UNIVERSITÀ
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Conferment of the title of Honorary Professor in Applied Physics on

WOLFGANG GÄRTNER

Laudatio

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Full Professor in Applied Physics

Centro Convegni Aule delle Scienze
University Campus - Parma

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It is with great pleasure that the University of Parma welcomes today prof. Wolfgang Gärtner to confer him the title of Honorary Professor in Applied Physics.

A chemist by training, during his whole scientific life prof. Gärtner has been fusing techniques coming from Physics with methods and issues coming from Chemistry and Biology, to create a blend of knowledge, enabling the study of biochemical processes activated by light.

The main source of energy for life on Earth is the Sun. Light can be regarded somehow as the very source of Life. Autotrophic photosynthetic organisms are at the bottom of the chains that eventually sustain life of heterotrophic organisms like, e.g., man. The interaction of light with living organisms triggers a variety of processes. Besides providing energy, light is the most ubiquitous environmental input of information, and while vision is perhaps the most obvious and known example, it is just one of the countless and ever growing cases we encounter in living beings.

Prof. Gärtner's professional life has taken place consistently and continuously in the research field dealing with the molecular mechanisms through which living systems, especially microorganisms and plants, transform energy transported by light, by stabilizing it in the form of chemical energy, or by transducing the information contained in light into messages for the organisms. His activity is almost paradigmatic in that it shows how in modern science different scientific disciplines and people with different backgrounds,

successfully meet to tackle difficult tasks like understanding the molecular mechanisms of relevant processes at the basis of life itself.

His career in scientific research led him to move through prestigious Institutions, first under the supervision of, and then collaborating with, top scientists coming from very different disciplines like Biology, Chemistry, and Physics, all conveying their efforts to uncover the hidden machinery that enables Life to exploit the energy and the information embedded in Light.

Wolfgang Gärtner studied Chemistry at the Universities of Göttingen and Braunschweig and got his PhD at the Würzburg University in 1982, under the direction of prof. Henning Hopf.

Since his first studies as a doctoral student, prof. Gärtner's interest has been directed towards processes of photonic energy transformation and light information processing by microorganisms and plants. His doctoral thesis dealt with bacteriorhodopsin, a light activated proton pump from *Halobacterium salinarum*, an ancient microorganism belonging to the Archaea superkingdom. Absorption of light by the retinal chromophore of bacteriorhodopsin, starts a complex series of molecular events, referred to as photocycle, ultimately resulting in the translocation of protons across a membrane. The stored energy is then used to synthesize ATP, the fuel of cells.

His first post-doctoral experience led him from 1982 to 1986 at the Max Planck Institute for Biochemistry in München where, within

the research group of prof. Dieter Oesterhelt, the “father” of bacteriorhodopsins, he further investigated the molecular basis of Archaea's photosynthetic systems.

Prof. Gärtner's strong background in organic chemistry allowed him to study the delicate interaction between the retinal chromophore and the protein environment using newly synthesized modified retinals assembled with bacteriorhodopsin, and related retinal proteins. His preparations of retinal analogues were later used by many laboratories with whom prof. Gärtner established several collaborations. Synergic use of time resolved and vibrational spectroscopies, synthetic organic chemistry and biochemistry offered unprecedented understanding of the molecular mechanisms at the basis of bacteriorhodopsin photocycle.

He then moved to the Biocenter in Basel within the group of prof. Kasper Kirschner and was associated as researcher from 1986 to 1991 with the Institute of Biology at the University of Freiburg in Germany.

In 1991, prof. Gärtner joined the Section led by Kurt Schaffner at the Max Planck Institute in Mülheim a.d. Ruhr in Germany where he then started working on phytochromes, photofunctional proteins considered the “eyes of plants”. The Institute, now called Max Planck Institute for Chemical Energy Conversion, at the time was named Max Planck Institute for Radiation Chemistry.

Since 1991 (and through 2016) he has been principal investigator, staff member and research group leader in this Max Planck Institute.

In those years, the Max Planck Institute for Radiation Chemistry in Mülheim was a prototype case of coexistence of advanced biophysics and physical chemistry skills, capable of providing a productive environment where cross-disciplinary issues were addressed.

In 1993, he received the “Habilitation” at the Duisburg University where he was appointed Adjunct Professor in 1999. In 2007, he became Adjunct Professor of Biochemistry at the Heinrich Heine University in Düsseldorf.

From 1991 onward, prof. Gärtner dedicated strong efforts to establishing for the first time the production in Mülheim of recombinant plant phytochromes. Up to then, plant phytochrome had been obtained by a complex extraction process from etiolated oat. That means that plants had to be grown in the dark in a humid and stinky cellar, under very unfriendly conditions for technicians and scientists. No wonder scientists were highly motivated to devise a different way to produce the compounds.

The novel heterologous expression in bacteria and in yeast led to a first publication on full-length and truncated phytochrome A in 1994, starting a new era in the study of these important photoreceptors.

Availability of recombinant proteins, i.e. not purified from etiolated plants, but rather expressed in a host organism, changed the way these systems could be studied. At the MPI for Radiation Chemistry, time resolved optical spectroscopies were applied

systematically to understand the molecular events that lead from the parent to the signaling state. In this context , it is important to mention the long standing collaboration with prof. Silvia Braslavsky, with whom prof. Gärtner tackled the problem of understanding the energetic content of the short-lived reaction intermediate states produced during the photo-induced cycles of retinal proteins. Spectroscopy provided suggestions and working hypotheses that were challenged systematically by rational mutations introduced in the photoreceptors with a typical approach of modern Science.

It may appear obvious to emphasize today the importance of this integrated approach, but prof. Gärtner and his colleagues have been pioneers in the systematic application of a truly interdisciplinary method to study the response of the molecular machinery to light absorption using time resolved spectroscopy.

In a joint effort with two groups in Berlin, prof. Gärtner discovered phytochromes in cyanobacteria in 1997: this was another turning point, given that bacterial sensory photoreceptors were configuring themselves as pseudo-visual systems. The simplicity and the somehow futuristic implications of working with cyanobacteria phytochromes, fascinated prof. Gärtner who actively worked on these new generation photoreceptors. The cyanobacterial phytochromes produced in Mülheim by prof. Gärtner and his group were used in many biophysical investigations.

A very productive and again innovative line of research in prof. Gärtner's group since 2002 has been the work developed with prof. Aba Losi on bacterial blue-light sensory photoreceptors containing unprecedented chromophores: derivatives of riboflavin, a yellow compound that goes under the common name of vitamin B2. This research effort holds a great potential for various applications spanning from development of fluorescent reporters to engineering photoactive proteins suitable for optogenetic applications.

The list of very productive collaborations that prof. Gärtner has established in Germany and all over the world is very long. Prominent, especially in the last few years, are his collaborations with the university of Wuhan, China, and with several research groups in Argentina. In particular, he is taking part in investigations on the role of blue-light photosensors in extremophile bacteria and in agricultural plant pathogens. His academic activity has brought him regularly to Wuhan where he has been teaching a two-week Photobiology course over the last six years.

He has been a member of the Council of the American Society of Photobiology, a long-time Associate Editor of Photochemistry and Photobiology, journal of the American Society for Photobiology, and has been invited to organize Symposia and to give lectures in numerous meetings. Since 2015 he has been a member of the Editorial Board of the prestigious Journal of Biological Chemistry.

Over the years prof. Gärtner has been committed to higher education, and has been guiding a number of PhD students who obtained their degree under his supervision. His agreeable character and positive attitude along with his great chemical, biochemical and biological knowledge on photosensors, have made him a very successful tutor for students in photobiology.

After retiring in 2016, he then initiated a new stage in his career at the Institute for Analytical Chemistry of the University of Leipzig.

For his outstanding and pioneering contributions to the field of photosensory biology, the Rector and Academic Senate are pleased to confer to prof. Wolfgang Gärtner the title of Honorary Professor of the University of Parma in Applied Physics.

Prof. Cristiano Viappiani

Parma, 5th December 2017