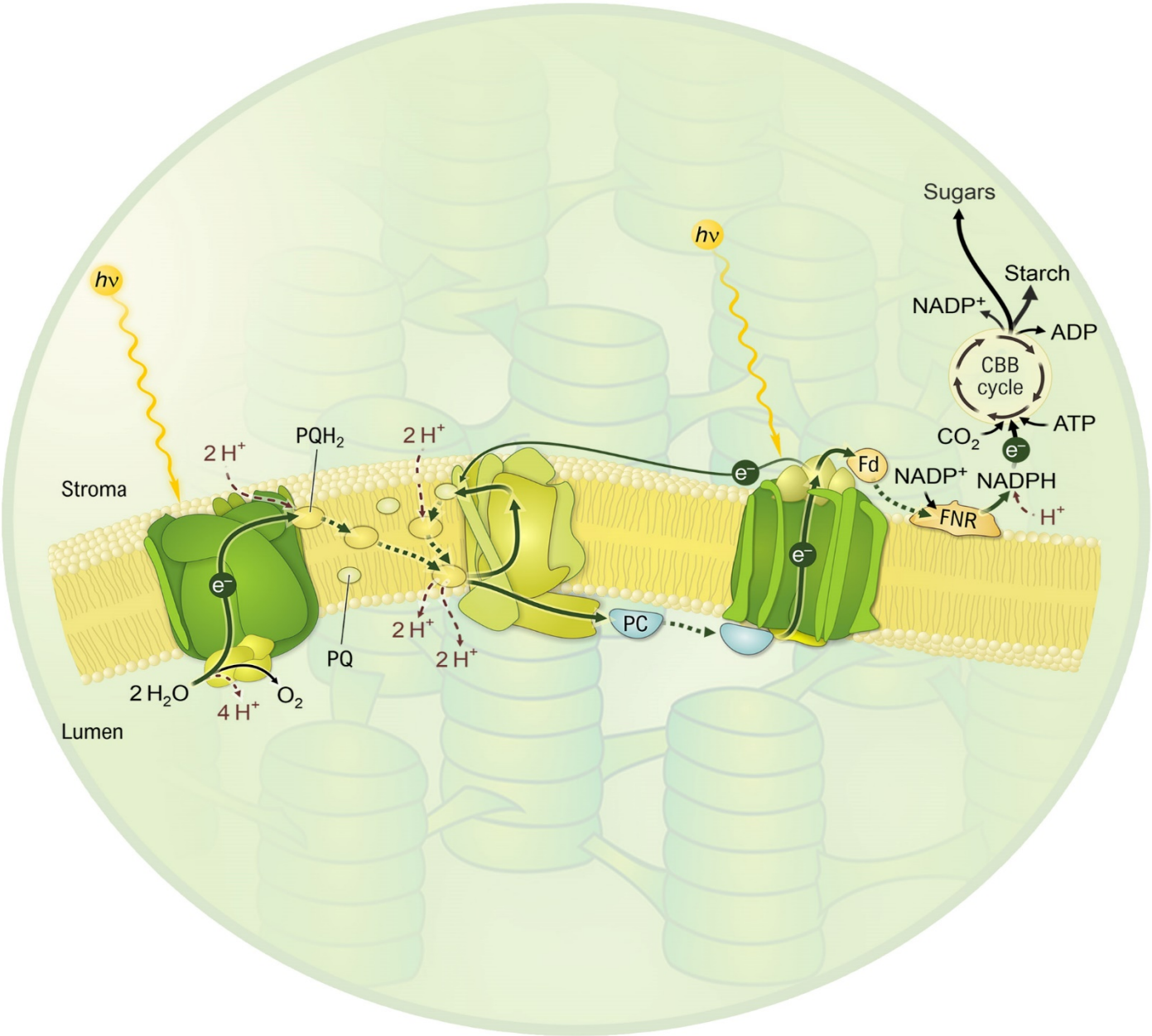
BOOK OF ABSTRACTS



PHOTOSYNTHETIC MICROORGANISMS FOR SUSTAINABLE DEVELOPMENT

6 - 7 December 2023

Rome, Italy

Consiglio Nazionale
delle Ricerche

CONFERENCE PROGRAM AND ABSTRACTS

GREEN CHRISTMAS SESSION

PHOTOSYNTHETIC MICROORGANISMS FOR SUSTAINABLE DEVELOPMENT

INTERNATIONAL ONLINE CONFERENCE

TOPICS:

Photosynthetic Factories

Structure, Function & Dynamics of Photosynthetic Components

for details visit the conference webpage

free registration is available here

contact us at gcs.org@cnr.it

6-7 December 2023, Rome, Italy

Consiglio Nazionale delle Ricerche
Istituto per i Sistemi Biologici/Dipartimento di Scienze Bio-Agroalimentari
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Thylakoid membrane and photosynthetic complexes. Source SciGrafik & Agrisera: Free educational poster and images https://www.agrisera.com/en/images-for-download.

The **Green Christmas Session** has been conceived as an annual series of interactive online meetings. The discussions will centre around various fundamental and applied aspects of photosynthesis research and its potential to offer sustainable solutions for addressing emerging questions and problems in modern society.

The **Green Christmas Session 2023** is under the patronage of the International Society of Photosynthesis Research (*ISPR*), European Society of Photobiology (*ESP*), Marie Curie Alumni Association (*MCAA*), Italian Society of Photobiology (*SIFB*) and GdR Integrative Biology of CO2 (*IBCO2*).

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The Conference is hosted by the Institute for Biological Systems, National Research Council, Territorial Research Area of Rome 1.

WELCOME

Dear participants,

On behalf of the Scientific Committee, we are delighted to welcome you to the third edition of the online **Green Christmas Session *"Photosynthetic microorganisms for sustainable development"***. The GCS 2023 will showcase the potential of photosynthetic microorganisms and photosynthetic components to promote the development of technology enabling the sustainable growth of modern society.

The employment of photosynthetic microorganisms as living *cellular devices* and *cellular factories* with self-propagating and self-repairing capacity continues to gain momentum in developing solar-powered biotechnology for fuel, chemicals and energy production. Both oxygenic and anoxygenic photosynthetic microorganisms are highly efficient in light-energy conversion and possess an astonishing capacity to adapt to different growth environments and unique metabolic diversity and flexibility. Knowing better the mechanisms of their photochemistry and environmental adaptation might promote the carbon-neutral production of a vast number of desirable compounds and the generation of green energy and might strengthen the notion of the circular economy.

The GCS 2023 will provide a platform for discussing the latest trends and advancements in the development of bio-based applications employing photosynthetic microorganisms or their photosynthetically active pigment-protein assembles. In addition to this, in-depth insights into the intricate aspects of photosynthetic reactions and their regulation will be offered through the presentation of a wide range of spectroscopy techniques.

It will gather scholars, early-stage researchers, and students from around the world. The conference format includes preselected Invited Speakers, free attendance for the audience, and dedicated time for Q&A after each presentation.

Once again, we extend a warm welcome and look forward to a fruitful exchange of knowledge!

Maya Dimova Lambreva
(*chair*)

Giorgio Perin
(*co-chair*)

CONFERENCE PROGRAM

The conference schedule is set to Central European Time

6th December 2023

08:50 Online Platform Opening

09:00 Welcome address by **Zeineb Aturki** *(Acting Director of the Institute for Biological Systems)*

Opening by **Massimo Trotta** *(President-Elect of the European Society of Photobiology)*

SESSION: Photosynthetic Factories

CHAIRS: Kyle Lauersen, Giorgio Perin, Maya D. Lambreva

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Elite strain development using phenomics

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Metabolic engineering of cyanobacteria for sustainable production of chemicals and fuels

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Prospects for lipid production and engineering in microalgae

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Bioengineering microalgae for their application as green cell factories

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Flavodiiron proteins, a molecular valve for the regulation and the engineering of photosynthetic electron transport

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Revealing ultrafast molecular mechanisms by two-dimensional electronic spectroscopy

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Tuning into photosynthesis with NMR: dynamic structures and processes in thylakoid membranes and whole cells

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Diatom model species to address the functional diversity of photosynthesis

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12:40	**Alberto Mezzetti** *(Sorbone University, France)* *Light-adapted state in photosynthetic reaction centres studied by time-resolved FTIR difference spectroscopy*	Page 16
13:05	**Closing remarks**	

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Ralph P.J

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Elite Strain Development Using Phenomics

Keywords: *screening, mutants, robotics and AI*

Phenomics has allowed the massive expansion in crop science over the past century; equally, it has revolutionized cancer research. Learning from these divergent fields, we can identify elite strains of algae to decarbonize virtually any industry while also providing a deeper understanding of global biogeochemical processes. In this talk, I'll explore the disciplines that have laid the foundations for the current expansion of algal phenomics. I'll establish the fundamentals of G x E = P and provide examples of industrial biotech and ecological processes using this technology. Finally, I'll explore the ancillary infrastructure and technology needed to accelerate this exciting new field of algal physiology (including high throughput screening, mutagenesis, cryo-preservation and AI-based data analytics). These HTS technologies can also be applied to seaweeds, allowing both algae forms to promote sustainable development and enable our rapid transition to a circular bioeconomy.

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Metabolic engineering of cyanobacteria for sustainable production of chemicals and fuels

Keywords: Synechocystis, metabolic engineering, terpenoids, phenylpropanoids, laboratory evolution

Cyanobacteria can be used as host organisms for solar-driven biotechnological applications converting CO_2 via photosynthesis into useful products. Using genetic engineering, we can make directed changes in the genome of model cyanobacteria to introduce new capabilities into the cells, enabling production of a vast array of compounds suitable for use as feedstock for chemical industry or as fuels. We have engineered strains of the unicellular cyanobacterium *Synechocystis* sp. PCC 6803 to produce *trans*-cinnamic acid (*t*CA) and *para*-coumaric acid (*p*Cou), the first intermediates of the plant phenylpropanoid pathway.[1] By applying laboratory evolution we have also generated strains of *Synechocystis* able to produce phenylalanine, and examined the capability of the evolved strains for production of *t*CA and *p*Cou. We demonstrate that the combination of laboratory evolution and targeted metabolic engineering can be a powerful tool in cyanobacterial strain development.[2]In another project, we engineer *Synechocystis* for production of isoprene, a small volatile hydrocarbon with a range of different applications including as a feedstock for jet-fuel production.[3,4]

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Prospects *for lipid production and engineering in microalgae*

Keywords: *Nannochloropsis, lipid engineering*

While microalgae have caught industrial interest as promising sustainable photosynthetic production platforms for several compounds (i.e., proteins, hydrocarbons, fatty acids) since several decades, it is clear that these microorganisms could be further optimized in solar energy conversion, carbon capture and utilization, and the partitioning of metabolic fluxes (1,2). In this context, our research moves towards the genetic domestication of robust, oleaginous microalgae, such as *Nannochloropsis oceanica*. These microalgae are ideal for the development of lipid production platforms that fulfil the necessity of improved yields, and of sustained productions at a scale. Part of our very recent activities involves the development of novel tools for both gene editing and gene expression, which we will present during this talk. We will also discuss our recent targeted genetic engineering activities aimed to generate and investigate high-lipid phenotypes, and to tailor lipid composition of *N. oceanica*, towards the inclusion of novel lipid classes (6-8).

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Bioengineering microalgae for their application as green cell factories

Keywords: *microalgae, Chlamydomonas reinhardtii, genetic engineering, synthetic biology*

Microalgae are capable of efficiently converting inorganic CO_2 with the help of sunlight energy and water splitting into organic biomass, which is composed of energy-rich carbon-based compounds. With this ability, microalgae have the potential to serve as “green cell factories” for bio-industries by bioengineering the direct catalysis of production processes for fine or bulk chemicals. However, in order to compete with heterotrophic bacteria systems in industrial biotechnology, bottlenecks such as limitations in photosynthesis, carbon fixation, and carbon partitioning towards the products of interest, as well as the availability of powerful molecular tools for the generation of mutants with enhanced efficiency as green cell factories have to be overcome. New achievements and insights into the design of synthetic constructs for efficient gene/protein expression and pathway engineering, performed with the microalga *Chlamydomonas reinhardtii* for the efficient synthesis of a variety of carbon-based products, will be presented with a specific focus on diterpenes, pigments and polyamines.

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Flavodiiron proteins, a molecular valve for the regulation and the engineering of photosynthetic electron transport

Keywords: *Photoprotection, Photosystem I, PSI, Flavodiiron proteins, FLV, Physcomitrella*

Plant development and metabolic processes rely on the efficiency of photosynthesis. Sunlight activates two photosystems, initiating an electron transport chain that yields NADPH and establishes a proton gradient, essential for ATP synthesis in carbon fixation. Photoprotective mechanisms come into play during fluctuating light intensities, preventing electron transport chain imbalances and potential cellular damage.

In response to sudden illumination, flavodiiron proteins (FLV) play a crucial role by accepting electrons downstream of photosystem I through O_2 photoreduction to water. While FLV serves as a safety valve for excess electrons in all photosynthetic organisms within the green lineage, excluding angiosperms, there remains a lack of knowledge regarding the structure and mode of action of FLV. In our research group, we are currently characterizing FLVA and FLVB proteins in the moss *Physcomitrium patens* to elucidate their functions during land colonization and adaptation to diverse environments.

Wild-type (WT) plants and *flva/b* double knockout mutants were acclimated to control light (CL), high light (HL), and fluctuating light (FL) conditions for a comprehensive analysis encompassing physiological, biochemical, and spectroscopic appoaches. Notably, FLV accumulation increased in WT plants acclimated to HL and FL compared to CL plants, suggesting their role in managing excess light conditions. Moreover, we generated plant lines expressing a 6xHis-tagged version of FLVB, enabling the purification of FLVB/A heterocomplexes. The stable binding between these proteins indicates a robust association. Importantly, the purified heterocomplexes demonstrated functionality, providing a solid foundation for further structural and interactome studies.

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Native phosphite metabolism in nitrogen-fixing cyanobacteria and its use to manage contamination

Keywords: *cyanobacteria, metabolic engineering, commercialisation, contamination*

Photosynthetic bacteria can be engineered to directly convert CO_2 and/or N_2 into useful products with the potential to reduce our overall environmental footprint. A number of barriers prevent commercialisation including engineering high-performance strains and contamination. While studying the model strain *Anabaena sp*. PCC 7120 we discovered that the wild-type strain is capable of utilising phosphite. Interestingly, this provides an opportunity to compare one media constraint (phosphite insted of phosphate) with another (no bioavailable nitrogen), or combinations thereof, as an approach to minimize contamination.

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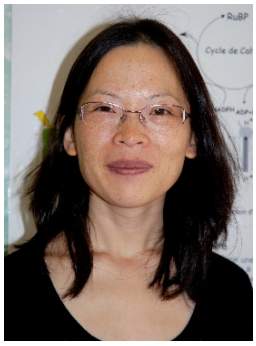

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Exploring algal lipid metabolism for a sustainable bioeconomy

Keywords: *Lipid metabolism, Chlamydomonas, Lipid droplet, Hydrocarbons, CO_2*

Microalgae are fast-growing microorganisms that have developed efficient mechanisms to harvest and transform solar energy into energy-rich molecules such as lipids. They are thus potentially great renewable cell factories for production of fuels and biomaterials for the chemical industries. However, a central issue is the inverse relationship observed between cell growth and cellular lipid content, i.e. conditions favoring a higher oil content per cell often compromises cell growth therefore lipid productivity. What makes the matter worse is that oil content fluctuate in response to environmental hues. To find solutions overcome these issues, we studied lipid metabolism and investigated the genetic, biochemical as well as environmental regulation of lipid metabolism in the model microalga Chlamydomonas reinhardtti. In this talk, I will present our current knowledge on the role of lipid metabolism in adaptation to a changing environment and discuss the exploration of this natural capacity for human benefit.

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Photosynthetic microalgae for sustainable wastewater treatment and agriculture

Keywords: *wastewater treatment, microalgae, agriculture, circular bioeconomy*

Microalgae are promising tools for establishing a circular economy connecting wastewater treatment (WWT) with agriculture in a sustainable approach, in opposition to conventional treatment which is highly expensive, energy-demanding, generates hazardous gaseous, and sludge wastes. This work focused on piggery WWT, highly pollutant in ammonia and organic matter, needed a pre-treatment to avoid dilution with a spence of fresh water (Ferreira et. 2022). Pork is one of the most widely consumed meats worldwide, due to smaller investment costs and fast economical return to farmers, which is associated to high fecundity, better-feed conversion efficiency, early maturity, and short generation interval (DAHD, 2022igs farms are spread all over the world.

On the other hand, current agricultural research is focused on ways to achieve sustainable food security amidst an ever-increasing global population and climate crisis, pollution, and deteriorating soil due to overuse of agrochemicals. Microalgae meet the criteria of being natural, renewable, promoting plant growth, improving soil fertility, and providing protection against pests and pathogens (Stirk 2021).

Two approaches are highlighted – a physico-chemical one (Photo-Fenton – ALGAVALOR project) followed by microalgae cultivation, and biological one (Constructed Vertical flow Wetlands (CW), microalgae cultivation and Microbial Fuel Cell– WCAlgaeKIT+ project).

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Chlamydomonas in the Light: One Alga, Multiple Responses

Keywords: *light-harvesting complexes, photosystems, regulation, non-photochemical quenching*

This presentation delves into the acclimation strategies of Chlamydomonas reinhardtii, a model green alga, highlighting its capacity to adjust to varying light and carbon conditions. The focus will be on the photoprotective mechanisms, particularly non-photochemical quenching (NPQ), state transitions and the regulation of the antenna size, which are essential for efficient photosynthesis, by modulating light capture and energy dissipation.
The discussion will also cover the genetic diversity among C. reinhardtii wild-type strains and its implications for photosynthetic and photoprotective capacities under high light exposure. Additionally, the influence of CO2 availability on the composition and function of the photosynthetic apparatus will be examined.
The findings presented illustrate the remarkable adaptability of the photosynthetic machinery of C. reinhardtii and its complex response strategies, which contributes to the robustness of the alga in diverse environmental conditions.

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Revealing ultrafast molecular mechanisms by two-dimensional electronic spectroscopy

Keywords: *Photosystem I, Photosystem II, light harvesting, time-resolved spectroscopy*

The two photosystems, PSI and PSII, that operate in tandem to drive the photoinduced electron transport from water to NADPH in plants, algae and cyanobacteria, are organized as protein supercomplexes containing hundreds of pigments and cofactors in multiple functional subunits. Following the pathways and the sequence of elementary steps from photon absorption in any of the associated light-harvesting antenna pigments to creating charge-separated states in the reaction centre is a highly challenging task. Two-dimensional electronic spectroscopy (2DES) is a valuable tool to monitor the excitation dynamics in complex multichromophore systems. 2DES extends the traditional pump-probe transient absorption spectroscopy by resolving the absorption changes in terms of both the excitation (pump) and detection (probe) frequency, directly revealing correlations between excited states and their population dynamics. A new experimental user end-station at the ELI-ALPS Research Institute using ultrabroadband laser pulses at high repetition rate is especially suited to probe light-harvesting in large photosynthetic supercomplexes. 2DES measurements were done on PSII and PSI antenna-reaction centre supercomplexes. The results can be compared with calculations of energy transfer based on recent cryoEM structures of the same supercomplexes toward identifying the energy migration pathways and kinetic bottlenecks of light harvesting.

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Tuning into photosynthesis with NMR: dynamic structures and processes in thylakoid membranes and whole cells

Keywords:

Regulation of photosynthesis under changing environmental conditions is associated with dynamic flexibility of photosynthetic proteins, membrane, and cell architectures. In my talk, I will describe how Magic Angle Spinning (MAS) NMR spectroscopy can be used for characterizing composition and fluidity of photosynthetic thylakoid membranes and to follow dynamic processes in photosynthetic cells. I will first explain the use of dynamics-based spectral editing NMR as a tool which reduces spectral complexity, by filtering motion-dependent signals. Next, I will illustrate how this approach allowed us to assess thylakoid protein and lipid dynamics and the influence of membrane stacking and zeaxanthin. Finally, I will show that the NMR approach has potential for following metabolic processes and structural dynamic changes in live microalgae cells.

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Diatom model species to address the functional diversity of photosynthesis

Keywords: *Diatoms, Phytoplankton, Photosynthesis, Plastid biogenesis.*

Diatoms are the world's most diverse group of algae, comprising at least 100,000 species. Contributing 20% of annual global carbon fixation, they underpin major aquatic food webs and drive global biogeochemical cycles. Over the past two decades, breakthroughs in genomics and ecosystem biology, as well as the development of genetic resources in diatom model species, have contributed to our understanding of this important class of microalgae in the context of evolution, cell biology, and metabolic adaptations. However, genetic approaches based on loss-of-function have long been precluded for the study of diatom photosynthesis because the established model species are essentially obligate phototrophs and inactivation of essential plastid functions could result in lethal phenotypes. To overcome this issue, we have recently developed genetic approaches in the facultative heterotrophic diatom species *Cyclotella cryptica*. We successfully transformed the nuclear genome of *C. cryptica* and knocked out, with the CRISPR/Cas technology, several nuclear genes, including that encoding the□□ subunit of plastid ATP synthase. We thus generated and characterize the very first diatom photosynthetic mutants, which highlights new peculiarities of photosynthesis regulation in diatoms and opens the way for further exploration of plastid function, biogenesis, and evolution in diatoms.

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Photosynthetic Control, a probe for the balance between the activities of photosynthetic electron transport and Calvin Benson cycle in plants

Keywords: *Photosynthetic Control, qP, P700 redox state, regulatory mechanism*

To tune the different parts of the photosynthetic apparatus, the chloroplast makes use of different regulatory mechanisms. The chloroplast can, e.g., adapt the activity of several Calvin-Benson cycle enzymes to the electron transport rate by the thioredoxin system and it can adapt the electron transport rate to the Calvin-Benson cycle activity via Photosynthetic Control, the slowdown of the re-oxidation of plastoquinol by the cytochrome b_6f complex as the lumen pH is getting lower. This causes a more reduced PS II + PQ pool and a more oxidized plastocyanin pool and PS I (P700 and ferredoxin pool). By keeping PS I largely oxidized, Photosynthetic Control protects PS I also against damage. By monitoring the PS II redox state by the parameter qP as a function of the redox state of P700 it is possible to get a measure for Photosynthetic Control. By determining these two parameters as a function of the light intensity (by making a Light Curve) the induction of Photosynthetic Control can followed. Comparing shade with sun leaves it can be shown that due to its lower photosynthetic capacity, induction of Photosynthetic Control occurs already at much lower light intensities in shade leaves than in sun leaves. The slope of the relationship between qP and P700 was for all the plants measured very similar. To compare different samples it is more practical to compare the qP-P700 relationship for a single medium light intensity. For the Light Curves the chosen step length was 2 min. By playing with the step length it may be possible to say something about the response time of the system to a sudden change in the light intensity, a topic that will be discussed as well.

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Temperature dependence reveals how singlet oxygen is formed and allows calculation of contributions of photoinhibition mechanisms

Keywords: *Singlet oxygen, photoinhibition, misses, manganese,* P_{680}^+

Singlet oxygen ($^1O_2$) is produced in chloroplasts via PSII charge recombination reactions, but it has not been clear which recombination reactions lead to formation of triplet chlorophyll (^{3}Chl*) and $^1O_2$. We compared the temperature dependences of $^1O_2$ production, photoinhibition and charge recombination pathways. Production of $^1O_2$ by thylakoids increased from -2 to +35 °C, showing a temperature dependence matching with that determined earlier for misses (failures of the oxygen evolving complex to advance an S-state). A dependence of $^1O_2$ production on physiological temperatures rules out recombination of the primary charge pair as a main contributor to $^1O_2$ formation, and the temperature dependences of $S_2Q_A^-$ and $S_2Q_B^-$ recombination pathways were found to be too steep to explain $^1O_2$ production.$^1O_2$ has been suggested to cause photoinhibition of PSII, and indeed photoinhibition showed similar temperature dependence as $^1O_2$ production. However, this temperature dependence of photoinhibition was preserved in anaerobic conditions where $^1O_2$ is not formed, indicating that photoinhibition only partially depends on $^1O_2$. Photoinhibition showed steeper temperature response when going from ultraviolet to red light. The data indicate that $^1O_2$ is produced via the miss-associated recombination of $P_{680}^+Q_A^-$. Furthermore, the contributions of three parallel photoinhibition mechanisms can be calculated. The manganese mechanism dominates in ultraviolet radiation but also functions in white light. Mechanisms depending on $^1O_2$ or long-lived P_{680}^+ dominate in red light. Furthermore, the contribution of $^1O_2$ to photoinhibition increases with temperature.

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Mathematical model to understand photosynthetic responses to light oscillating on different time scales

Keywords: *frequency analysis, non-photochemical quenching, oscillating light, regulation*

Algae live in a dynamic light environment that depends on up/downwelling, intermittent shading, or light focusing by surface waves. The light modulation in algal bioreactors can be even more dramatic. Depending on the mechanism of the light modulation, its characteristic frequencies can range from many cycles per second to minutes or hours. Application of light-emitting diodes allows control of the light frequency also in the high-frequency range, much above thousands of cycles per second and to manipulate the light spectrum. The response of algae to changing light differs from stationary light and this has led to suggestions that photosynthetic efficiency can be enhanced by light modulation. Another opportunity has been seen in perturbing the algal physiology by oscillating light to produce high-value products. Light-emitting diodes further permit to study photosynthesis and its regulation in the frequency domain, like the homologous sensing approach that brought progress in physics, and engineering. Also important, the frequency-domain analysis does not require a dark acclimation of the algae that often limits sensing in the time domain. Like the well-established frequency-domain approaches in other fields of science and engineering, this analysis of algal photosynthesis requires mathematical tools to identify dynamic signatures that can be attributed to individual photosynthetic processes and regulatory mechanisms acting on different time scales.

Here, we offer a mathematical model illustrating the frequency-domain approach to algal photosynthesis.

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Light-adapted state in photosynthetic reaction centers studied by time-resolved FTIR difference spectroscopy

Keywords: *FTIR, electron transfer, hydration state, H_2O molecules, 2D correl. spectroscopy*

We have investigated by rapid-scan FTIR difference spectroscopy (1), the build-up of light-adapted state in bacterial Reaction Centers (RCs) under continuous light. It is important to note that the same effect was recently reported also in PSII (2).
Illumination with 20 s continuous light induce formation of a $P^+Q_A^-$ charge separate state with much longer lifetime compared to the charge separate state obtained after a saturating flash (3). This effect was found to be highly dependent on the hydration state of the RC.
A detailed 2D correlation spectroscopy analysis showed that the kinetics of marker bands for localized protein conformational changes and of for the oxidised primary donor is not the same (4). The results are discussed in the framework of the current knowledge on bacterial RC photochemistry.

(1) Mezzetti & Leibl, Photosynth Res 2017, 131, 121-144
(2) Sipka et al., Plant Cell, 2021, 33, 1286-1302
(3) Malferrari et al., BBA-Bioenerg. 2013, 1827, 328-339
(4) Malferrari, Mezzetti, Francia, Venturoli, Noda in preparation

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https://www.mariecuriealumni.eu/

Congress call MCAA 2024

The 2024 conference is scheduled for 15-16 March and will be held in Milan, Italy

The MCAA Annual Conference and General Assembly in 2024 will take place in Milan, Italy, starting with satellite events on March 14th, followed by the conference on March 15th and 16th.

We dedicate the 2024 conference to the 10th anniversary of the Marie Curie Alumni Association and to everyone who has made this journey possible.

The call for sessions is currently open for six thematic tracks: (1) Bridging Science and Business, (2) Career Development, (3) Genders, Equity, Diversity and Inclusion, (4) Policy, (5) Research Funding, (6) Research Management and (7) Science Communication.

https://www.mariecuriealumni.eu/conference-2024

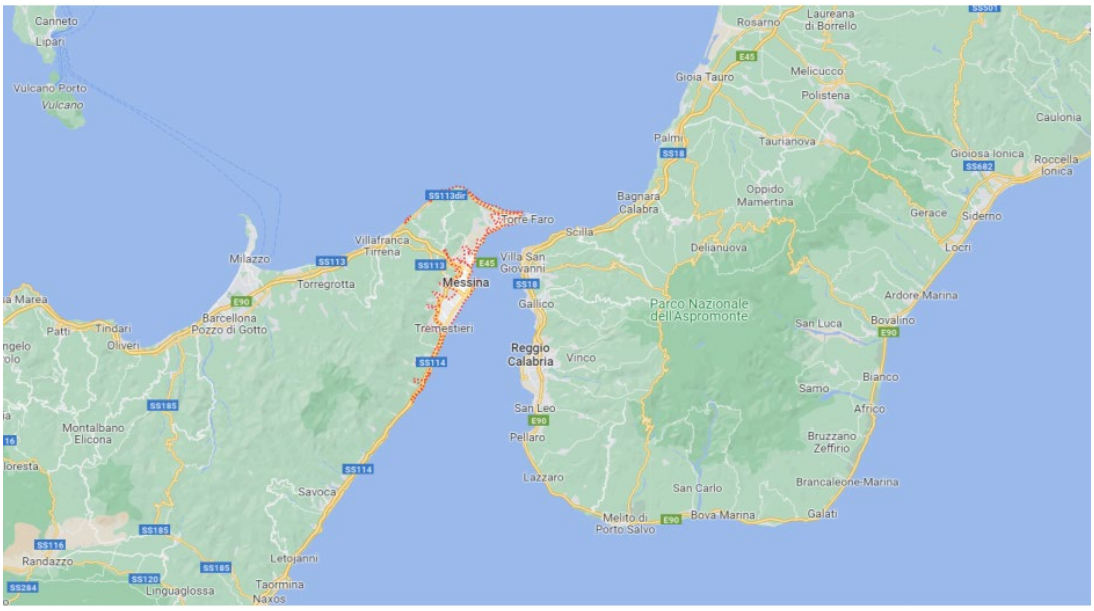
http://www.sifb.it/

Congress call ISFB 2024

The 2024 conference is scheduled for 9-11 September and will be held in Messina, Italy

Continuing the tradition of encouraging interdisciplinary exchange, the conference intends to broaden the audience to encompass scientists from across the Mediterranean who are actively involved in these areas.

http://www.sifb.it/congress-call/



ePS2
2nd European Congress on Photosynthesis Research
Padova, Italy | 25-28 June, 2024

https://www.eps2.org/

Congress call Second European Congress on Photosynthesis Research

The ePS2 congress is scheduled for 25-28 June 2024

and will be held in Padova, Italy

After the success of the first edition, the European Congress for Photosynthesis Research will come back in 2024. From June the 25th to the 28th 2024, experts in the field of natural and artificial photosynthesis will gather in Padova (Italy), the cradle of the scientific method developed by Galileo, for an exciting second edition of this scientific event.

KEY DATES

ABSTRACT submission OPENING
1 December 2023

ABSTRACT submission DEADLINE
15 February 2024

EARLY REGISTRATION DEADLINE
29 February 2024

Join us for this exciting second edition!

https://www.photobiology.eu/

The 7th ESP Photobiology School is scheduled for 16-22 June 2024 and will be held in Bressanone, Italy

The purpose of the ESP Photobiology Schools is to provide an introductory overview of all main aspects of photobiology, presented by experts in each area. The intention is to cover the basic principles of photobiology and photochemistry of biomolecules as well as applications of such knowledge in understanding effects of climatic changes, influence of light on biological systems, applications of light in medicine and related purposes.

The School includes basic lectures in each field that should be attended by all participants as well as optional special lectures in the same fields. The students will have the opportunity to present their results at a poster session.

7th Photobiology School - June 16-22, 2024

Casa della Gioventù Universitaria of the University of Padova
Via Rio Bianco 12, I-39042 Brixen/Bressanone, Italy

With the the patronage of the University of Padova and of IQS-University Ramon Lull.

Please keep visiting https://photobiology.eu/photobiology-school for registration instructions (Registration will start on February 1st).

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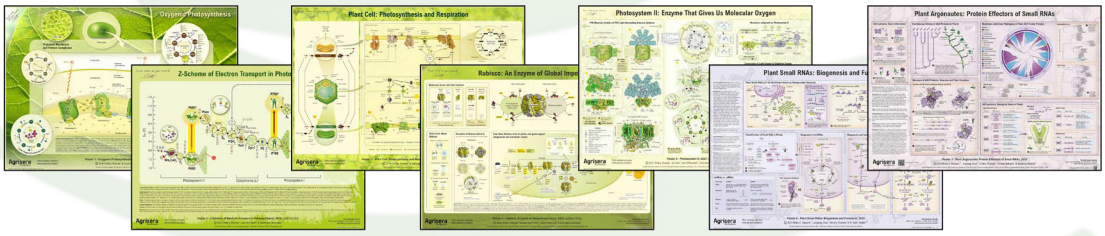

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