# Robert J. Genco: Pioneer in Oral Science Advancement

Journal of Dental Research
2018, Vol. 97(7) 737–741

DOI: 10.1177/0022034518770607
journals.sagepub.com/home/jdr

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**Abstract**

Professor Robert J. Genco made extraordinary research advances in immunology, periodontology, and microbiology research, pioneering major advances in oral science. In addition to his extraordinary research advancements in oral biology, his pioneering advances in oral science leadership at the local/university, national, and international levels are recognized worldwide, as are his educational advancements. In his era, he is truly the "father" of oral science.

**Keywords:** cardiovascular disease, dental education, diabetes, microbiology, mucosal immunity, periodontal disease

## Dr. Genco's Unique Training

Not only was Dr. Robert Genco a pioneer in oral science, but he was also one of the first individuals to receive dental (oral) specialty training coupled with oral biology (immunology) at a PhD level. The unique combination of clinical excellence and outstanding scientific training placed Dr. Genco in position to lead the oral scientific awakening in the 1970s, of which he was perhaps the major contributing pioneer. In fact, I consider him to be the father of oral biology or "oral science," as it may now be called.

Robert Genco surfaced in the area of oral science (oral biology) in 1967 when he became assistant professor of oral biology and periodontology in the State University of New York (SUNY) at Buffalo School of Dental Medicine. Dr. Genco had begun his science education as a biology student at Canisius College and completed dental training (DDS) at SUNY at Buffalo School of Dentistry (1963).

As a senior dental student, Bob planned to become a clinical periodontist and researcher. At that time, it was rare for dentists to extend their clinical education. However, it was far less frequent for dentists (dental students) to combine advanced clinical training with graduate research training. When Bob went to the University of Pennsylvania to give a clinic on Sjögren syndrome, he met Dr. D. Walter Cohen, chairman of the Periodontology Department, who explained that his school had the first dental training grant (DT-1) from the National Institute of Dental Research (NIDR) as it was called then. This grant could be used to support a graduate student in microbiology and immunology who also wanted training in periodontology. That support was perhaps the most fortuitous occurrence of training in Bob's career. Bob's mentor was Dr. Fred Karush, an internationally recognized scholar of immunology, a rising scientific discipline at the time, which enabled Bob to study oral infectious disease. After 4 years at the University of Pennsylvania, Dr. Genco graduated with a PhD in microbiology and immunology and a certificate in periodontics in 1967. Bob's unique academic and clinical credentials enabled him to become assistant professor in the first (from 1962) Oral Biology Department in the United States at the SUNY at Buffalo. Figure 1 shows Bob as an assistant professor. The department mission was to perform research related to oral diseases. Also, the department developed the first oral biology PhD program in the United

**Figure 1.** Dr. Robert Genco in his early days as assistant professor, Department of Oral Biology, School of Dental Medicine, SUNY at Buffalo (circa 1970).

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States (from 1963). There was no better position than this for a person interested in the advancement of oral science and periodontal disease research.

## Scientific Accomplishments

Bob established a very productive research program in oral immunology and microbiology with a focus on periodontal disease pathogenesis in Buffalo. Bob began his initial research in the mucosal immunology field, then a relatively recently discovered fledging scientific area with many roots in the oral cavity associated with the oral infectious diseases, dental caries, and periodontal disease. Dr. Genco and his colleagues contributed a broad range of seminal work to the field, including the molecular basis for local induction of secretory IgA antibody for vaccines in the mucosal system (Genco and Taubman 1969), elucidation of biological properties of secretory IgA involving valence, binding properties and specificity (Taubman and Genco 1971), and discovery of IgA protease from oral streptococci, which was specific and destructive for secretory IgA1 (Plaut et al. 1974).

In the IgA studies, prior attempts to induce a specific antibody of the secretory IgA isotype had been unsuccessful. However, in humans, authors had described antibodies in nasal secretions most closely associated with secretory IgA of those fluids. Dr. Genco and colleagues demonstrated that local injection of antigen into the vicinity of rabbit mammary tissue consistently elicited colostral secretory IgA antibody, which was synthesized locally (Genco and Taubman 1969), and could be most useful as a reliable vaccine to induce secretory IgA antibody.

As director of the Buffalo Periodontal Disease Research Center (1978 to the present), Dr. Genco and colleagues identified specific bacteria associated with periodontal disease pathogenesis (Genco et al. 1980; Slots et al. 1980; Brennan et al. 2007) and evaluated immune response to these periodontitis-associated bacteria (Patters et al. 1980; Mouton et al. 1981; Okuda et al. 1981) that immune dysfunction could contribute to periodontal pathogenesis (Cianciola et al. 1977). Bob and his group established "risk factors" for periodontitis (Beck et al. 1992; Grossi et al. 1994) and was one of the first investigators who associated periodontal disease with systemic diseases such as diabetes (Cianciola et al. 1982) and cardiovascular diseases (Genco et al. 2002; Genco and Van Dyke 2010; Kholy et al. 2015).

Genco and his colleagues studied the Pima Indians, who have the highest recorded incidence and prevalence of diabetes in the world, and found that the prevalence of periodontal disease is greater in patients with diabetes than in control subjects (Nelson et al. 1990). They also found that patients with non-insulin-dependent (type II) diabetes mellitus had rapid onset and severe periodontal bone loss (Cianciola et al. 1982).

## Educational Leadership

As a faculty member in the fledgling oral biology PhD educational program, Bob was involved in training more than 19 postdoctoral students, of whom more than 8 received PhD degrees. Bob in many ways was also a pioneer in oral science and periodontology education. His appointment at SUNY at Buffalo with the first oral biology PhD program facilitated Bob's leadership in education. As we all know, one's legacy is often sealed by the accomplishments and educational acumen of a mentor. Bob was such a mentor. His advancement of oral science (oral biology) was greatly heightened by the work of his students, which included the following projects as examples:

- "Induction and Properties of Secretory Gamma A Antibody Directed to Non-Replicating Antigens"
- "Characteristics of the Secretory Immune Response in the Submandibular Glands"
- "The Lymphoproliferative Response in Human Periodontal Disease"
- "Complement Cleavage Products in Inflammatory Fluids and Their Role in Modulation of Lymphoproliferative Response"
- "Studies of Neutrophils in Human Periodontal Disease"
- "*Bacteroides gingivalis* (*Porphyromonas gingivalis*) Antigens and Periodontal Disease"
- "Analysis of Total Genome Restriction Fragments of *Bacteroides gingivalis* Isolates"
- "Structural and Functional Study of *Porphyromonas gingivalis*"

Bob was an inspiration to students and mentees. These students were involved in oral science research leadership, as well as their future students (see Table 1 and titles above). We estimate that Bob's students and the students of students would number in excess of 100 international oral science contributing scientists. Each of Bob's students, mentees, and trainees are testimony to his professional and personal legacy, thus greatly increasing Dr. Bob Genco's oral science legacy as the father of U.S. oral biology.

Bob, who was the hardest working scientist I ever met, usually taught by example. Actually, there was only one instance where I did not follow Bob's example. Bob was teaching us to retrieve animals from the cages (a rabbit cage in this case). There we stood in front of the cage—Bob, a young female technician who was fearing that she would be called upon to capture the rabbit and was actually shaking, and I. Bob roughly opened the cage and abruptly stuck his hand into the cage to grab the rabbit, whereupon the rabbit (knowing it was a dental school) sank his teeth into Bob's hand. Bob extricated his hand from the rabbit's mouth and jumped back, as did the young lady. I knew I would never emulate this action. No one said a word except Bob, who was always dedicated to continuing his work and said, "OK, let's get the next rabbit." I earned the PhD in "getting the next rabbit."

In 1977, Dr. Genco was appointed chairman of the Department of Oral Biology at the School of Dental Medicine of the SUNY at Buffalo, succeeding Professor Solon "Art" Ellison, the founder and chairman of the first Oral Biology Department in the United States. Bob held this position for 25 years. At the department's 50th anniversary, Professor Genco described the main mission, which "was to carry out fundamentally applied research related to oral disease." Bob adhered to

**Table 1.** Past and Current Students of Professor Robert J. Genco.

| Student Name | Training Level | Training Period | Major Leadership Position in Oral Science |
|---|---|---|---|
| Martin A. Taubman | Postdoc | 1966–1970<br>PhD conferred 1970 | Head, Immunology Department, The Forsyth Institute<br>Professor, Department of Developmental Biology, Harvard Medical School, Harvard School of Dental Medicine, Boston, MA |
| Fred G. Emmings | Postdoc | PhD conferred 1973 | Professor and chair, Department of Clinical Dentistry, University of Rochester Medical Center, Rochester, NY |
| Christian Mouton | Postdoc | 1976–1980 | Professor, School of Dental Medicine, University of Laval, Quebec |
| Mark R. Patters | Postdoc | PhD conferred 1977 | Professor and chair, Department of Periodontics, University of Tennessee, Memphis, TN |
| Harvey Schenkein | Postdoc | PhD conferred 1978 | Assistant dean for research, director of Clinical Research Center for Periodontal Diseases, professor of Periodontics, Microbiology, and Immunology, Virginia Commonwealth University, Richmond, VA |
| Thomas Van Dyke | Postdoc | PhD conferred 1982 | Professor and chair, Periodontology and Oral Biology, director of Graduate Periodontics, Goldman School of Dental Medicine, Boston University, Boston, MA |
| Linda L. Moore | Postdoc | 1982–1984 | Clinical microbiologist, Department of Obstetrics and Gynecology, Tulane Medical School, New Orleans, LA |
| Robert Schifferle | Postdoc | PhD conferred 1992 | Professor, Department of Oral Biology, SUNY at Buffalo, Buffalo, NY |
| Bruno Loos | Postdoc | PhD conferred 1993 | Associate professor, Department of Periodontology; co-director, Master of Science Program in Periodontology, Academic Centre for Dentistry, Amsterdam, The Netherlands |
| Ann DeNardin | Postdoc | 1988– | Currently in private medical practice, Buffalo, NY |
| Jin-Yong Lee | Postdoc | PhD conferred 1994 | Professor, Kyung Hee University, Seoul, Korea |
| Carmen Yolanda Bonta | Postdoc | 1986–1989 | Manager, Dental Clinical Research, Colgate Oral Pharmaceuticals, Colgate Palmolive Co., Piscataway, NJ |
| YoungBum Park | Postdoc | 2005–2009 | Clinical associate professor, Yonsei University, Seoul, Korea |
| Xiaodan Mai | Postdoc | 2010–2015 | Research assistant professor, Department of Epidemiology and Environmental Health, University at Buffalo, Buffalo, NY |
| Ngozi Nwizu | Postdoc | 2010–2015 | Assistant professor, Oral & Maxillofacial Pathology, The University of Texas, Health Science Center at Houston, School of Dentistry, Houston, TX |
| Jeanie E. Suvan | Postdoc | 2013–2018 | Clinical research coordinator, Unit of Periodontology, London, Great Britain |
| Wei Zheng | Postdoc | 2015–2018 | Department of Computer Science and Engineering, University at Buffalo, Buffalo, NY |
| Josh Gordon | Postdoc | 2016–2020 | Department of Epidemiology and Environmental Health, University at Buffalo Microbiome Center, University at Buffalo, Buffalo, NY |
| Jiho Sohn | Postdoc | 2016–2020 | Department of Microbiology & Immunology, Computer Science and Engineering, and Bioinformatics, University at Buffalo Microbiome Center, University at Buffalo, Buffalo, NY |

the core values laid down by the first chairman and "pioneering grandfather" of oral biology, Professor Ellison (listed below). Bob became the father of oral biology and continued in that role for more than 25 years, devoting the department to the conduct of oral biology research and basic oral science education.

1. The Oral Biology Department at Buffalo maintained the same standards and scientific rigor as any university basic science department.
2. Trainees perform research in areas related to oral health and disease.
3. Trainees find mentors by rotating through laboratories.
4. Trainees take examinations on feasible research projects on important scientific problems.
5. Department will search funding to support students.
6. Graduates shall become academicians by research and training.

These core values are operative today after 30 more years of departmental excellence (Genco 2014). This department became prominent in the university and contributed numerous academicians to the oral science base (see Table 1 for Bob's students and their leadership positions in oral science). Each of the PhD-granted students and mentees were true leaders in their own right, with many trainees supporting the oral science field and highlighting Dr. Genco's role in educating numerous oral scientists and serving as mentor/father with a profound influence on the field.

A number of my colleagues have had the opportunity to discuss the scientific areas that were most significant/influential in advancing oral science. The 3 consensus areas of greatest contributions to oral science were mucosal immunology, studies of the nature of periodontal disease (primarily the host response), and the microbiology of organisms associated with periodontal disease as promoted by the initiation and support of the NIDR through periodontal disease research centers. Bob and his students contributed significantly to the 3 reputed most important areas of oral science (mucosal immunology, host response to periodontal-associated microorganisms, and characteristics of periodontal disease–associated bacteria). Recently, a fourth important area, the study of the oral microbiome as initiated by genomic investigations, has emerged. Bob Genco, director of the Buffalo Center of Microbiome Research, contributed pioneering scientific advancement in each of these

**Table 2.** Dr. Genco's Pioneering Oral Science Advancement through Leadership.

| University Leadership at the Local Level | |
|---|---|
| Leadership Position | Dates |
| Chairman of the Department of Oral Biology (SUNY at Buffalo) | 1977–2002 |
| Director, Buffalo Periodontal Disease Clinical Research Center | 1978–present |
| SUNY Distinguished Professor of Oral Biology, Microbiology, and Immunology | 1990–present |
| Vice Provost of Science, Technology Transfer and Economic Outreach (STOR), (SUNY at Buffalo) | 2002–2016 |
| Interim Vice President for Research (SUNY at Buffalo) | 2004–2005 |
| Research Leader, Director, Multidisciplinary Center for Microbiome Research (Buffalo) | 2016–present |
| Richard T. Sarkin Award for Excellence in Teaching (Buffalo) | 2016 |
| **National and International Leadership Honors and Positions** | |
| Positions/Honors | Dates |
| Basic Research in Oral Science Award from International Association for Dental Research | 1975 |
| Chair, Dental Section, American Association for Advancement of Science | 1980 |
| President, American Association for Dental Research | 1985 |
| Editor-in-Chief, *Journal of Periodontology* | 1988–2006 |
| American Dental Association, Chair Council on Dental Research | 1989–1990 |
| Member of the Institute of Medicine of the National Academy of Sciences | 1990–present |
| President, International Association for Dental Research | 1991 |
| American Dental Association Gold Medal for Excellence in Dental Research | 1991 |
| American Academy of Periodontology, Gold Medal for Excellence in Dental Research | 1993 |
| Distinguished Scientist Award from the American Academy of Periodontology | 2012 |
| Distinguished Scientist Award from American Association for Dental Research for Outstanding Contributions to Periodontal Disease Research | 2016 |

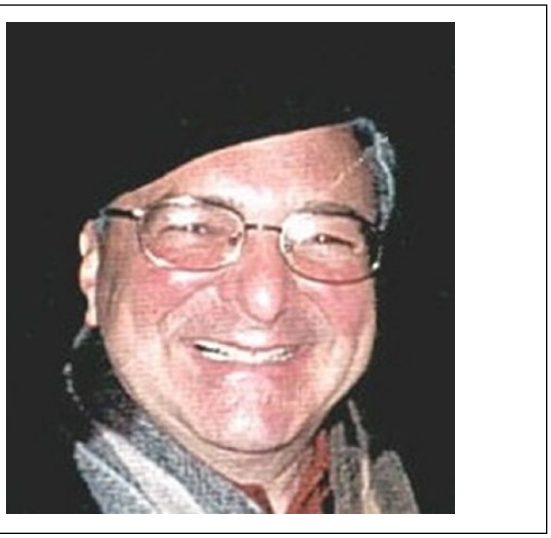

**Figure 2.** Distinguished Professor of Oral Biology, Microbiology, and Immunology (SUNY at Buffalo) after 25 years as chairman of the SUNY Oral Biology Department (circa 2004).

areas and many others, most recently in microbiome science (Zheng et al. 2015).

## Bob's Pioneering Oral Sciences Advancement through Leadership

Bob served in various organizations, mainly to advance the role of science in the practice of dentistry, particularly periodontics (Genco 2017). Bob said, "There's some satisfaction in changing the profession because you find something in your research and can bring it to the clinicians." He succeeded in bringing science leadership to the dental oral science profession.

As the current father of oral science advancement through extensive research (Dr. Genco has published more than 400 scholarly scientific papers), Bob also served numerous organizations mainly to advance the role of science in the practice of dentistry (particularly periodontics) (Genco 2017). Bob has had many appointments and served in numerous professional organizations that have enabled advancement of oral science (Table 2). He has been a leader as the director of the Buffalo Periodontal Disease Clinical Research Center (1978 to the present) and interim vice president for research (2004 to 2005; SUNY at Buffalo). In Figure 2, Bob is shown as he looked then. He also has been SUNY Distinguished Professor of Oral Biology, Microbiology, and Immunology from 1990 to the present. Thereafter, from 2002 to 2016, Bob was the vice provost of Science, Technology Transfer and Economic Outreach (STOR), SUNY at Buffalo. His mission was to facilitate commercialization of university inventions, support university research, and foster a culture of innovation and entrepreneurship. Bob and his colleagues formed 81 STOR-related startup companies. Dr. Genco clearly succeeded in the mission to facilitate commercial advancement of university research.

Bob demonstrated concerted leadership in many distinguished and prestigious organizations, including the Distinguished Scientist Award from the American Academy of Periodontology in 2012 and the Distinguished Scientist Award from the American Association for Dental Research for outstanding contributions to periodontal disease research in 2016. He is a member of the Institute of Medicine of the

**Figure 3.** Dr. Genco (circa 2014) can occasionally be found in the laboratory. However, word has it that he no longer invades the rabbit quarters.

National Academy of Sciences (1990 to the present). From 1988 to 2006, Dr. Genco was the editor-in-chief of the *Journal of Periodontology*. Bob increased the rigor of selection of scientific articles and markedly improved the quality of the international journal to a large degree after 18 years of leadership.

Dr. Genco also received the American Dental Association Gold Medal for Excellence in Dental Research in 1991 and the Basic Research in Oral Science Award in 1975 from the International Association for Dental Research. Bob was a leader in the major dental research organizations: American Association for Dental Research (president, 1985) and the International Association for Dental Research, for which he was president in 1991.

In 2016, Dr. Genco was chosen as the research leader of the multidisciplinary center for microbiome research at Buffalo as Bob Genco is an expert in the microbiome. He is a pioneer in the study of the impact of oral health on overall health. Bob and colleagues were among the first to report a correlation between periodontal disease and heart disease and stroke, as well as relating periodontitis to diabetes and obesity. The Center for Microbiome Research will focus on powerful methods, such as nucleic acid sequencing techniques, to characterize organisms associated with disease. Figure 3 shows Dr. Genco in the laboratory. Bob will certainly add more to his vast oral science base.

It has now been 50 years since Bob brought his science and leadership to SUNY at Buffalo. He has contributed greatly to the establishment of the scientific basis for modern dentistry/oral science. Dr. Robert J. Genco should be recognized and honored as the major pioneer research contributor to oral science.

## Author Contributions

M. Taubman, contributed to conception, design, and data acquisition, drafted and critically revised the manuscript. The author gave final approval and agrees to be accountable for all aspects of the work.

## Acknowledgments

The author acknowledges the wonderful contributions of information and numerous discussions with Mrs. Frances Genco. Also contributing exceptional expertise and manuscript preparation was Mrs. Anna Rivkin. This manuscript would not have been possible without these 2 outstanding contributors. The author received no financial support and declares no potential conflicts of interest with respect to the authorship and/or publication of this article.

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