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In Memoriam of Prof Dr Bernhard Guggenheim: a pioneering Oral Microbiologist

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Professor Bernhard Guggenheim died on June 27th 2015 at his home in Zürich, age 79. The community has lost a true visionary with a creative and challenging mind who made seminal contributions to the field of Oral Microbiology over the last half century. Bernie was an extremely influential oral scientist, undoubtedly controversial at times, who changed the thinking of others. His combination of absolute scientific rigor and forceful personality, were critical in his many scientific advances and his impressive influence on the oral scientific community.

Bernie was Emeritus Professor of University of Zürich. He had officially retired in 2005 as Professor and Director of the Institute of Oral Biology, which was formed in 2003 from the fusion of two historical Institutes, the Institute of Oral Microbiology and General Immunology (chaired by himself), and Institute of Oral Structural Biology (chaired by Hubert Schroeder). Bernie was born on 11 April 1937 in Zürich, Switzerland and attended Kantonales Realgymnasium in Zürich. He obtained his first degree in Agriculture in 1962 and his PhD degree in Microbiology in 1965, both from the Swiss Federal Institute of Technology, Zürich (ETHZ). While doing his PhD at the ETHZ, he also became an associate researcher at the Caries Research Laboratories of the Dental Institute of Zürich with Prof Hans Mühlemann. It was in Mühlemann's lab where Bernie's love for dental research blossomed, and he remained grateful to Hans throughout his career.

Bernie's scientific achievements and services to the community have been recognized by several accolades. His notable domestic and overseas

scholarly accomplishments include the Silver Medal Federal Institute of Technology (1963), the European Organization for Caries Research Rolex Prize (1972) and the Research in Dental Caries Award of the International Association for Dental Research (1986). Bernie was particularly proud of receiving the Silver medal from the City of Paris in 1993. He served the wider community in a number of significant roles including as a Foundation member (since 1982) and the President (1993-2004) of the Toothfriendly Society ("Aktion Zahnfreundlich"). He also received honorary doctorates from Umeå University, Sweden (1990), and the University of Bergen, Norway (2004). He served for twelve years (1986-1998) as Associate Editor for Oral Microbiology and Immunology (the precursor to Molecular Oral Microbiology), and as board member of several associations including the European Organization for Caries Research (ORCA), the Swiss Society of Microbiology (SSM) and the Swiss Dental Association (SSO). Bernie initiated the European Research Group in Oral Biology (ERGOB) and was a major contributor to the success of this organization.

His passionate commitment to ERGOB was exemplary and for the past 47 years, this organization has made seminal scientific contributions in oral biology and is now highly regarded. Bernie sheltered the ERGOB against temptations to become part of a larger scientific organization and thus it has maintained its avant-garde position since 1968. This organization is steered today by a three-member committee of Andrea Mombelli, Nagihan Bostanci and Denis Kinane. On the 23rd April 2016, ERGOB will run an open Congress in Geneva to honor Bernie's scientific contribution and indomitable spirit.

During the course of his career, Bernie broadened and strengthened the research group at the University of Zürich by recruiting scientists such as Rudolf Gmür, Christoph Wyss, Peter Schüpbach, Stuart Shapiro, Thomas Thurnheer and Jan van der Ploeg from different fields of science. However, he was not only engaged in research but also established, along with his excellent co-workers, an extensive curriculum in oral microbiology and immunology for undergraduate dental students, as well as in hygiene in dental practice.

Bernie's early work in the Mühlemann laboratory involved the study of the metabolism of bacteria in saliva. Caught up in stimulating atmosphere at the ETHZ, and prompted by his friends, Klaus König and Thomas Marthaler, Bernie became interested in the clinical, etiological and prophylactic basics of caries. He began to isolate streptococci from the supragingival plaque of schoolchildren with caries. He found strains of Streptococcus mutans that showed the same phenotypic characteristics as the cariogenic streptococci isolated at the NIH by Fitzgerald and Keyes, and in animal experiments with rats he demonstrated the particular cariogenicity of sucrose compared to other mono- and disaccharides. Bernie's work was thus key in the establishment of the fundamental concepts of caries microbiology, which still hold true today. When Klaus König was promoted to Assistant Professor in 1966, Bernie took over the position as a Senior Assistant. His research now focused on 'why cariogenic streptococci were dependent on sucrose to develop caries?'. He demonstrated that S. mutans synthesizes at least three

different extracellular polysaccharides, including the water-insoluble α-1-3 glucan, which he named “mutan”. Since mutants of S. mutans deficient in polysaccharide synthesis were not cariogenic, Bernie’s thoughts turned towards enzymatic degradation of the glucans in plaque as a means to control caries. Serendipitously, when he was searching for edible mushrooms in the woods Bernie found a piece of tree bark, from which he was able to isolate a saprophytic fungus (Trichoderma harzianum). This fungus produced an α-1-3 glucanase (named “mutanase”) which strongly inhibited the development of caries in rats. With this work as the core, the Caries Research Station developed into one of the leading international groups in oral microbiology. Bernie’s engagement in teaching, together with the initiation of practical courses in oral microbiology and immunology for dental students, laid the foundation for a new Department within the Caries Research Station, the then Department (later Institute) of Oral Microbiology and General Immunology. In 1972 Bernie was promoted to Professor and Head of this newly established Department.

When, towards the end of the last century, microbiologists recognized the fundamental importance of bacterial growth in biofilms, Bernie was quick to understand that an artificial oral biofilm model could reduce or replace the need for animal experiments. The “Zürich biofilm model”, with its supragingival and subgingival variants, is one of Bernie’s final contributions, and one which gained worldwide recognition. Bernie remained active in research and academic life until his last years.

Bernie had an indefatigable passion for debate (and argument) about science, academia, academic politics and indeed a whole range of other intellectual issues. He was one of those remarkable individuals whose very presence in a workshop, on a conference platform or indeed in a conference audience could electrify (and occasionally terrify) the entire assembly. He was both outspoken and fearless at challenging premises which he felt lacked sufficient evidence. Whilst this was a daunting experience for many to give a presentation with Bernie as chair or in the audience, his presence elevated the event to new heights. It was a true achievement to gain Bernie's scientific respect and friendship.

It is both a distinct honor and yet a sad task for the current workers of the Division OMI of the University of Zürich, the executive committee of ERGOB and the long-standing close colleagues of Bernie to write his tribute. We hereby take this opportunity to express our gratitude for the solid foundations that he has built for the field. We shall miss his energy, his towering intellect and his fearless inquisitions but equally his warmth and generosity of spirit.

Figure 1: Bernie Guggenheim in the K40 laboratory at the Dental Institute of the University of Zürich, in 1983.