Glyco-Forum section

The 2013 Karl Meyer Award and Rosalind Kornfeld Award from the Society for Glycobiology

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The Society for Glycobiology is pleased to announce that the recipient of the 2013 Karl Meyer Award is Markus Aebi and the 2013 Rosalind Kornfeld Award is awarded to Carlos Hirschberg. The Karl Meyer Award was established in 1990 to honor the distinguished career of Karl Meyer and his outstanding contributions to the field of Glycobiology. This international award is presented to well-established scientists with currently active research programs who have made widely recognized major contributions to the field of Glycobiology. The Rosalind Kornfeld Award for Lifetime Achievement in Glycobiology was established in 2008 to honor the distinguished scientific career and service to the Society by Dr Rosalind Kornfeld. The award is given by the Society to scientists who have, over their professional lifetimes, made significant contributions with important impact on the field.

Karl Meyer Lectureship Award

Dr. Markus Aebi (Professor, Swiss Federal Institute of Technology, Zurich, Switzerland) has been a pioneer in the application of yeast genetic tools to identify the enzymes involved in endoplasmic reticulum N-glycosylation. His interest for glycobiology started with the serendipitous identification of the essential subunit WBP1 of yeast oligosaccharyltransferase. This discovery was rapidly followed by the description of several components of the eukaryotic oligosaccharyltransferase complex, thereby unraveling the intricate regulatory mechanisms underlying the transfer of oligosaccharides to nascent glycoproteins. The work of Dr. Aebi also led to the description of a novel class of mannosyltransferases and glucosyltransferases that utilize dolichol-phosphate-mannose and dolichol-phosphate-glucose for the assembly of the lipid-linked oligosaccharide substrate of oligosaccharyltransferase. The genetic and biochemical characterization of these endoplasmic reticulum glycosyltransferases established the structural requirements for recognition of lipid-linked oligosaccharides by oligosaccharyltransferase. Similar applications of yeast genetics yielded essential insights on the importance of dolichol recycling for N-glycosylation and on the function of N-linked carbohydrates in the processing of glycoproteins. Dr. Aebi showed that defined N-glycan structures serve as signals in the quality control process that leads to the degradation of misfolded proteins in the endoplasmic reticulum, an important step forward in the deciphering of the "glyco-code" of eukaryotic cells. The use of the model system Saccharomyces cerevisiae was not only instrumental for the detailed description of the conserved pathway of N-linked protein glycosylation in eukaryotes but also provided the necessary tools to identify and describe multiple types of human congenital disorders that affect this process.

A step forward in the understanding of N-linked protein glycosylation was achieved by the discovery of a general protein glycosylation system in the bacterium Campylobacter jejuni. The research team of Dr. Aebi transferred the biosynthetic pathway from Campylobacter into the model system Escherichia coli and described this N-glycosylation pathway at a molecular level. Most importantly, it was shown that the eukaryotic and the bacterial N-glycosylation are homologous processes, making it possible to decipher the molecular mechanisms of N-linked protein glycosylation in the bacterial system. This achievement also made possible the development of a bacterial expression system capable of producing recombinant human-type glycoproteins. This outstanding research work culminated in the publication of the

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structure of the bacterial oligosaccharyltransferase and the formulation of a reaction mechanism for the N-glycosylation process (in collaboration with the group of Kaspar Locher, ETH Zurich).

Dr. Aebi has the remarkable ability to integrate the outcome of his research in a broad biological context. Along this line, the description of fungal galectins has been related to the defense mechanisms of fungi against predation or the description of endoplasmic reticulum-associated protein degradation has been interpreted in the context of membrane homeostasis and cell viability. In addition to being an outstanding scientist, Dr. Aebi is an enthusiastic teacher and mentor and greatly contributed to the visibility of glycobiology by promoting junior researchers in the field.

For his seminal contributions to the field of glycobiology, both in high impact research in defining the mechanisms of protein glycosylation and quality control as well as carbohydrate-based defense mechanisms in fungi, Markus Aebi represents the very best in the field and thus has been awarded the 2013 Karl Meyer award from the Society for Glycobiology.

**Rosalind Kornfeld Award for Lifetime Achievement in Glycobiology**

**Dr. Carlos Hirschberg** (Professor, Department of Molecular and Cell Biology, Boston University Goldman School of Dental Medicine) has made many seminal contributions to the glycobiology and biochemistry of glycan synthesis as well as sugar precursor transport for more than four decades. Carlos Hirschberg received the professional degree of “Biochemist” from the University of Chile in 1965, followed by a combined Master’s degree in Nutrition and Biochemistry from Rutgers University in 1966. That year he enrolled at the University of Illinois at Urbana-Champaign for doctoral training. He was awarded his Ph.D. in Chemistry in 1970, working with Professors H.E. Carter and G.J. Schroepfer on sphingolipids. This was followed by postdoctoral training at Harvard University Medical School from 1970 to 1972 with E.P. Kennedy, and then at the Massachusetts Institute of Technology from 1972 to 1974 with P.W. Robbins. In hindsight Carlos Hirschberg training in these laboratories, dealing with problems in lipid synthesis, nucleotide enzymology, and glycobiology, set the stage for the work to come as an independent scientist, beginning as an Assistant Professor of Biochemistry at St. Louis University School of Medicine in 1974. Hirschberg’s productivity rapidly led to academic advancements, as well as appointments in the Department of Biochemistry and Molecular Biology at the University of Massachusetts Medical Center from 1987 to 1998, and then the Boston University Goldman School of Dental Medicine, where he organized the Department of Molecular and Cell Biology and currently holds the title of Professor and was Founding Chair from 1998 until 2011.

Carlos Hirschberg has made groundbreaking scientific discoveries with enormous contributions to the fields of glycobiology and cell biology. The findings of Hirschberg and his colleagues have been fundamental toward the understanding of how the carbohydrate groups of glycoproteins, glycosaminoglycans and glycolipids are assembled and modified by sulfation and phosphorylation. Carlos Hirschberg’s group is generally responsible for determining the mechanisms by which nucleotide sugars cross biological membranes, specifically in the endoplasmic reticulum and Golgi apparatus. His group discovered novel transporters in the membranes of the Golgi apparatus and endoplasmic reticulum that translocate nucleotide sugars, nucleotide sulfate, and ATP in the organelle lumen where they serve as donors for modifications of membrane and secreted proteins as well as lipids. Using a combination of biochemistry and genetics, his group then purified, cloned, and elucidated the mechanisms of action of several of these multi-transmembrane spanning proteins.

As demonstrated by the Hirschberg group, these transporters are antiporters that use the corresponding nucleoside monophosphate to move nucleotide sugars. Studies using both mammalian cells and yeast showed that a Golgi luminal nucleoside diphosphatase is required for generating the nucleoside monophosphates of the nucleotide sugar transport/antiport cycle. This cycle regulates nucleotide substrate availability in the organelle lumen and thereby the rate of posttranslational modifications. In support of this, the Hirschberg group showed that the rate of transport of UDP-galactose into the Golgi lumen regulates the types of proteoglycans that are synthesized. For the above work Carlos Hirschberg received a MERIT award from the NIH.

Work by Hirschberg’s and other groups showed that loss of a specific transporter results in selective impairment of posttranslational modifications, leading to defective tissue development and loss of virulence of pathogenic protozoa. A human disease, Leukocyte Adhesion Deficiency Syndrome II, is the result of a specific partial loss of GDP-fucose transport into the Golgi apparatus. As happens with truly original and basic findings, those from Carlos Hirschberg’s group have opened a new
field of research that is being followed by numerous other investigators.

Carlos Hirschberg’s work is so well established and so much part of the standard description of glycosylation processes, that some take it for granted. No textbook figure or review article diagram of glycosylation in the secretory pathway can be drawn without showing the essential roles of the transporters Hirschberg and his group identified. This seminal work has withstood the test of time because of its remarkable rigor and durability. Every assay was carefully calibrated, every substrate thoroughly characterized, every isolated membrane fraction painstakingly quality-controlled for content and sidedness. For these reasons, Hirschberg’s work is appreciated by all in the field. Hirschberg’s group was also the first to purify, clone and functionally express the heparan sulfate N-sulfotransferase and to demonstrate that the protein also has N-deacetylase activity.

Carlos Hirschberg has also always been influential in other ways over the years - mentoring students, postdocs, junior colleagues and even more senior colleagues, and by being a ‘behind the scenes’ proactive voice in supporting glycobiology and glycobiologists, at conferences, in discussions, and at study section meetings. He served as Chair of the 1989 Gordon Conference on Glycoproteins and Glycolipids and Chair of the Glycobiology Symposium at the ASBMB centennial meeting in 2006. In both instances he infused the programs with new faces in the field. Carlos Hirschberg also served as a member of two NIH Study Sections and as a member of the Editorial Board of several journals including the *Journal of Biological Chemistry, Glycobiology, and Biological Research*, a publication of the Society of Biology of Chile. He was Executive Editor of *Analytical Biochemistry* from 1991-2002. As Professor and Founding Chair of the Department of Molecular and Cell Biology at the Boston University Goldman School of Dental Medicine, he built a major center of glycobiology research and training.

Carlos Hirschberg merits the award based upon the exceptional impact of his work, his service to the field, and his high standards of excellence, integrity and fairness. His publications stand out for their high quality and completeness. He represents an eminent example of the qualities expected for a recipient of the Rosalind Kornfeld Award for Lifetime Achievement in Glycobiology.