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ABSTRACT

In 1960, the first Department of Oral Biology in the United States dedicated to the conduct of research, graduate biomedical research education, and the provision of basic oral science education for the DDS curriculum was established at the University at Buffalo. In 1963, the Department organized the first PhD Program in Oral Biology in the United States. This PhD program has produced a large cadre of oral health researchers, many of whom have gone on to make major contributions to dental research and education. This article provides a brief history of the program, the context within which the program was organized and developed, and a description of some of the many faculty, students, and fellows associated with the program. Additionally, to celebrate the 50th anniversary of this program, a symposium, entitled “The Oral Microbiome, Immunity and Chronic Disease”, was held on June 12-14, 2013, in Buffalo, New York. The proceedings are published online in *Advances in Dental Research* (2014, Vol. 26).

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Oral Biology in Middle Age: A History of the University at Buffalo Oral Biology PhD Program

INTRODUCTION

Schools of dentistry must contribute new knowledge to the profession by supporting faculty and student scholarship. Only by creation of new knowledge will the profession advance to benefit patients. Most dental schools state research as a primary mission, recognizing that a school’s reputation in the eyes of the profession and public depends on the quality and quantity of the scholarship generated by both faculty and students. To evaluate this scholarship, colleagues review publications in peer-reviewed journals, textbook chapters, monographs, and grants obtained.

In 1960, to further its research mission, the School of Dentistry (now the School of Dental Medicine) at the University at Buffalo established the first department of Oral Biology in the United States. In 1962, the university merged with the State University of New York, and in 1963 the department organized the first PhD and graduate training program in Oral Biology in the United States. This article provides a brief history of the department, the context within which the program was organized and developed, and sketches of some of the many faculty, students, and fellows associated with the program. Additionally, to celebrate the 50th anniversary of this program, a symposium, entitled “The Oral Microbiome, Immunity and Chronic Disease”, was held on June 12-14, 2013, in Buffalo, New York. The proceedings are published in *Advances in Dental Research*.

RESEARCH IN DENTAL SCHOOLS – A VERY BRIEF HISTORY

Historically, both medicine and dentistry have not been research-based disciplines. Things changed in North America following the publication in 1910 of the “The Flexner Report”, a study of medical education in the United States and Canada, by the professional educator Abraham Flexner and published by the Carnegie Foundation. The Flexner Report recommended that medical training be based on scientific findings and thoroughly grounded in human physiology and biochemistry.

Dentistry followed this lead somewhat later, catalyzed by a 1926 report by William J. Gies, a professor at Columbia University. “The Gies Report” encouraged dental schools to increase their full-time faculty, promote research and graduate study, ground the practice of dentistry in science, become better integrated with parent universities, and make investments in research infrastructure.

The Institute of Medicine (IOM), in its 1995 report “Dental Education at the Crossroads”, recommended that dental schools expand research to

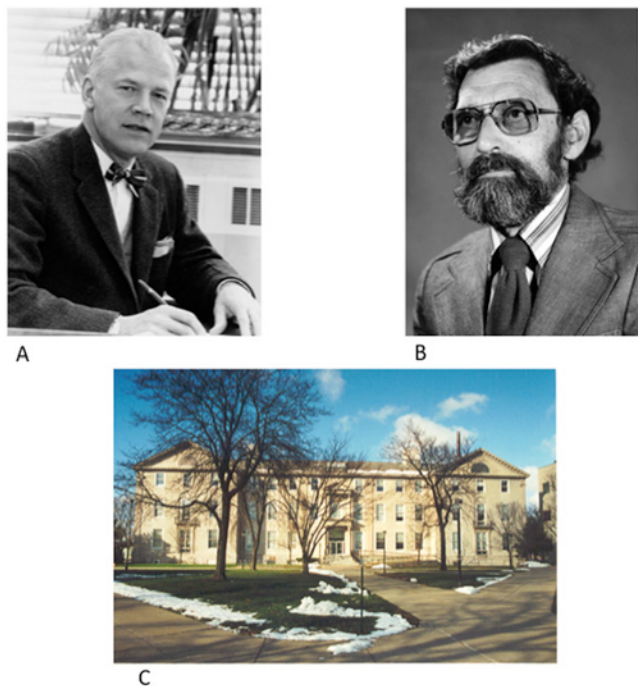


Figure 1. Key figures in the program. **(A)** James English, Dean of the School of Dentistry and visionary of the Department of Oral Biology. **(B)** Solon "Art" Ellison, founding chair of the Department of Oral Biology. **(C)** Foster Hall, home of the Department of Oral Biology.

improve the effectiveness of alternative preventive, diagnostic, and treatment strategies, and to provide more evidence-based guidelines for appropriate dental practice. Most recently, a 2011 IOM report, *Improving Access to Oral Health Care for Vulnerable and Underserved Populations*, called for research to formulate strategies to increase the capacity of core dental public health functions.

These reports all emphasized the need for robust research efforts in dental schools. This is reinforced by Standard 6 of the accreditation guidelines for dental education (CODA) mandating the need for a Research Program to be available in each school to encourage and support faculty-mentored student research and other scholarly activities.

ORAL BIOLOGY IN BUFFALO

The University at Buffalo was founded in 1846 as a private university and for its first 40 years consisted of a single school (Medicine). The School of Dentistry was founded in 1892 (renamed the School of Dental Medicine [SDM] in 1985) in response to the first state dental practice acts implemented in 1868 (in Kentucky, New York, and Ohio) that called for the establishment of formal dental curricula.

Formal research activity within the UB-SDM between 1892 and 1958 is hard to document. During that time, the major focus was clinical teaching, and the only full-time member of the faculty was the Dean; all others were part-time and practiced dentistry in the community. Faculty scholarship was limited to presentations of clinical techniques at regional and national meetings.

Some creative work was done: George B. Snow, the second dean of the school, was an inventor with several dental instrument patents, including the "Snow Bow" facebow. He eventually left the school to found the Buffalo Dental Manufacturing Co.

In 1960, James English (Fig. 1A), a Navy dentist-researcher, was recruited to be Dean. Although there was no Department of Oral Biology at that time, his academic title was Professor of Oral Biology, likely given in principle by the University (Emmings, 1999). This 1962 merger with the State University of New York brought new state funding to UB to support the hiring of many new full-time faculty members. Within a few years, the SDM full-time faculty had increased from one (the Dean) to about 90.

Dean English chose to establish the Department of Oral Biology, the first dental department in the United States dedicated to research, graduate biomedical research education, and the provision of basic oral science education. Note that the use of school resources to establish Oral Biology was not universally supported by other members of the school's faculty. Nevertheless, Solon Arthur ("Art") Ellison (Fig. 1B) was recruited from Columbia University as the first Chair of the Department, serving from 1963 to 1976. Art Ellison was an accomplished researcher in microbiology and the nascent field of immunology. He was also a pioneer, along with Irwin Mandel, in characterizing the components of saliva (Emmings, 1999). In 1963, Ellison established the first Oral Biology PhD program in a dental school in the United States. He sought approval for the PhD degree program from the University Graduate School, to be sure that Oral Biology would be held to the same standard as traditional programs. In 1966, he secured funding for an NIH Training Grant that, over the ensuing 30 years, supported a large cadre of students, many of whom have gone on to make major contributions to dental research and education.

Ellison's intention was to train dentists to perform dentally related research and to join dental faculties (he was concerned that dentists trained in traditional basic science departments often drifted away from dentistry). He designed the program to include two features: (1) Each student would rotate through several laboratories before selecting one for his/her research, and (2) instead of the traditional examination of general basic science knowledge, the qualifying examination would require preparation of several research proposals based on topics of the student's choosing. All students took course work taught by other basic science departments. Ellison explained, "The object is to provide persons who will use more biological thinking and methodology to attack problems significant to dentistry" (Emmings, 1999). These features remain effective elements of the program.

At the time of the Department's founding, the University at Buffalo was in the throes of vigorous physical expansion, necessitating the Department's location in an off-campus building at 4510 Main St. in Amherst, which, as recalled by Mark Herzberg (PhD, 1978), "was directly across from Adam's Rib, a restaurant with excellent beef on weck [Ed. note: a variety of roast beef sandwich], and next to the Teck Pharmacy, which was situated at the corner of Harlem Road. Today the site is entirely redeveloped. The main campus of the University, where we took classes and trained in the dental clinics, was a short drive west on Main Street. At that time, the (new) Amherst campus of the University was a blank check waiting to be cashed. Laboratory space was

scarce, and Oral Biology shared space with the Department of Behavioral Sciences.” [See the Appendix for complete memoir.]

Since its founding, the Department of Oral Biology, now located in historic Foster Hall (Fig. 1C), attained national and international prominence in dental research. The PhD program continues to train young scientists who have contributed and will continue to contribute important basic and translational knowledge pertinent to oral health. To date, 81 individuals have earned the PhD through this program (Appendix Table).

PROMINENT FACULTY MEMBERS

From its beginning, the Department of Oral Biology at Buffalo has been fortunate to enjoy the fruits of the labor of many talented and creative individuals. Due to space limitations, only a few individuals will be mentioned here.

Ernest Hausmann (Fig. 2A) was the first and only full-time researcher on the faculty when Jim English arrived as Dean in 1960. Hausmann, who was jointly appointed in pharmacology in the medical school, was educated at Harvard University (DMD) and the University of Rochester (PhD). Among his many contributions was the first report of bacterial lipopolysaccharide (LPS) as an osteolytic agent (Hausmann *et al.*, 1970). Later, he developed computer-assisted measurement systems to measure alveolar bone height in periodontal disease. He remains active in research, collaborating with an x-ray physicist and computer programmer to develop an automated program to measure bone height from a digital tooth image.

One of the first hires was Joseph Gong (Fig. 2B), an expert in radiobiology who spent his career developing a rat model of predictable, accurate, and practical markers of internal cellular damage from radiation. He also developed and patented a simple blood test to measure accumulated cell damage from ionizing radiation. Gong trained six of the first PhD students admitted to the program.

One of the most significant of Ellison’s recruits was Robert Genco (Fig. 2C), who joined the faculty in 1968 following his DDS training in Buffalo and PhD training in microbiology and immunology at the University of Pennsylvania. He established a productive research program in oral immunology and microbiology, focusing on the pathogenesis of periodontal disease. Genco and his colleagues suggested that immune-dysfunction affecting neutrophils, for example, contributes to periodontal pathogenesis, identified specific bacteria associated with periodontal destruction, and established risk factors for periodontal disease. He also was one of the first investigators to associate periodontal disease with systemic diseases such as diabetes and atherosclerosis. Genco is one of the few dentists in the Institute of Medicine and was editor of the *Journal of Periodontology* for 18 years. Genco also served as the second Chair of the Department of Oral Biology. During his 25-year tenure as Chair, the Department rose in prominence, becoming one of the most well-funded departments in the United States. During this time, he further helped to develop tracks for PhD students to pursue clinical specialty training in periodontics, prosthodontics, or oral pathology.

Howard Kuramitsu was recruited in 1992 from University of Texas Health Science Center at San Antonio. A prominent oral microbiologist, he was among the first to apply molecular

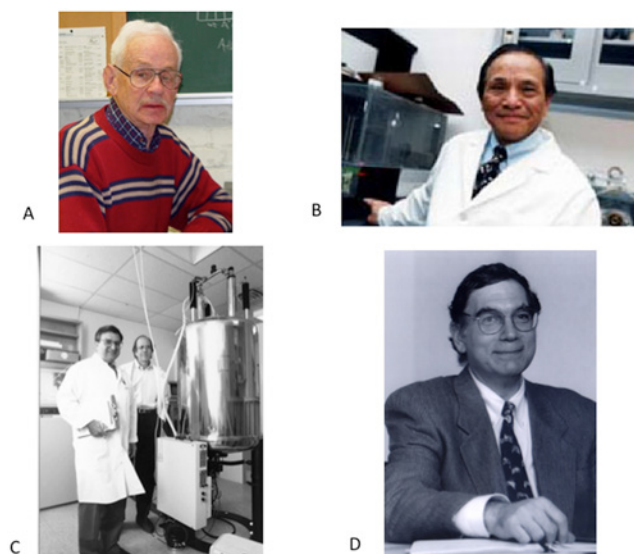


Figure 2. Notable faculty of the program. (A) Ernest Hausmann. (B) Joseph Gong. (C) Robert Genco (left), second chair of the department, and Michael Levine (right). (D) Larry Tabak.

genetic techniques to the study of oral bacteria, most importantly the oral pathogens *Streptococcus mutans*, *Porphyromonas gingivalis*, and *Treponema denticola*.

Michael Levine probably had the greatest impact on the graduate training program (Fig. 2C). He served as a mentor for over a dozen PhD graduates and many post-doctoral fellows. He also made significant contributions to salivary research. He and his students were the first to purify salivary mucin (MG2) and the proline-rich glycoprotein and to characterize mucin structure and function, the interaction of salivary components with bacteria, salivary dysfunction, and the development of biologically based artificial saliva (Scannapieco, 2003).

Several department research scientists have also made significant contributions, including Molakala Reddy (glycoprotein biochemistry), Elaine Haase (oral microbiology), Todd Evans (dental caries), Gurinder Bedi (salivary biochemistry), Homer Reynolds (microbiology), Robert Schifferle, Bengt Rosling, Lars Christersson, and Sara Grossi (clinical research), and many others who cannot be mentioned due to space limitations.

PROMINENT ALUMNI

Many graduates of the program have assumed significant leadership roles in dental research, education, and industry. For example, Lawrence Tabak, PhD 1981 (Fig. 2D), served as the Director of the National Institute of Dental and Craniofacial Research, and is now Deputy Director of the National Institutes of Health. Mark Herzberg, PhD 1978, is past Editor of the *Journal of Dental Research*. Numerous alumni have served as deans and associate deans of dental schools (Michael Reed, PhD 1981; Harvey Schenkein, PhD 1978; Joseph Zambon, PhD 1984; Hua-Hong [Ben] Chien, PhD 1997). Also, several graduates are present or former chairs of academic departments (Martin Taubman, PhD 1970; Neil Frederiksen, PhD 1979; Mark Patters, PhD 1977; Robert Davidson, PhD 1989; Andrew Dentino, PhD 1992; Frank

Scannapieco, PhD 1991; James Katancik, PhD 1998). Leslie Winston (PhD 1995), Aaron Biebrock (PhD 1995), Michael Lynch (PhD 2000), and Jenny Sun (PhD 2008) have served in senior leadership roles in industry.

Many alumni have made fundamental contributions to oral health research. Martin Taubman is a leader in oral immunology research, a primary contributor to the development of a dental caries vaccine (Taubman *et al.*, 2000), and to periodontal immunology (Kawai *et al.*, 2000). Michael Levine made major contributions to salivary biochemistry (Levine, 1993). Mark Herzberg defined a novel platelet aggregation phenotype of oral bacteria that may prove to play a major role in the pathogenesis of endocarditis, myocardial infarction, and stroke (Herzberg and Meyer, 1996). Harvey Schenkein and Tom Van Dyke have made important contributions to our understanding of the pathogenesis and genetics of periodontal disease (Schenkein and Van Dyke, 1994). Lawrence Tabak is an expert in mucins and glycoconjugate biochemistry (Tabak, 1995). Joseph Zambon, Ken Miyasaki, Lily Mirels, Frank Scannapieco, Dorothy Rowe, Bruno Loos, Keith Kirkwood, and Mira Edgerton are all leaders in their fields of study.

THE PHD PROGRAM

Students typically take a heavy concentration of graduate courses offered by other departments throughout the university. The students also engage in Journal Club and the weekly departmental seminar series.

A hallmark of the program is its flexibility to accommodate the interests of the student. Many PhD students have pursued concomitant specialty training, most often in periodontics or prosthodontics. A smaller number of students also earned the PhD in combination with the DDS degree.

The effectiveness of the program is well-summarized by Casey Chen (PhD 1990): "A strength of the program was the challenging but flexible curriculum. Beyond a set of core courses, students were encouraged to explore learning and research opportunities outside of (the) Oral Biology Department. I also enjoyed the Journal Clubs and the invited speaker seminars. Part of the qualifying examinations was to prepare and defend 4 NIH-style grant proposals that included research topics outside of my training. To this date, I am still using some of the writing skills that I used for my exam."

THE DEPARTMENT OF ORAL BIOLOGY TODAY

The Department continues its scholarly contributions to knowledge in oral science through the efforts of the current faculty and students. Primary foci of interest include microbiology and immunology (Ernesto DeNardin, Mira Edgerton, Chunhao Li, Ashu Sharma, Frank Scannapieco, Meg Vickerman, Michelle Visser, Jason Kay), salivary research (Libuce Bobek, Olga Baker, Stephan Ruhl, Mira Edgerton, Jill Kramer, and Frank Scannapieco), periodontal research (Robert Genco, Frank Scannapieco, and Robert Schifferle), and bone and connective tissue research (Rosemary Dziak and Shuying Yang). The graduate program accepts two or three new PhD students each year, and supports a good number of Master of Oral Science and dental students.

WHY SUPPORT FOR RESEARCH IN A DENTAL SCHOOL IS A GOOD IDEA

The Department of Oral Biology was founded on the principle that research activity is essential to the intellectual milieu of a dental school. While support for research is expensive, especially in the biomedical sciences, there are several arguments to be made for such an investment. Rarely are the best universities and schools defined only by their educational programs. In fact, a university's reputation is largely based on the research performed by its faculty and students. The generation of new knowledge is essential for the future of a vibrant profession, and university research is more open and accessible than that supported by industrial or government laboratories. Research investigators bring new ideas and theories into the classroom, and their laboratories provide the infrastructure for training the next generation of scientists.

Can such a department be established today? The Department of Oral Biology was established during a time of growing public investment in higher education. Such investment is not the norm today. Indeed, while several new dental schools have opened over the past decade, few have made significant investments in basic and translational research. The need for investment in research and scholarship is unquestionably required to continue to generate new knowledge and train the next generation of investigators. The Department of Oral Biology at Buffalo is one example of how such investment in research by a dental school benefits not only the school and University, but the profession as well.

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