
BIOGRAPHICAL SKETCH

NAME: Tomas Morosinotto

POSITION TITLE: Full Professor in Plant Physiology

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	Completion Date	FIELD OF STUDY
University of Verona, Italy	MS	07/2001	Biotechnology
University of Verona, Italy; University of Marseille, France	PHD	01/2005	Plant Biochemistry
CEA Cadarache, France	Postdoctoral	09/2006	Structural Biology

A. Personal Statement

I am a professor in plant physiology and my research is focused on the study of photosynthesis in different organisms, investigating how evolution shaped the regulation of this metabolic process going from algae, mosses and plants. These studies are characterized by the integration of multiple approaches, starting from generation of lines with genetic modifications and using biophysical, biochemical and functional investigation in combination with genome, transcriptome, lipidome, and metabolome analyses.

From the knowledge developed from basic research, I also devoted significant time in developing applications of photosynthetic organisms and the biomass they produce. For several years I have been involved in developing biotechnological applications of algae, also in collaboration with several companies aiming at developing commercial products (e.g. biofuels, novel foods). One of the patented strains is expected to be commercialized by Alver SA soon.

More recently, this work expanded in plants, participating to different projects aimed at improving photosynthesis in crops.

Since 2021 I am the Director of the Botanical Garden of the University of Padova. Work here entitles the supervision of technical personnel (gardeners, maintenance, administration, 15 persons in total), and research activities, as well as coordination with staff responsible for events and visitors.

In summary, I have the expertise and motivation necessary to carry out the proposed project but also to fully exploit the results obtained for the development of further ambitious research initiatives.

Ongoing and recently completed projects that I would like to highlight include:

On algae genetic engineering for improvement of photosynthetic productivity:

2012- 2017 ERC – Starting Grant BioLEAP focusing on the “Biotechnological optimization of light use efficiency in algae photobioreactors

2021-2024: supervisor of one Early Stage Researchers (ESR) within the ITN network Digitalgaesation (<https://digitalgaesation.eu/>) call H2020-MSCA-ITN-2020

On algae biotechnological applications:

2017-2022: PI of multiple research contract with different companies (Alver SA, ENI spa, TMCI Padovan spa) development of large-scale cultivation of algae for food/fuel applications.

2021-2024: International coordinator of project “CooCE- Harnessing potential of biological CO₂ capture for Circular Economy”. ACT Accelerating CCS Technologies, (<https://cooce.eu/>)

On improvement of photosynthesis in plants:

2023-2025: Local PI of a PRIN-PNRR project entitled: “ Improving photosynthetic efficiency by manipulating the redox regulation of carbon fixation – IPERAFIX”

2023-2028: Local PI of H2020 project entitled “Best-Crop Boosting photosynthESis To deliver novel CROPs for the circular bioeconomy”, from the call HORIZON-CL6-2022-CIRCBIO-02 (RIA).

2020-2025: Local PI of H2020 project entitled “Gain4Crops Rewiring photorespiration using natural and synthetic pathways to sustainably increase crop yield”, <http://gain4crops.eu/> from the call BIOTEC-02-2019 - Boosting the efficiency of photosynthesis (RIA).

B. Positions, Scientific Appointments, and Honors

Positions and Scientific Appointments

2021- Present	Prefetto (Director) of the Botanical Garden of the University of Padova. Work entitles the supervision of technical personnel (gardeners, maintenance, administration, 15 persons in total), and research activities as well as coordination with staff responsible of events and visitors.
2019 – 2023	Scientific coordinator of Plant Genome Editing facility, Department of Biology
2018– Present	Full Professor in Plant Physiology, department of Biology, University of Padova, Italy
2016 – 2021	Member of the evaluation committee of ANR (French National Research Agency), Panels on Energy and sustainable development / bioeconomy
2015 – Present	Member of the Internal Resources and Scientific Evaluation committee, Department of Biology
2015 – 2021	Deputy director of PhD school in Biosciences, Department of Biology
2014- 2018	Associate Professor in Biochemistry, Department of Biology, University of Padova, Italy
2007 - 2014	Assistant professor in Biochemistry, Department of Biology, University of Padova, Italy.
2005 - 2006	Permanent CNRS researcher working at the LGBP (Laboratoire de Biophysique et Génétique des Plantes) in the science Faculty, Marseille, (France). Renounced to the position, opting for a position as assistant professor in Padova.

Honors

2024	Chair of 2nd European Congress on Photosynthesis Research, ePS-2 (https://www.eps2.org/)
2014	“Baccarani-Melandri” award presented by the Italian Society of Plant Biology to “a young researcher providing a personal, relevant, contribution to the development of plant physiology in Italy”
2010	“Vincenzo Caglioti” award presented by the Accademia Nazionale dei Lincei as a young researcher in Chemistry.
2010	“Robin Hill” award presented by the International Society of Photosynthesis as a young scientist (under 40) in photosynthesis.

C. Contributions to Science

1. My first contributions, as a Ph.D. student, were to the structural and biophysical characterization of antenna proteins in the photosynthetic apparatus. Main results were on the identification of the origin of red-shifted chlorophylls of Photosystem I, some peculiar spectral forms which have a profound impact on the properties of this pigment protein complex but whose molecular identity remained elusive. The interest in red-shifted spectral forms has increased in the past few years since it emerged that they play an essential role for photosynthesis in specific environments.

Cit. **Morosinotto T**, Breton J, Bassi R, Croce R. The nature of a chlorophyll ligand in Lhca proteins determines the far red fluorescence emission typical of photosystem I. J Biol Chem. 2003 Dec 5;278(49):49223-9. (cited 155 times)

2. as a postdoctoral researcher at CEA Cadarache (France) and then a permanent researcher at CNRS in Marseille (France), my research concentrated on the structural properties of VDE (Violaxanthin De-epoxidase), a crucial enzyme for photosynthesis regulation. Our structural analysis revealed a pH-controlled conformational change associated with the activation of this enzyme, representing groundbreaking information. This is still the only structure available for this protein that is now recognized also as a target to improve photosynthetic productivity in crops.

Cit. Arnoux P§, **Morosinotto T**§*, Saga G, Bassi R, Pignol D. A Structural Basis for the pH-Dependent Xanthophyll Cycle in *Arabidopsis thaliana*. *Plant Cell*. 2009 Jul;21(7):2036-44. § Equal contribution * Author for correspondence (cited 134 times)

3. As assistant professor/associate professor position in biochemistry at the Department of Biology in Padova (Italy), my research shifted from isolated protein complexes to *in vivo* functional studies of photosynthesis and its regulation. My research scope expanded to include various processes such as light-harvesting system regulation, electron transport modulation (cyclic and pseudocyclic), and, more recently, the influence of mitochondrial respiration and carbon fixation, which are crucial background for the current project. In this work, I used the nonvascular plant, *P. patens*, aiming at understanding how evolution has shaped plants metabolism and photosynthesis regulation mechanisms, revealing diverse strategies employed by different organisms in response to environmental cues. Key findings in mosses included the revelation that Non-Photochemical Quenching (NPQ) in *P. patens* is controlled by a combination of mechanisms from both algae and higher plants. We also established that Flavodiiron Proteins (FLV), first identified in cyanobacteria, also function in plants and plays a seminal role in response to light fluctuations, although they are absent in angiosperms. This interest in biodiversity has grown over the years, and our lab now investigates various organisms, including procaryotic cyanobacteria, eukaryotic algae, and nonvascular and vascular plants. This expansion was at the base of my current role as the director of the Botanical Garden at the University of Padova, where we now systematically explore the diversity of photosynthetic responses and analyse the impact of phylogenetic history versus adaptation to environmental conditions.

Cit. Alboresi A, Gerotto C, Giacometti GM, Bassi R and **Morosinotto T**, Mutants on heat dissipation in the moss *Physcomitrella patens* provide insights on the evolution of protection mechanisms upon land colonization, *PNAS* 2010 Jun 15;107(24):11128-33 (cited 156 times)
Gerotto C, Alboresi A, Meneghesso A, Jokel M, Suorsa M, Aro EM, **Morosinotto T***, Flavodiiron proteins act as safety valve for electrons in *Physcomitrella patens*. *PNAS* 2016 113(43):12322-12327 (cited 116 times).
Alboresi A, Storti M, **Morosinotto T***. Balancing protection and efficiency in the regulation of photosynthetic electron transport across plant evolution. *New Phytol*. 2019 221(1):105-109. (cited 77 times).

4. Since 2008, I have also been exploring the potential exploitation of algae as a source of biomass for biofuel, food, or feed production. This research has led to applied projects in collaboration with different companies that yielded 5 different patents. In research not devoted to specific applications, we investigated the metabolism of an eukaryotic alga, *Nannochloropsis*, which has a remarkable capacity to accumulate a large amount of lipids within its cells. In a series of highly cited publications, we explored how photosynthesis is regulated and the interplay between photosynthesis and lipid metabolism in this organism.

Cit. Simionato D, Sforza E, Corteggiani-Carpinelli E, Bertucco A, Giacometti GM and **Morosinotto T*** Acclimation of *Nannochloropsis gaditana* to different illumination regimes: effects on lipids accumulation. *Bioresource Technology* 2011 102(10):6026-32 (cited 154 times)
Sforza E, Simionato D, Giacometti GM, Bertucco A and **Morosinotto T***. Adjusted light and dark cycles can optimize photosynthetic efficiency in algae growing in photobioreactors. *PLoS ONE* 2012 7(6): e38975 (cited 242 times)
Simionato D, Block MA, La Rocca N, Jouhet J, Maréchal E, Finazzi G, **Morosinotto T***. Response of *Nannochloropsis gaditana* to nitrogen starvation includes a de novo biosynthesis

of triacylglycerols, a decrease of chloroplast galactolipids and a reorganization of the photosynthetic apparatus. *Eukaryotic Cell* 2013 12(5):665-76 (cited 301 times)

Alboresi A, Perin G, Vitulo N, Diretto G, Block MA, Jouhet J, Meneghesso A, Valle G, Giuliano G, Maréchal E, **Morosinotto T***. Light Remodels Lipid Biosynthesis in *Nannochloropsis gaditana* by Modulating Carbon Partitioning Between Organelles. *Plant Physiol.* 2016 171(4):2468-82 (cited 86 times).

5. Our research on algae was also dedicated to exploring the possibility of engineering their photosynthetic metabolism. We devised various strategies to optimize algae photosynthetic properties and in fact demonstrated that it is possible to obtain strains with higher biomass productivity when cultivated in artificial environmental conditions within photobioreactors.

Cit. Perin G, Bellan A, Segalla A, Meneghesso A, Alboresi A and **Morosinotto T*** Generation of random mutants to improve light-use efficiency of *Nannochloropsis gaditana* cultures for biofuel production *Biotec for Biofuels* 2015 8:161 (cited 81 times)

Perin G, Bernardi A, Bellan A, Bezzo F and **Morosinotto T*** A Mathematical model to guide Genetic Engineering of Photosynthetic Metabolism. *Metabolic Engineering* 2017 44:337-347 (cited 14 times)

Perin G, Bellan A, Michelberger T, Lyska D, Wakao S, Niyogi KK, **Morosinotto T***. Modulation of xanthophyll cycle impacts biomass productivity in the marine microalga *Nannochloropsis*. *Proc Natl Acad Sci U S A.* 2023 Jun 20;120(25):e2214119120. doi: 10.1073/pnas.2214119120. (cited 9 times)

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