The American Academy of the History of Dentistry, a not-for-profit organization founded in 1951, has as its goals the following:

- Increasing interest among dentists in dental history.
- Encouraging dental schools to develop historical collections on dentistry, and to offer adequate instruction in dental history.
- Developing a broader understanding of the facts of dental history among the leaders in dentistry in order to aid them in their attempts in solving important problems in dental education and practice.
- Stimulating more thorough and comprehensive research in dental history, thereby extending the boundaries of dental knowledge, giving substantial support to growing professional culture.
- Creating an authoritative body to which important questions relating to dental history could be referred for factual verification.
Announcement of the American Academy of the History of Dentistry 59th Annual Meeting

The American Dentists: Ethics, Technology and Education for the Twenty-First Century
*by Brian Dolan, PhD*

The Maturation of Science Within Dentistry: The Impact of Critical Milestones and Visionary Leaders on Contemporary Achievements
*by James L. Gutmann DDS, Cert Endo, PhD (honoris causa), FACD, FICD, FADI*

How American Dentists Helped Pioneer Oxygenation of General Anesthetics Worldwide
*by George S. Bause, MD, MPH*

Dental Postcards XLIII
*by Arden G. Christen, DDS, MSD, MA & Joan A. Christen, BGS, MS*

Dental Trade Cards XXVIII
*by Theodore P. Croll, DDS & Ben Z. Swanson, Jr., DDS*

Dentistry on Stamps
*Hannelore T. Loevy, CD, PhD & Aletha A. Kowitz, MA*

From the Archives: Vol. 2, Nos. 7 & 8

Photographs from our 58th Annual Meeting

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Thursday, June 10th

Backstage at the Biography - Nancy Kriplen § 9-10am

‘A Good Story’: Writing Biography For Fun and (No) Profit - Ray Boomhower § 10:15-11:15am

Question & Answer Panel with Nancy Kriplen and Ray Boomhower § 11:15-11:45am

Orland Lecture Luncheon: Maynard K. Hine’s Legacy:
    In The Words of A Grandson - William Hine, Jr., DDS § 12-1:30pm

The Zeal of Ziegler: How a Physician-Editor Misled Generations of Dental and Medical Practitioners - George S. Bause, MD, MPH § 1:45-2:45pm

Joseph C. Muhler: The Father of Crest - Victor H. Mercer § 2:45-3:45pm

Walking Tour of IUPUI School of Dentistry - Dean Lawrence I. Goldblatt, DDS, MSD § 3:45-5pm

Friday, June 11th

Selected Lecture From IUPUI Dental School Freshman Dental History Course - Paul A. Zitterbart, DDS, MSD, MPH § 9:30-10:30am

How To Make Biography Enticing in Dental History Teaching - J. Henry Clarke, DMD, MS § 10:45-11:30am

Hayden-Harris Award Luncheon § 11:30am-1pm

Dental Biography: A Collector’s Resource - Joseph Chester, DDS § 1-2pm

Women Alumnae (1880-1909), University of Michigan School of Dentistry - Shannon O’Dell § 2-3pm

A Hoosier Tragedy: Betrayal and Murder in 1896 - James L. McDonald, Jr., PhD § 3:15-4pm

Gala Evening Reception and Banquet § 6:30pm

Cole Porter: Composer of the 1946 Comic Song ‘Snagtooth Gertie’ - Arden G. Christen, DDS, MSD, MA Featuring Susan Day (vocal) and Darrell Day (piano)
Introduction

This article examines issues regarding technology and its impact on the relationship between health practitioners and patients. My references are not only relevant to dentistry, but to the broader community of professionals involved with oral healthcare.

In a previous article, I discussed how the evolution of the profession of dentistry helped redefine the mouth as site of complex pathology.\(^1\) With the emergence of epidemiological studies, the health of one’s mouth was seen to have an impact on the health of whole populations, since an individual’s oral health and hygiene became a measure of need for public health interventions. In the early 20th century, American dentists developed what I referred to as the ‘ethical core’ of their professional identity, which was linked to public health service.

Clifton and Lois Dummett once wrote that: “Traditionally, the dental profession took pride in its entrepreneurship and its independence.”\(^2\) But in the early 20th century, with increased attention to “social aspects” of dental practice, there was a newly perceived need to reform the professional identity to win the public’s trust. The American Dental Association (ADA) then backed the Oral Hygiene Movement, but three problems affected the promotion of dental public health. First, the “professionalization paradox” made it difficult to recruit dentists for public...
service, since dentistry’s success hinged on the growth of its elite professional status, which is not conducive to offering low cost or free service to underserved populations. Training and education are expensive, and bills do not get paid by giving away free services. This is a problem that remains throughout the health fields to this day. Second, the promotion of dental public health was met with cynicism and skepticism by critics who suspected profit-driven motives. Third, dentistry’s association with the politics of health insurance intertwined the concerns of private practitioners for their professional futures with the commercial interests of insurers. Navigating the scientific, technological and social milieu of the 21st century still requires dentists to overcome these challenges, and yet more which arise when facing “newfangled” solutions to the problems of providing oral healthcare to an expanding population.

In this article I will develop two narratives: One is a story about the development and impact of a dental technology that, it is hoped, will provide one solution to the dilemmas of increasing access to dental healthcare among underserved populations. The other story is about the future challenges in dental education and training. Both share an underlying theme: the difficulties that the profession of dentistry faces in providing oral healthcare in the interests of public health. At heart, this returns to a discussion about the ethical core of any health profession. At issue is how health professions can train for and accommodate increasing access to healthcare. This issue, with its social, ethical and economic entanglements, may prove to be among the most difficult things to navigate as we proceed into the 21st century.

**Teledentistry and Access to Oral Healthcare**

Problems of access to oral healthcare in America can be conceptualized and approached from a number of different angles. One way is approach it as a technological problem. When the Internet was new, there was a lot of talk about how it would democratize knowledge. Libraries worldwide could scan their collections and make them available online for everybody. This was a noble idea, but the problem was (and is) access: not everyone has a computer and Internet access; not everyone could read. This is a clear example of how the unequal distribution of resources resulted in “free” knowledge, but only for select and privileged segments of society. Despite the underlying issues of socioeconomic inequality, this was still conceived of as a technological problem. One partial solution was making computers cheap and wireless access free. In what ways might we think about increasing access to healthcare as a technological problem, that might also be overcome through technological intervention?

Teledentistry is being pursued as a means of improving access to oral healthcare in remote populations (of course the concept of a “remote” population is culturally relative.) If you cannot bring a doctor to the patient, then bring the patient to the doctor, virtually, through the Internet. E-mail is one such method. There are interesting pilot programs in teledentistry underway across the country, but they raise ethical and legal questions of their own, relating to jurisdiction, and more so, whether or not the patient wants to interface with his or her provider in this way. These are points to consider, but first, some background to this technology.

**Teledentistry** is the application in the dental field of what is broadly considered “telemedicine” or “telehealth.” In the 1950s, NASA partnered with the US Public Health Service to provide tele-consultations for the Papago Indians from a reservation in Arizona. Arizona provided good ground for the US military to test equipment which would later be used to connect doctors to Antarctic survey stations, offshore oil exploration rigs, and space-station astronauts. The University of Arizona remains one of the leading centers for the study of telemedicine.

Teledentistry was first put into practice by the US Army in 1994. Fifteen patients underwent periodontal surgery at Fort Gordon in Georgia. A week later their sutures were removed at a clinic at Fort McPherson, 150 miles away. Intraoral color photos were taken and sent via a 9600 band modem
back to the periodontist who had performed the surgery. Consequently, only one patient needed to make a return trip for a follow-up procedure.3

California was one of the first states to allow Medicaid reimbursement for telehealth services. The California Telemedicine and eHealth Center (CTEC), founded in 1997 in Sacramento and partnered with UC Davis, created a teleophthalmology program for Indian Health Clinics. Since problems associated with diabetic retinopathy can lead to blindness, the goal was to use telemedicine to increase vision screenings.4

One of the key strategies for rural health maintenance and disease prevention is providing health education. CTEC has experimented with setting up e-health kiosks at agricultural worker clinics. These kiosks have touch screens that show a cartoon in Spanish, which provides information about asthma, diabetes and heart disease for the Hispanic population in the central valley. The diabetes program issues eye-screening vouchers which the patient is asked to take to a nurse to arrange an appointment. The rationale is that if people do not know they need the test in the first place, the lack of early detection makes them more likely to go blind.

There are a number of different genera and species of telemedical systems—some are designed solely to share information between healthcare providers. But telehealth is also largely about linking providers to distant sites, and reaching previously “marginalized” people. This particular aspect of telehealth raises questions suited to research in the social and behavioral sciences:

How do technologies of telehealth change or challenge concepts of what defines an underserved population? Do these technologies have an impact on health policy? If telehealth transcends geographical limitations—barriers of physical distance—in what ways do we redraw our conceptual boundaries about who is “inside” or “outside” the system? What are the ethics of using or relying on a particular communications system to open up access to healthcare? We are thus forced to think about risk, technological imperatives, unintended costs, and different concepts of communication skill and technological literacy (of patients and practitioners alike). How do we teach “chairside manner” in a virtual world?

As suggested above, telehealth is a class of technology that cuts across many different healthcare disciplines. Another question is: what concerns or problems cut across medical disciplines but are inherent to their use of this particular medical technology? Cross-field comparison allows us to think about how teledentistry, and the future of this area of dental practice, might be shaped. Issues and experiences that affect other healthcare specialties could potentially provide insight to future collaborations in training and practice, among physicians and dentists alike.

How has teledentistry been used to date? In 2003, a partnership between the Children’s Hospital Los Angeles and the University of Southern California School of Dentistry initiated a Teledentistry Project. This project provides free service to low-income children. Medical students were trained to collect patient information and digital images, and the information was then sent to faculty dentists for treatment suggestions. The system “greatly streamlines the patient flow into the clinic in the field, eliminates field screening field days, [and the need to] schedule visits from faculty dental specialists.”5

Other studies have examined the impact of the technology on patient referrals. In 2002 fifteen dental practices in greater Manchester in the UK participated in a randomized trial to

A teledentistry system can allow dental professionals to share patient information. Radiographs, both periodontal and hard tissue charting, treatment notes, photographs and any other needed drawings or information can be transferred between multiple providers. … When a dental hygienist has a patient who presents with a painful periapical abscess, the dental hygienist could send a radiograph of the area, an intraoral photograph, all charting and health history information, and then consult with their dentist.5

Other studies have examined the impact of the technology on patient referrals. In 2002 fifteen dental practices in greater Manchester in the UK participated in a randomized trial to
evaluate the validity of teledentistry screenings for new patient orthodontic referrals. The study, which involved over 300 patients, found that teledentistry was a valid screening mechanism for positively identifying appropriate new patients. This system, like many others which can be reviewed in the literature, proved successful for managing time and coordinating the relationship between different medical centers.

In order to raise awareness of community health issues relating to access to care, some dental schools have recently started including courses in teledentistry for dental hygienists. An outcomes assessment published in 2007 showed an association between an increase in practitioner skills and the use of teledentistry systems, and also revealed that these systems encouraged students to form the opinion that teledentistry could play an important role in increasing access to care. The message that is being conveyed to the students of the study’s focus group reaffirms the sanguine declaration made in 2004 in the International Journal of Dental Hygiene:

Teledentistry has the potential to expand the oral healthcare being provided. It can be utilized by any dental care professional who wishes to gain advice, improve diagnostic care or determine referrals. The prospects of teledentistry are enormous. It has the ability to alleviate many barriers that currently exist in access to oral healthcare.

Not to be disenchanting, but the benefits that have been primarily touted in the literature appear to outstrip any mention of disadvantages, by such an overwhelming proportion that it begins to sound like science fiction. One social scientist who has studied the nascent implementation of telemedical systems has argued that these technologies are not only a feature of healthcare, but furthermore work to redefine the composition of society (or perhaps ‘citizenship’) itself:

Telehealth may thus be seen within a wider process of empowering citizens and workers, [the] democratization of public institutions and making service delivery process more localized and responsive to people’s needs. Thus telehealth can, at times, promote a view of communities and individuals as more active participants in the health process, not passive receivers of medical treatment, and be developed and used with the aim of limiting social exclusion.

Above-mentioned concepts like empowerment, democratization, active participation, and social exclusion are worth closer examination and careful consideration.

The cornerstone of telehealth is the presumed increase in access to care for remote populations. Geography, or measures of distance, seems to be the obvious framework for analyzing the uses of this technology; but time is also important. Dramatic reductions in travel time, no appointment backups, even the very digitization of medical data (particularly medical images for radiological analysis, or electronic health records) promises to speed everything up.

The imagined potential of teledentistry is predicated on the proposition that it collapses time and space. However, it has been much more difficult to anticipate its effects on the quality of care. In the history of medical technology, we find numerous examples where the introduction of yet another technology further alienates the patient or dehumanizes the clinical encounter. Telehealth goes one more step further in this transformation of the clinical encounter. In the pursuit of dental public health, which was originally conceptualized as an ethical core to the profession and a way to establish public trust, how might technologies such as teledentistry affect that social bond?

Teledentistry and Patient Trust

What does history suggest will be the impact of “diagnosis at a distance” on patient satisfaction? To answer this, we need to examine notions of trustworthiness and lifestyle integration of this unique technological system. Part of the reason that “technologization” of healthcare was considered dehumanizing throughout the 20th century was because previous technologies that intervened in the doctor/patient encounter were unfamiliar to patients.

The trust that first underwrote the provider-patient relationship drew on notions of expertise
and faith in human judgment. The “human bond” can be empathetic and insightful of a patient’s particular problems. Even medical specialization, which began to erode the paternalistic ideal of the general practitioner, was still rooted in assumptions and cultural attitudes about the value of human skill and perception. Attitudes about the introduction of computer-generated pictures and computer aided diagnosis reveal the tensions surrounding the displacement of human skill. Our present culture has a sophisticated approach to visual media, one where people are increasingly skeptical of pictures as reliable proof. Thus the idea that computer-generated pictures or even video can be used for diagnostic purposes is problematic, even though popular culture suggests that the public is dazzled by colorful MRIs. But this awe does not automatically confer upon these pictures privileged epistemological status. Patients still want their healthcare providers to see things for themselves, “in the flesh”. Patients still want to be seen by human eyes rather than cameras alone.

Historical precedent may suggest that patients are prone to reject telehealth (referring only to that kind of telemedical practice which recreates the clinical encounter virtually, rather than the simple transmission of data between providers). But surprisingly, much of modern telehealth—even those methods which would seem most “dehumanizing” of the clinical encounter—is not being rejected. Why not? And in what ways should dentists consider the integration of these new technologies into their practices? How does this affect social trust, and the notion of evidence-based practice in the future?

A closer analysis of patients’ perspectives on telehealth systems throws new light on the conditions that create a trustworthy relationship between doctors and patients. Studies from the 1990s suggest that there was resistance among medical practitioners to use telemedicine systems, because removing patients from the clinic was seen as a bad move for the future of the business component of providing healthcare. Another concern: if the system ever became widely adopted, and not solely used for “remote populations,” how will the practitioner maintain the bond with the patient? Are not computer relationships weaker than face-to-face relationships? However, instead of thinking about the weakening of social bonds as a result of a technological intervention, one might instead consider how this technology has the potential to foster a stronger business model, due to an increase in familiarity with the technological system. Patients might prefer convenience and speed over a paternalistic doctor/patient relationship.

However, the message from those who promote teledental systems, quite obviously seen in the industry literature, is that telehealth can help build one’s practice by recruiting patients from further afield. Own the system, and in a sense you own the people who put faith in that system. Once again, instead of seeing telehealth as a concern about the transformation and destabilization of the clinical encounter, one must also analyze this as an issue of technology transfer between one established social world and another. Once one understands, for instance, how Amazon.com became trustworthy and successful as an online retailer, it becomes easier to understand how telemedicine can be “good for business”. Thus history suggests we look at the role of computers and online communication as a way of thinking about teledentistry’s future prospects, rather than what people feel about waiting in a doctor’s reception area, or driving long distances to seek healthcare.

But this perspective is inadequate when addressing the ethical issues raised by the development of telehealth systems, since it takes into account only those patients who have already have access. Putting that discrepancy aside, other reasons why healthcare providers have hesitated in adopting telehealth systems shed light upon the way practitioners navigate the scientific, technological, and social milieu of the 21st century. First, practitioners have resisted the adoption of teledental systems for fear of the loss of business. Studies suggest some resistance within the professional organizations to the implementation of telehealth, for fear that it will
make smaller, rural practices redundant and run the practitioners out of business. (Consider again Amazon.com—but in relation to smaller booksellers). The telemedical industry replies that this is precisely why practitioners should adopt these technologies and not get left behind—it could potentially increase their business in the longer term.\textsuperscript{11,12} So the issue of increasing patients’ access to care is, inversely, intertwined with questions about professional access to patients.

Next, there are worries about the expense of the system. For all the rationale behind the system as a way of reducing healthcare costs by collapsing space and time, new technology is never cheap. What will be the technological requirements for minimum standards of care? In other words, if telehealth becomes an ethical, moral and healthcare policy imperative, this will have implications for standards in telecommunication systems. In fact, it soon might mean that not having access to the internet becomes a health risk!

Third, there is concern over the fragmentation of professional identity. This is mainly a generational issue: in research on telemedicine, looking specifically at its impact on radiological workflow, there has been criticism by older radiologists about the fact that traditional ‘departments’ no longer exist.

Finally, there are a host of unresolved issues over jurisdiction, regulation, and licensing. These matters have received by far the most attention in the literature, because they have a direct impact on the practicality and logistics of telemedicine. In the wake of the ADA and Alaska Native Tribal Health Consortium debacle over the uses of dental therapists from New Zealand, you can imagine that teledentistry is a sensitive topic. Legal issues bear upon the integration of such technology, particularly those systems that facilitate provider/patient contact, which might cross over state or even national boundaries. These issues include a range of concerns, from ensuring patient confidentiality; to collecting informed consent; to malpractice insurance coverage.\textsuperscript{13} There are calls for a national or even international registration system for telehealth practitioners. State licensing appears to be the preferred method, but since teledentistry can cut across jurisdictional lines, this leads to the question of who can practice where. The problem revolves around regulating the qualifications of those who engage in telemedicine consultations.

With the introduction of a technology that both separates and yet “virtually” connects doctors and patients, states differ in their interpretations of the changes in the doctor-patient relationship. One legal question raised in this circumstance is that of malpractice: whether a “relationship” has been established in the eyes of the law between doctor and patient when the encounter is mediated through this technology. If doctors are sued, in which state are they being sued? Do they need to hold a license in the state that their patient is in?

We are obliged to take a slightly broader perspective on this major new technology which in the years to come has the potential to change oral healthcare and dental practice. It is a technology that it is hoped will solve a major social problem: to remove all-too-common barriers to the provision of healthcare.

The question that remains is whether telehealth provides appropriate solutions to the larger problem of quality healthcare provision. Perhaps what is to be resisted is not the technology itself, but the naïve positivist notion that such technology can itself solve the social problems that create health disparities to begin with.

There is something comforting and optimistic in the idea that science and technology provide solutions to social problems. Yet the history and philosophy of science teach us to be cautious of the idea that technology has its own agency to offer far-reaching solutions, rather than merely serving as a tool which might encourage us to think differently about problems.

There will be major ethical issues at the core of what it will mean to be trained as a dentist in the 21st century, especially in light of the scientific and technological developments to come. Current and future dental students will face increasing challenges in navigating their role in the healthcare system. When confronting the pressing social issue of the provision of care to the poor and
underserved, the question they will face is one of whose responsibility it will be to offer that care and ensure its quality.

**Professional Obligations in Dental Education**

When one examines ethics in the history of dentistry, conversations often separate into two categories. On the one hand, the matters of how to avoid malpractice, how to maintain good bookkeeping, and so on. The other category revolves around dental education and the need to instill a sense of professional obligation in the next generation of students about delivering care to the underserved. The best way to widen public health is to begin upstream, at the point of passage where professionals are the closest together. Thus the focus should turn to the obligations teachers and mentors have in shaping the awareness of dental and other health professional students about major social issues.

We need to change the prevailing attitude about responsibility; while respecting students’ choices of career path and specialization, to encourage them to engage with social health discourse; to raise the profile of discussions about shared responsibilities and define the place of all stakeholders in the social contract of health; to teach healthcare collaboration by example. Problem–based learning (PBL) modules illustrate how different health researchers collect information and tackle complex scenarios. There is still an underdeveloped interest in mapping the intellectual contours of our institutions to connect those people of diverse backgrounds who share common interests. By structuring research and teaching around shared health problems, it becomes easier for students to combine different perspectives and achieve otherwise unattainable goals.

There is a body of literature on interprofessional education (IPE) that provides inroads to pedagogical models. Many curricula today have “cultural-competency” components and ethics modules, but too often they are didactic lectures with the objective of raising awareness and promoting self-reflection. The coming ethical landscape will require more than self-reflection. It will demand an interdisciplinary understanding of how many distinct contributions can be combined to compose a strategy. An obesity clinic, for instance, would be a good place to bring in a diverse team of students. Junk food is a problem for dentists, nutritionists, physicians, and social scientists alike, so an interdisciplinary perspective could foster a sense of collective responsibility and lead to new attitudes about how to collaborate on solutions.

It is also necessary to better train students to see healthcare problems through the eyes of patients. It should matter less what the professor thinks about oral healthcare access than what the patient population thinks. Students should research the perceived need for interventions, so that good intentions do not backfire due to an unresponsive patient population. Grant money is often awarded to faculty and students to travel somewhere to deliver healthcare, but often they have done very little to demonstrate that what they want to do is considered necessary or a priority by the patient population itself. If practitioners take the paternalistic attitude that they “know best” what is good for the patient, it invites more debate about ethical principles of treatment. Instead, instructors and students must communicate with social scientists, historians and anthropologists who examine the social and cultural beliefs of different populations, to see what kinds of interventions would work well. This collaboration is not routinely done. A study at the University of California San Francisco on “oral-health related cultural beliefs” found the literature on this to be nearly non-existent. These strategic alliances must be built within pedagogical curricula. There are serious obstacles to overcome, because disciplines speak different academic languages.

From one perspective, social problems are not categorically different from scientific problems. Many medical students choose their career path because they love science, and many were undergraduates at places that did not require any study of humanities. They are still motivated by humanitarian goals, however; but they may pursue
these goals through lab tests rather than social analysis. Educators can do a better job of showing how science and society are interdependent. Students can be shown that lab tests are socially conditioned; that the behavior of the patient affects every micro-analysis one can do; that faith in test results should be contingent on an understanding of the patient and his or her community. To use again the example of the obesity clinic, patients can be asked whether they eat a lot of sugar, or lab tests can be ordered to check their glucose level—different approaches that ask the same questions. The pursuit of hard data is never to be abandoned, but all data collection must be recognized as part of a continuum, one of many worthwhile elements to building a strategy for healthcare delivery.

The “research cluster” concept would, for example, link dentists to people involved in smoking cessation programs who have access to populations and are collecting patient data. Such collaboration would synergize efforts and maximize the value of the brief contact time practitioners have with their patients.

Let us take it for granted the ethical core of the profession of dentistry. The problem we face with regard to access to healthcare is not an ethical problem in the sense that anyone has forgotten the ethical responsibility to help the underserved. The problem lies less with any diminished sense of moral responsibility, and more with the provision of practical education about how to effectively engage in community service. The discussion, the literature, and the reflections of ethicists need to move away from generalized propositions about social justice, and instead ground themselves in case studies of community-based pedagogy and the practical aspects of implementing technological solutions like teledentistry. Navigating scientific, technological and social issues of the new century will demand collaboration, and the diverse range of work being done studying these issues is a sign of how powerful cross-disciplinary communication will be in the coming century.

References


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**Bremner Award for Pre-Doctoral Dental Students**

A certificate, $500 cash prize and up to $500 travel and related expenses will be awarded to the winning unpublished essay on:

1) A subject relevant to the history of dentistry

2) The result of an original research effort related to dental history

3) A composition revealing an uncommon appreciation and understanding of historical items related to dentistry.

*Eligibility*: Contest open to all predoctoral students of dentistry in the US and Canada, including undergraduate students preparing for admission to dental school. Purpose is to encourage the student and research of the history of dentistry.

Entries must be original essays, not more than 5,000 words, on a subject relevant to dental history.

*Selection*: A special committee of the Academy will judge all entries received prior to March 1, 2010, for the current year's award. The winner will be announced prior to June 1, 2010, so that said winner may be in attendance at the annual meeting of the Academy.

*Application*: Send typed essays (in triplicate), following the Instructions for Authors for the *Journal of the History of Dentistry*, along with a statement of authenticity by the Dean or responsible faculty, by March 1, 2010.

*The Award is presented at the annual meeting of the American Academy of the History of Dentistry.*

*Please submit papers prior to March 1, 2010.*

Please direct correspondence to:

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7112 Sylvan Ridge Road
Indianapolis, IN 46240
The Maturation of Science Within Dentistry: The Impact of Critical Milestones and Visionary Leaders on Contemporary Achievements

James L. Gutmann DDS, Cert Endo, PhD (honoris causa), FACD, FICD, FADI
Professor Emeritus, Baylor College of Dentistry
Texas A&M Health Science Center, Dallas, Texas

In the last 150 years dentistry has faced myriad challenges as it has developed as a technical profession; but even greater struggles to develop a true scientific basis, one that permeates both the academic and practice sectors. In the latter part of the 19th century, technical advances abounded and clinical practice was empirically driven. The first few decades of the 20th century were a tumultuous time in the scientific evolution of dentistry, and many political barriers existed. The formation of scientific journals, research institutes, and a focus on dental education all contributed to a slow and sometimes agonizing evolution of the scientific development of dentistry. Today, while research endeavors are vast, the dental educational system and its embracing of new science within its curricula may not have kept pace with the vision of William J. Gies to revitalize the dental profession over 75 years ago. We are on the brink of a remarkable transformation for both dental education and the practice of dentistry, one that will require enhanced leadership, a revitalized vision and a passion for excellence to allow its continued progress and ultimate success.

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Mortal Prudence, handmaid of divine Providence, hath inscrutable reckoning with Fate and Fortune: We sail a changeful sea through halcyon days and storm, and when the ship laboureth, our steadfast purpose trembles like as the compass in a binnacle. Our stability is but balance, and wisdom lies in masterful administration of the unforeseen.

Thus has been the development of the art and science of dentistry for the past 150 years. In many respects, the balance was often heavily focused on the mechanical aspects of the profession, occasionally being offset by attempts to integrate science into the delivery of patient care. While attempts had been made since the treatise *Le Chirurgien Dentiste ou Traité Des Dents*, by Pierre Fauchard, (known to many as “the Father of Dentistry”), to elevate dental science to its rightful place as the basis for our clinical treatment, little codification and clarification existed. No doubt, there were significant developments in the mechanical/technical and biological aspects of dentistry: the development of anesthesia; x-rays and radiographic documentation; classifications of malocclusion; the lost wax casting machine; the standardization of operative dental procedures and cavity filling materials; the porcelain crown; the discovery of the impact of caries on the dental pulp; and delineation of local inflammation and its role in periodontal disease. However, the driving force in dentistry was still one of a technical nature and science per se was primarily empirically based, with the theoretical framework yet to be built.

By the mid 19th century, the geographic center of innovation in dentistry was viewed as being in the United States. However, the innovations were essentially based on applied research as opposed to more basic science, which continued to flourish in Europe. The applied research, however, was monumental. For example, the use of general anesthesia by Horace Wells, who used nitrous oxide for the painless removal of a tooth; or the subsequent use of ether, often attributed to William T. G. Morton for the same purpose. Additional notable strides in applied research were the discovery of the welding property of annealed gold foil by Robert Arthur; innovative methods in oral surgery from Simon Hullihen, who became known as the Father of Oral Surgery; the characterization of oral deformities and procedures for their corrections by Norman Kingsley, who became known as the Father of Orthodontia; the classification of malocclusion and proper treatment for each condition without the sacrifice of teeth by Edward Angle; surgical management for clefts of the jaws by Truman Brophy; the use of radiographs to reveal anatomical and pathological conditions of the teeth and jaws by C. Edmund Kells; and the major contributions by Greene Vardiman Black in the realm of operative dentistry and oral pathology. However, even in light of these developments, there were skeptics who challenged the essence of dentistry as it was being practiced in the 19th century. One in particular was Alton Howard Thompson from Topeka, Kansas:

We claim, and often seem to believe, that we, at last, in this, the pedantic nineteenth century, have reached the scientific period, the golden age, the era of the application of exact knowledge in the methods of practice; that we are, in short, ‘scientific’. As we bask in the supposed dawn of this glorious age, we do not notice the lingering twilight of empiricism which yet enshrouds us; we think we see the sun, and ignore the shadow of night but slowly fleeing away. But as we indulge the hope that this is true, we cannot suppress the doubt that will arise that we are, after all, not so scientific as we could wish, or as we assume to be. We think with pain of how little exact knowledge we have, and how little of that we have is applied in a scientific manner in practice. We think of our routine work, of how we repeat the same operations day after day with the regularity and thoughtlessness of a machine, and with no consideration of the scientific principles involved. Then we alone from effect to cause, and blindly follow the lesions of mere experience without finding out the causes of things. That, we know, is not science…We know that science stands like a Recording Angel over our professional work, and without mercy or favor inscribes success or failure over each and every operation coming from our hands, and brands us as hypocrites or fools as we may be dishonest or honest in the ignorance of her laws; and when we fail it is because of that ignorance.

The development of science that would define the essence of dentistry beyond that of a mere technical or empirical profession began in the third and fourth decades of the 20th century. Previously,
dentistry in America underwent both major enlightenments and challenges, and American dentistry had been renowned throughout the Western world for its technical excellence. However, problems that arose shortly after the turn of the century raised serious questions, as the quality of total oral care provided by the dental professional was inferior. The focus was on the lack of understanding of oral disease, in particular the microbial aspects of the disease process. Apparently the dental profession had not adopted or considered the wealth of information on microbes and the role in the oral disease processes, as highlighted by one of the first true American dental scientists, Willoughby D. Miller. In 1890, in his seminal publication entitled, *The Micro-Organisms of the Human Mouth,* Willoughby 1) highlighted the fact that carbohydrate foods mixed with saliva and incubated at 37° C generated lactic acid, which could decalcify the entire crown; 2) identified several bacterial organisms that created acids during their metabolism; 3) proposed 18 propositions regarding the role of bacteria in oral disease processes, most of which are valid today; 4) focused on saliva as a research fluid; and 5) attempted to reorient the dental profession from one of treatment to one of prevention.

While the first few decades of the 20th century were a tumultuous time in the evolution of dentistry, many factors stood in the way of scientific development. Seven major initiatives and their offshoots made a significant impact on bringing true science into the profession.

**The Dental Journal as a Disseminator of Scientific Knowledge**

The first dental periodical in the world, published in 1839, was known as the *American Journal of Dental Science,* which was changed to the *American Journal and Library of Dental Science* with its second volume. Within 20 years it became associated with dental dealers and trade houses. Other early publications included *Stockton's Dental Intelligencer,* *The New York Dental Recorder,* *The Dental Register of the West,* *Southern Dental Journal,* *The Dental Review,* *Dental Items of Interest* and the *Dental News Letter,* with the latter becoming *Dental Cosmos* in 1859, *Dental Cosmos,* under the auspices of the S.S. White Manufacturing Co., published a wide range of materials, including historical accountings, personalized techniques, and practitioner opinions, much of its content being empirical in nature.

Historically, the statement has been made that a profession is known by the quality of its literary output, and if this yardstick was accepted at the beginning of the 20th century, dentistry fell far short of measuring up. The art of practice had so absorbed the interest of dental organizational affairs that the provision for publications which addressed scientific knowledge had significantly lagged. In 1913 *The First Official Bulletin of the National Dental Association* appeared; it was renamed *The Journal of the National Dental Association* in 1915. In 1922, when the National Dental Association’s name was changed to the American Dental Association, the name of the journal was changed to the *Journal of the American Dental Association.* In 1936 this journal merged with the *Dental Cosmos* and in 1937, the first joint publication appeared.

The journals of the New York Institute of Stomatology, American Academy of Dental Science, Harvard Odontological Society, and Metropolitan District (Massachusetts State Dental Society) amalgamated in 1906, and in 1912 their quarterly journal became known as the *Journal of the Allied Societies.* During World War I, publication was suspended with the December 1918 issue, but was revived by William J. Gies shortly thereafter in March 1919 as the *Journal of Dental Research,* a quarterly publication. Because of the increase in dental research during the 1920’s, the journal changed to a bi-monthly publication in 1928. Subsequently, the journal was transferred to the International Association for Dental Research in 1934. With the leadership of the two major journals, and the enhanced focus on research, the *Journal of Dental Research* and the *Journal of the American Dental Association* began to define and extol the scientific nature of the dental profession through the dissemination of research findings.
The Formation of the National Institutes of Health & National Institute of Dental Research

In 1916, the National Research Council of the National Academy of Sciences was one of the first federal government bodies to promote dental biological research. President Woodrow Wilson had created the council to coordinate the nation’s scientific research facilities for defense work. While the council originally did not include dental research, its organization was such that it could easily promote dental research. In 1918 a division of medical sciences was created. In 1919, the division created a committee on dental investigations to encourage dental scientific research, and appointed Thomas B. Hartzell as the committee’s first chairman. However, in the next few years he met many roadblocks, both financially from lack of support from the council, and prejudicially from the lack of respect received from the chairman of the division of medical sciences, a physician named Dr. Henry Christian:

I believe that the dentists can help us with their cooperation. Of course, they can’t do any real investigating of such a problem on their own hook, but in a cooperative thing I think we can make use of them, and the way to do it, it seems to me is to let them think that they are just as important cogs in the wheel as anybody else….If eventually we get the money we will…have complete control of the whole thing.9

These patronizing views held by some members of the medical profession provided a glimpse of the problems facing dental research inasmuch as the physicians controlled most of the health care and research at that time. However, a breakthrough came in 1924 when the Carnegie Corporation, a member of the National Research Council of the National Academy of Sciences, awarded $85,000 to the University of California College of Dentistry in San Francisco “to undertake, through cooperation of a number of men in different fields of science, a joint study of pyorrhea and its possible relation to other human maladies.” The American Dental Association Scientific Foundation and Research Commission helped to plan this project. The award marked the first large dental research grant in the United States from a foundation outside the dental community.10

The National Institute of Health originated in 1887 in Staten Island, New York as a small laboratory called the Laboratory of Hygiene in the Marine Hospital Service, a precursor to the US Public Health Service. In 1891, the Hygienic Laboratory, as the small laboratory became known, moved to Washington. The Ransdall Act changed the name of this laboratory on May 26, 1930, to the National Institute of Health (NIH) (later to be referred to as Institutes with the creation of multiple institutes within) The NIH was established with specific directives for the administration and operation of the institute, with the Surgeon General selecting persons who showed unusual aptitude in science. In July of that 1930 the American Dental Association passed a resolution to call to the attention of the Surgeon General the necessity of conducting dental research.11 However adamant, the plea initially fell on deaf ears, and it was not until 1931 that the Surgeon General agreed to appoint five dental scientists from outside the government to advise him on the establishment of a constructive program of dental research. Foremost on their agenda were the pressing issues of mottled enamel, fluoride, trench mouth (Vincent’s Angina), the epidemiology of dental caries, particularly in children, and a new discovery, penicillin.

In 1944 the American Dental Association’s legislative committee prepared a proposal for the United States government: a bill to establish a dental research institute in the NIH. The bill required the Surgeon General to direct the proposed institute using a national advisory research council, of which he would chairman. The advisory council would consist of six members distinguished in dental and scientific endeavors, with at least four holding dental degrees. Much of the impetus for this development was due to the relationship between dental health and national security. World War II revealed that dental problems made the difference between adequate and insufficient manpower to fight in the United States armed forces. Dr. Sumter S. Arnim, chair
of the Committee on Research and Graduate Study, School of Dentistry, Medical College of Virginia, explained that “it has required a national emergency in the form of war to focus the spotlight of attention on this most common of all ailments, dental disease.” Arnim also indicated that there were far too few individuals trained to conduct dental research, and that a national dental research institute could stimulate graduate research training programs in dental schools. It took four more years of federal indecision—counteracted by the political maneuvering and testimonials of the American Dental Association, the International Association for Dental Research and the American Association of Dental Schools, in conjunction with supportive legislators—to get President Truman to sign H.R. 6726. This bill was transformed into Public Law 755 and was called the National Dental Research Act – the National Institute for Dental Research (NIDR) (now known as the National Institute of Dental and Craniofacial Research, NIDCR) was born.

The first challenge that this fledgling institute faced was one of fluoridation, with agendas ranging from the scientific, clinical, and epidemiological, to the psychological and legislative areas. Second, the need to train researchers in dentistry was paramount, as Dr. Anim had indicated. This latter imperative began to achieve fruition in the 1950s, and in further in the 1960s, with sufficient funds being appropriated for research training from Congress during the Kennedy and Johnson administrations. By 1972, the NIDR had supported over 1,600 trainees and fellows, with the greatest percentage of these involved in teaching and research, and over half involved in the provision of patient care. The evolution of science and scientific manpower in dentistry was now under the public microscope.

**The Formation of the International Association for Dental Research (IADR)**

The formation of the *Journal of Dental Research* by William J. Gies fulfilled the concept of merging basic scientists with dental professionals only to the extent that it disseminated their research findings. Gies also had a vision that included an organization in which there could be a meeting of the minds, on a person-to-person basis, of all research-oriented individuals to promote interest in dental science. Therefore, two years after the formation of the *Journal of Dental Research* in 1918, William J. Gies, who was a professor of biological chemistry at Columbia University, organized the International Association for Dental Research. This association brought together dentists and scientists who were seeking to enhance dental research. Gies was also committed to the encouragement of research in the dental schools. The IADR was to play a major role in the promotion both of integrated science in dentistry and the formation of the NIDR in 1948. The North American Division of the IADR began in 1952. In 1972, the American Association of Dental Research (AADR) replaced this division, and the AADR was formally incorporated into the IADR. The AADR has served as a driving force in the continued scientific evolution of dentistry in the United States.

**The Dental Curriculum**

In the early 1900s, there was a concern over the uneven quality of medical education in the United States, which eventually led, with the support of the American Medical Association, to the formation of the Carnegie Commission on Medical Education and the appointment of Abraham Flexner to head a study of US Medical Schools. The result, which culminated in what has become known as the Flexner Report, was issued in 1910. The outcome of this report had great impact on the field of dentistry. In a special study, William J. Gies encouraged research in dental schools. Gies’ findings resulted from a 1921 decision by the Carnegie Foundation for the Advancement of Teaching to also fund an examination of dental education in the United States. Published in 1926, the Gies Report urged dental schools in the United States and Canada to improve their curricula by using well-trained full-time teachers, conducting and encouraging research, and providing adequate libraries. Gies recommended that each dental school should “encourage and support research by
its teachers and should arouse and develop creative capacity and professional leadership among its most gifted students.”

In addition to including research by the faculty, Gies pleaded for a revamping of both the predental and dental educational process. For example, a minimum of two years of college would be required for entry into dental school. This was a major change in that there were no academic requirements from 1840 to 1869; from 1870 to 1891 only a good English education was required; from 1891 to 1897 not even a grammar school education could gain approval; from 1899 to 1924 various numbers of high school years of education were required. Even with the Gies report in 1926, two years of college would not become a requirement until 1937.

Furthermore, Gies called for the development of instruction at the graduate level, better cooperation between dentistry and medicine, and for the disappearance of independent or proprietary dental schools. Additionally, he called for increased financial support for dental education and for greater appreciation by dental teachers of the biological and medical side of dentistry. Gies suggested that dental disease was being treated too mechanically and empirically because of lack of fundamental knowledge in the field, and that the means for prevention of dental disease were deeply lacking for the same reason. He considered that many dentists at that time practiced superficially, even unprofessionally, and that they regarded dentistry as a trade and a business rather than as a profession. For these reasons, Gies felt that dentistry had failed to reach the accord and cooperation required for the highest development of oral health care.

The National Board of Dental Examiners was created by the American Dental Association in 1928. Its function was to establish an adequate qualifying dental examination of such character that the certificate awarded to successful candidates could be accepted by many heretofore established State Boards of Dental Licensure, and secondly, to elevate the standard of qualification for the practice of dentistry. Therefore, any student who matriculated in an approved dental school in the United States in the scholastic year of 1926-1927 or after, could apply for examination and registration. It was within this context that dental graduates were finally being examined, not only on practical and mechanical dental sciences, but also on the basic sciences. Even though this process appeared to raise the bar of dental education with a focus on science, the true application and integration did not receive the same impetus in the dental curriculum. Much of the problem for this failure resided in the fact that as universities acquired dental schools, administrations were forced by fiscal realities to use the basic science departments already established and staffed by medical school personnel for the instruction of the dental students. This was a logical position for the university administration, but the dental clinical faculties and administrators never took basic science instruction of the dental students quite as seriously as their medical school colleagues. Not only did this reality impede the integration of oral sciences into applied dental situations, it also stymied attempts at a strong and sustained effort at dental research.

**Improving the Teaching of Clinical Applications of Pure Sciences**

Although the pure sciences were long a component part of the dental curriculum, too little practical application had been made of this knowledge. With this deficit in mind, the organizers of the 16th Annual Meeting of the American Association of Dental Schools in 1939 focused an entire section on how to change the dental curriculum to address these shortcomings. However, the focus was not only on the teachers of dentistry but also on the dental licensing boards. According to many students at that time, “they wanted to study dentistry, not biochemistry, histology and bacteriology.” Bodecker indicated that the pure sciences were not applied more thoroughly because the clinical teachers had given the subject too little thought. Furthermore, no efforts had been made to gather and integrate this information into meaningful, applicable learning experiences. One of the biggest hurdles identified
by Bodecker was the fact that teachers had not paid attention to many of the dental investigations taking place and being published in reputable journals such as the Journal of Dental Research and the Journal of the American Dental Association. A perfect example of this neglect is evident in a paper presented by Dr. Balint Orban and published in 1941, which concerned itself with the “Biological Considerations in Restorative Dentistry”. In it, Orban highlighted current biological principles regarding the pulp, gingiva and periodontal membrane as they related to the restoration of teeth; yet these concepts were not being taught in the dental school curricula. In fact, the concepts within would escape integration into the dental curriculum for many years. Part of Bodecker’s plan was to have teachers begin to publish articles that would show how pure science should be integrated into and applied within the practice of dentistry, and that this information be put into the Licensing Board examinations.

The integration of scientific principles into clinical dental applications has come a long way in enhancing the science of dentistry. While this approach has occurred primarily in formalized postgraduate and graduate programs, as indicated by the specific requirements for advanced specialty education and by the research that has come from the specialty educational programs, the incorporation has taken a longer period of time within the predoctoral curricula. While the possibilities for this integration are promising and are occurring in many sectors, there is great need for faculty to develop and nurture this vision for dental education.

**The Development of Oral Biology and the Promotion of Science in Dentistry**

As has been seen with the aforementioned initiatives on the evolution of science within dentistry, there existed in each area driving forces which altered the environment, or specific individuals who took up the gauntlet in the pursuit of this goal. The same is true for the development of oral biology within the United States, a development that may very well have ensured the scientific evolution of dentistry not only for the past 80 years but for the future of the profession. Ironically, however, this impetus did not come from the Federal government or from the powerful dental societies on the East Coast, but rather from a combination of world conflict and a focus on academic leadership and research that was thriving in and around Chicago, a great metropolitan center with economic dominance extending over a large region of the central United States. In Chicago in the 1920s there existed three well-established dental schools: Chicago College of Dental Surgery at Loyola University, Northwestern University Dental School, and the University of Illinois College of Dentistry. The complex early histories of these schools included some of the major players in the development of dentistry as a science: G. V. Black, Truman Brophy, Edmund Noyes, Charles N. Johnson, Thomas Gilmer, W. G. Skillen, Edgar D. Coolidge, Balint Orban, Frederick B. Moorehead, Edward H. Hatton & S. D. Tylman. While all three schools had early associations with proprietary schools, both Northwestern and the Chicago College of Dental Surgery were ultimately associated with private universities, and the University of Illinois was a state supported institution. William J. Gies had indicated that these types of affiliations were essential for the betterment of dental education.

The turning point in the development of oral biology as a significant research entity occurred in the mid-1920s, when the Dean of Dentistry at Loyola, William H. G. Logan, sought the advice of Dr. Bernhard Gottlieb on how to establish a research endeavor within an academic environment. Dr. Gottlieb conducted a prestigious research institute in Vienna at the world-renowned University of Vienna School of Medicine. The achievements of the Vienna medical school in the 19th century had enriched the scientific basis of every area of medicine, including the then ill-defined discipline of dentistry. In fact, a formal dental educational program did not exist at this university until 1890, followed by the formation of a Dental Institute in 1898. During the next 20 years this institute served to educate
many American students who sought to expand their horizons in the realm of science, while American dentistry continued to be internationally recognized and admired for its technical excellence. The Germans were so impressed with the work of G.V. Black that they translated his landmark work, “A work on operative dentistry” (1908) into German. A protégé of Gottlieb was Balint Orban, who practiced with Gottlieb in the early 1900s. Orban joined Gottlieb’s staff in 1922 and his research was also world-class. He published two groundbreaking reports in the mid-1920s on nutrition and the development of teeth, and on the histology of enamel. Upon the recommendation of Gottlieb, Orban came to the United States in 1927 to establish a research program at Loyola, and spent the next two years in that endeavor. Balint Orban returned to Vienna in 1929, but the research endeavors did not stagnate, as Dr. Rudolph Kronfeld, another Gottlieb assistant, was appointed to replace Orban. Kronfeld was instrumental in propelling forward the visions of his mentors. Kronfeld’s short career at Loyola was marked by tremendous achievements in research, publication, and influence on the positioning of science within the practice of dentistry. His message to clinical dentistry was set out most explicitly in a widely published article entitled, “Research and the future of dentistry” in which he delineated the crucial connection between the techniques of restorative dentistry and the biological foundation on which those techniques must rest. One month before Kronfeld was scheduled to become the president of the IADR, he suffered an untimely death, and as his colleague Edgar Coolidge put it, Kronfeld “was surrounded by his library, his histological material and his work in progress for the coming season.”

Other stalwarts who entered the scene at this time were Harry D. Sicher and Joseph Peter Weinmann. Dr. Sicher began his career in the United States at the Chicago Medical College, later moving to the Chicago College of Dental Surgery at Loyola University. Dr. Weinmann began his career in the United States in 1938 at the University of Illinois College of Dentistry, followed by one year at Columbia University. He then joined the faculty of the Chicago College of Dental Surgery at Loyola University. In 1946 he returned to the University of Illinois. Both scientists undertook significant research in oral anatomy, bone physiology and oral pathology. Weinman received significant grant funding from the National Institutes of Health. Together these scientists, a pathologist and an anatomist, published a classic text on the fundamentals of bone biology (Bone and Bones, St. Louis, The C.V. Mosby Company, 1947). In it they attempted to:

[Eliminate the differences between the diverse points of view of those who, clinically and microscopically, roentgenologically and chemically, examine bone and bones of those who experiment with bone and bones...and to serve as a] guide to those work on bone and bones in their medical specialty: orthopedists, radiologists, metabolists, dentists, orthodontists; and aid to the teacher who wants to integrate his particular field into the greater unit of biology.

This was a major attempt to provide a meaningful link between research-based science and the clinical practice of medicine and dentistry. During this period of scientific emergence in dentistry in the United States, political upheaval, anti-Semitism, and the winds of war were brewing in Europe. Under these pressures, many dentists and medical scientists, primarily from the University of Vienna, sought refuge in the United States. The response to this influx, however, created problems. The issue reflected a complex struggle between those who saw facilitating the emigration of foreign-trained scientists as an opportunity for the dental profession (as well as a moral responsibility), and those who saw it quite simply as an economic threat. Additionally, many of the practicing dentists in Austria and Germany also sought to emigrate. In Austria alone, more than 75% of the Medical Faculty lost their positions due to both official and unofficial anti-Semitic rules. While many who lost their positions sought desperate help from their United States colleagues, only a few had lifelines within the dental profession: namely, Gottlieb, Orban, Sicher, and Weinmann.
While the option of coming to the United States appeared to promise a livelihood for these specific individuals, the Dean of the Dental School at the University of Michigan indicated that the dental schools which made up the AADS “are faced with a decision as to what they will do to orient the stranger dentists within our gates to become useful citizens and respected practitioners.”25 The National Association of Dental Examiners also began to address this issue, and a smoldering feud existed between the AADA and NADE as to who was the gatekeeper in this situation. Fortunately, the AADS member deans took a more welcoming stance toward the refugee dentists than did the examiners. However, the dental school deans were still faced with the dilemma of how to assess and evaluate the skills of these individuals for entry into a United States dental school curriculum. Furthermore, Dr. Hamilton G.B. Robinson expressed concern that incorporation of any “refugee professors” in the teaching faculty would absorb all available open faculty positions, leaving none for students currently enrolled in teacher training programs.26 While some dentists did receive dental degrees and passed licensing boards in the various states, some also left professional dental careers and focused exclusively on their responsibilities in an academic and research environment. To these individuals a tremendous debt is due, as they were instrumental in nourishing the vision of dental research and its incorporation into the dental education curriculum. In fact, according to Kremenak and Squier, while Bernhard Gottlieb’s contribution to understanding of the structure and function of the teeth and oral tissues was monumental:

[H]is greatest legacy to dentistry may have been the tradition of careful systematic inquiry his leadership instilled. His career, and the careers of the students and colleagues who had worked with him in Vienna, enriched the scientific foundations of dentistry and, perhaps even more significantly, helped lay the foundation for a vigorous research enterprise in the United States.23

In 1928, oral biology research and training at the University of Rochester Medical Center was instituted and was the first program in the United States to establish a formalized oral biology research endeavor, under the vision of Nobel Laureate and Dean of the School of Medicine and Dentistry, Dr. George Whipple. The oral biology research training program eventually developed into the Department of Dental Research in the School of Medicine and Dentistry. In 1998, the Department of Dental Research, renamed the Center for Oral Biology, joined five other research centers to form the Aab Institute of Biomedical Sciences.27 Today, the Center for Oral Biology consists of several interdisciplinary research teams which integrate and blend aspects of biochemistry, developmental biology, genetics, immunology, microbiology, physiology, pharmacology and structural biology to explore important problems of craniofacial, dental and oral biology.28

The American Institute of Oral Biology (AIOB) was founded in 1943 by Professor Hermann Becks of the University of California to provide a forum to emphasize the application of basic and clinical research to the prevention and treatment of oral disease.29 The AIOB offered the practitioner the opportunity for knowledge-building in allied clinical fields, as well as those more traditionally associated with dentistry. This exposure enabled the healthcare provider to recognize incipient threats to the health of the patient, and to develop improved treatment methods in the daily practice of dentistry and medicine. It encouraged the consideration of clinical problems as involving the whole individual rather than as a simple concern of regional pathology. The Institute has served as a meeting-ground for the academically-oriented researcher and the treatment-conscious clinician.

In 1959 the first International Conference on Oral Biology was sponsored by the IADR and the ADA with a grant from the Colgate-Palmolive Company.30 Reflecting on the conference, Dr. Seymour J. Kreshover from the NIDR noted:

During the past three days we have experienced a process of intellectual cross-fertilization, which has made it possible to bring to bear on international health problems the thoughts and scientific efforts of a group of outstanding researchers. I am certain that in the course of this conference we have become increasingly aware that effective progress in dental
research involves horizons considerably broader than those encompassed in the activities of any single research unit, school, institution, or country. Each day, the shrinking world encompasses a greater community of interests in health and disease problems... However, the speed and adequacy of disseminating scientific information, the methods for free exchange of ideas, the opportunity to consult scientists with specialized knowledge and experience, the ways of learning new techniques and procedures – all are of vital importance, if we, as research workers, are to gain greater insight into the illusive etiology of such disorders as dental caries and periodontal disease.

In this same year, the publication Archives of Oral Biology first appeared, and has been viewed as a premier dental research journal ever since.

In 1968 the European Group for Oral Biology was established, and 30 years later, it held a conference to address the status of “Oral Biology at the Turn of the Century.” This group was formed by a group of colleagues who were extremely devoted to dental research, but who were frustrated by the inadequate ten-minute forums offered for the exchange of scientific information by established scientific organizations (such as the IADR/AADR). The extent of scientific advancement is astounding, and reflects a continued striving for the development of the biological basis for treatment parameters world-wide. As indicated by the editors of this publication, Oral Biology at the Turn of the Century:

The pace of research in oral biology during the past decade has been so rapid that many of us no longer have a comprehensive overview even in this narrow field. Furthermore, dental research is not immune to the economic vicissitudes of the worldwide recession. The undisputed success of scientifically- and prophylactically-oriented dentistry has led many politicians to assign further investment in dental research a low priority... dental research not only deserves a prominent place in the sun but that further process in dentistry depends upon continued active and vigourous research programmes.

Even now dental research and its incorporation into the treatment being rendered to patients worldwide was still struggling for its identity and support.

In 1988, the first step was taken to form a society of Oral Biologists, initially as part of a section of the AADR. This organization was to become the American Association of Oral Biologists (AAOB). A call for this type of organization was made by Dr. Richard P. Suddick in 1984:

Oral biology is a legitimate biomedical discipline of fundamental importance to dental education, but its incorporation into undergraduate dental education is proceeding too slowly, especially considering the changing conditions of dental practice. Widespread adoption of oral biology into dental curricula will enhance the biological orientation of dental students, and graduate education in oral biology can play a significant role in training dental researchers and academicians. Advances in the field of oral biology and the potential broadening of its role have been overlooked or downplayed by some dental educators, making it something of an issue in the U.S. dental community. Resolving this issue will depend on several relatively independent events: (1) some relief from, or an adaptation to, the present situational pressures on dental education; (2) a well-informed pro-oral biology position from dental education’s national leaders; (3) improved efforts by oral biologists to communicate the importance of their field; and (4) an understanding of this issue by the dental community with an organized effort to bring oral biology into the mainstream of dental education as it changes to meet new needs.

The AAOB’s first annual meeting was held in San Francisco in 1989 with the following theme: Oral Biology Research: Implications Beyond Dentistry. The following presentations were made:

- Gibbons, R. Bacterial adhesions to oral tissues: role in colonization.
- Golub, L. Tetracyclines inhibit connective tissue breakdown: new therapeutic implications for an old family of drugs.
- Kleinberg, I. Dentition microenvironments: models for studying microbial flora engineering.
- Mandel, I. Diagnostic uses of saliva in medicine.

In 1990, the organization launched the publication Critical Reviews in Oral Biology and Medicine. Its fundamental goal was to provide critical reviews on facts of oral biology, which
would serve as a valuable resource to researchers, teachers, and graduate students in the all-encompassing field of Oral Biology. Today, this journal is published as part of the Journal of Dental Research.

It took five years for the AAOB to reach its initial goals and ratify its bylaws. During this period, it also brought to light a very serious issue in dental education. In a presentation at its annual meeting in 1993, the past president, Dr. Robert Boackle indicated that there was a widening gap in dental education:

The dental profession is being called to provide care to more and more individuals with complicated medical problems. Often these individuals are receiving several types of medications and/or have debilitating illnesses. As the twenty-first century approaches, the oral biology community will be called to lead dental schools in developing applied basic science (oral biology) curricula which will prepare dentists to better understand modern dental medicine and interact more effectively with physicians when treating patients. Recently the AAOB National Board Assessment Committee, chaired by Dr. Kathleen Dobrosielsky-Vergona, revealed the sobering fact that with a few exceptions, the National Boards are not examining students for their knowledge of dentally related basic science (oral biology). The oral biology community has an obligation to correct this error and to teach the importance of applied basic science as it relates to the understanding of oral diseases. This cryptic gap in dental education is widening at a time when monetary constraints are causing dental administrators to reformulate their commitments and strategies in regard to the basic sciences. Dental schools are actively seeking sound advice on the best approach to properly educate their students while remaining within budgetary limitations. The oral biology community must respond to this critical need and to teach the importance of applied basic science. Perhaps one future goal for the AAOB should be to develop a series of short courses to be presented to dental administrators and faculty. In these courses we could provide practical answers with regard to the teaching of oral biology.

These observations and concerns echo the call to arms of William J. Gies 70 years prior, in his special report to the Carnegie Foundation, and to Rudolph Kronfeld’s exhortations of the 1930s.

The Emergence of Evidence-Based Dentistry and Dental Informatics

In the late 20th century three science-based initiatives have greatly affected the ability to identify the scientific evidence for clinical practice and create applications for computer and informational sciences to support clinical care. These were evidence-based dentistry (EBD), bioinformatics in dentistry and biomimetics. Applying the evidenced-based medical model to dentistry, the American Dental Association developed the following definition of evidence-based dentistry as: “an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to the patient’s oral and medical condition and history, with the dentist’s clinical expertise and the patient’s treatment needs and preferences.” Scientific evidence, when collected properly and analyzed systematically, can provide useful and up-to-date information for dental practitioners. Furthermore, this approach implies the need to incorporate the patients’ characteristics into the treatment plan, including their needs and preferences. In order for the patient to make informed decisions, he or she must be given scientifically valid information – hence the need for three things to occur in the dental educational process and the practice of dentistry. First, the educational system must prepare the dental student to be able to secure, analyze and understand the scientific advances in dentistry. Second, the dental graduate must be committed to lifelong learning to ensure that new scientific knowledge and advancement is both understood and incorporated into the delivery of oral health care. Third, the dental practitioner must value research, such as cluster or clinical trials, and participate in the advancement of research ideas.

Bioinformatics in dentistry is the application of computer and informational sciences to improve dental practice, research, education and professional management.
term, biomedical informatics, supports educational research through simulations of biological systems to improve understanding of the roles and interactions of biological systems for students and practitioners. Communication and collaboration strategies are accelerating information dissemination and connecting remote researchers and clinicians. Eventually, the development of diagnostic codes, and refinement of treatment codes, will provide a strong basis for assessing treatment efficacy, and will assist in assessing outcome data for patients and practices. In the future, bioinformatics may facilitate the discovery of more sensitive and specific drugs for the treatment and management of diseases and disorders, and it will enable dental and medical records to be accessed readily anywhere in the world.

Biomimetics is the study of the structure and function of biological systems as models for the design and engineering of materials and machines. While biomimetics has had a place in dentistry for many years in developing dental materials, it promises to take on new importance in terms of tissue engineering and the development of true organic biomaterials to replace body parts such as teeth, salivary glands, muscle, cartilage, bone and joints.

These developments in the advancement of science in dentistry are essential on all levels of dental education and clinical practice. However, they imply the need to have faculty well-versed in these sciences, and the commitment of every dental educational system to these new approaches of integrating science and dentistry for the betterment of the patients we serve.

In the last 150 years, dentistry has faced a myriad of challenges and struggles in its technical and scientific evolution. New challenges are now present as the future begins to unfold – a future that must be driven by a global vision for the provision of science-driven oral health care, a commitment to revitalization of the dental educational process, and an eagerness to embrace science as an integral and essential driving force for our profession. This vision should be foremost for the dental profession, and is attainable, lest we forget the lessons of history as we hurtle forward in this rapidly changing world. “Our stability [in this pursuit] is but balance, and wisdom lies in masterful administration of the unforeseen.”

In that first International Conference on Oral Biology in 1959, Dr. Carl Sebelius presented a beautifully illustrated lecture on his recent experiences around the world as the World Health Organizations’s dental officer. In the concluding remarks by Dr. Kreshover, he reflected on Dr. Sebelius’ presentation:

Before closing, permit me just one minute more so that I may refer to Dr. Sebelius’ performance of last evening. By so vividly bringing to our attention a first hand account of the way of life, health conditions, and dental problems in many parts of the world, including those generally thought of as remote areas of our global population, we have forcibly brought before us the magnitude of our responsibility to contribute tirelessly and with continued effectiveness to a better understanding of oral health and disease —problems which recognize no barriers of geography.

Dr. James Gutmann
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Dentists Horace Wells and later William Morton introduced the world to general anesthesia with nitrous oxide and ether, respectively. During the latter half of the 1800s, some of their colleagues actually redefined anesthetic gas mixtures as ones including either room air or oxygen as a carrier gas. American dentists pioneered America’s first series of bubble-through anesthetic vaporizers as well as early efforts in anesthesia literature and education. By the end of the 19th Century, America’s leading dental supplier, S.S. White, was mass-producing an anesthesia apparatus which combined oxygen with nitrous oxide— a template or catalyst for the design of anesthesia machines worldwide.

Introduction

On the evening of December 10th, 1844, in Hartford, Connecticut, an itinerant “professor” named Gardner Q. Colton (1814-1898) administered “laughing gas” recreationally to twelve gentlemen, including pharmacy assistant Samuel Cooley. A fellow gas-breather that evening was Dr. Horace Wells (1815–1848), who observed that Cooley had injured himself while under nitrous oxide’s influence without any awareness of the trauma at the time. That night, after Colton’s demonstration, Wells engaged in a long conversation with Dr. John M. Riggs (1810-1885), the result of which was that Wells decided to try to have a bothersome tooth extracted the following day, while under the influence of the gas. Wells and Riggs agreed “to push the administration to a point hitherto unknown,” not knowing whether death or success confronted them. It was terra incognita they were bound to explore. By the next day, Wells...
would orchestrate the world’s first dental extraction under the influence of nitrous oxide.

Riggs wrote that “Wells took the [gas] bag in his lap—held the tube to his mouth and inhaled till insensibility relaxed the muscles of his arms—his hands fell on his breast—his head drooped to the head rest...Mr. Colton...stood by the open door, ready to run out if Wells jumped up from the chair and made any hostile demonstrations.”

Colton had attested earlier that Wells “took the bag into his hands, and breathed the gas till he became insensible....” Having “used a small bag, such as would ordinarily produce inhalation,” Colton eventually admitted to having taken “a bag of gas to [Wells’ office]...and administered it to Wells...”

Pooling the witnesses’ accounts yields a fascinating story. Colton prepared gas that morning in a small bag, which, diluted by exhaled gases, would have failed to fully anesthetize most individuals. Wells’ confidence 1) in his own convictions about nitrous oxide as a potential anesthetic, 2) in Riggs’ extraction skills, and 3) in the effects of Colton’s gas from breathing it the night before—all these factors likely contributed to making Wells an easy patient to anesthetize. With Wells in the dental chair, Riggs prepared to conduct a swift dental extraction.

As Wells exhaled fully before breathing and rebreathing the bag’s contents, Colton likely assisted in holding the small bag as Wells grew drowsy. Remember, it is important to note once again that Colton reported having no second bag and needed to secure this bag from damage in case Wells required a follow-up round of inhalation. Air was not completely excluded for any great length of time, as Wells was not reported to have experienced jaw clenching, finger twitching, nor asphyxial posturing. As soon as Wells was under the influence, Colton stood at the doorway with the gas bag, in the event that a disoriented Wells tried to leap from the chair. Riggs accomplished a single difficult but swift dental extraction. Wells required a modest period of time to recover from the gas and was observed to be unable to leave the dental chair. Even if, as self-proclaimed, Colton “gave the nitrous oxide gas for the first surgical operation where pain was destroyed,” the showman-turned-dental-anesthetist would spend the rest of his life crediting Wells for having conceived of the discovery of anesthesia.

Having been raised in grinding poverty in his and Wells’ home state of Vermont, the acquisitive Colton had dropped out of medical school to join the lucrative lecture circuit in New York and New England as a “laughing gas” demonstrator. Not surprisingly, following the dental anesthetic experiment on Wells, Colton returned to his own heavy schedule of lecturing and laughing gas demonstrations.

Reviving Nitrous Oxide for Dentistry (1863-67)

Following Wells’ partial anesthetic failure with nitrous oxide in 1845, W.T.G. Morton’s success with ether anesthesia in 1846, and chloroform anesthesia’s discovery in 1847, professional use of nitrous-oxide anesthesia essentially expired along with Wells in 1848. Soon after, Colton, a perennial opportunist, abandoned his laughing gas demonstrations to join the California Gold Rush of 1849. When his luck as a “forty-niner” failed to pan out (no pun intended), Colton became successful in the Golden State initially as a ferryman, subsequently as a physician, and finally as a Justice of the Peace in San Francisco.

Soon after his return to the East Coast, a hapless Colton squandered most of his wealth by speculating on the doomed Salt Works of Schenectady, New York. The broadside for March of 1863 (to the left of Colton’s portrait in Figure 1, following page) advertised the “Free Exhibition!” that Colton had conducted in the very city where his California fortune had evaporated—Schenectady, New York.

Just over two months after that demonstration, while visiting New Haven, Connecticut, Colton remarked to a private group...

* Editor’s Note: Colton’s statement of his participation and location is at odds with Riggs’ recollection.
that he “had never been able to induce a dentist to try the gas [on his patients].” Colton’s offer to provide “gas” to a dental practitioner’s patients was accepted by Dr. J.H. Smith, an attendee at a subsequent demonstration. During a 23-day period, Colton provided nitrous-oxide anesthetics for more than 3,000 dental extractions! This “painless” success “induced [Colton] to abandon the ‘Exhibition’ business, and to establish…[the Colton Dental Association] in New York...”

Discussions with dental and medical colleagues soon alerted Colton to an opponent-turned supporter of nitrous oxide, George J. Ziegler, MD (1821-1895), who actually advocated resuscitating asphyxiated patients with laughing gas. Ziegler penned and reprinted his own articles on the “Antidotal Applications,” the “Revivifying Properties of Nitrous Oxide” and the resuscitating role of “Nitrous Oxide in Asphyxia” in multiple medical journals and in JADA’s predecessor, S.S. White’s Dental Cosmos, the journal which Ziegler served from 1859-72 as associate and then medical editor.\(^9\)\(^\text{-12}\) In defending laughing gas as nonasphyxial, Colton would repeat Ziegler’s nitrous-oxide-as-resuscitator arguments as late as 1892.\(^13\)

Beyond his flair for showmanship, Colton also helped re-popularize laughing gas’ dental applications by promoting pragmatic versions of the foolproof Sprague self-regulating “apparatus for generating and washing” nitrous oxide.\(^14\) (See the right side of Figure 1.) Besides purifying the gas through a series of two to four Woulfe (double-necked) wash bottles to cleanse out impurities, the self-regulating Sprague allowed a busy dental practitioner to turn his back on the apparatus while it self-adjusted optimal temperatures for heating ammonium nitrate to produce laughing gas. Colton would introduce the Sprague Apparatus “universally” at the Paris World’s Fair of 1867, Emperor Napoleon III’s Exposition Universelle.\(^15\)

Thus Colton played at least three pivotal roles in “reviving nitrous oxide”: 1) reviving dental
use of the gas in general—nearly twenty years after the experiment with Horace Wells and John M. Riggs—by transforming himself a second time from showman to dental anesthetist: 2) passing and then passing off “revivifying nitrous oxide” as a potentially safe and oxygen-like resuscitator of a gas; and 3) reviving the safe ease of generating and washing purer laughing gas by popularizing Sprague’s self-regulating apparatus, both at home and abroad.

Colton’s Disciples: Evans, Fox, Rottenstein & White (1867-68)

While the United States waged its Civil War, French Emperor Napoleon III decreed that Paris would host in 1867 an Exposition Universelle. His imperial court dentist, Philadelphian Thomas W. Evans (1823-1897), invited Colton to demonstrate nitrous oxide at this Paris World’s Fair of 1867. Evans noted that “Dr. Colton has reestablished by thousands of experiments the superiority of the protoxyde of nitrogen gas over other anaesthetics in Dental Surgery….The gas has recently been employed with success in Paris…in the gravest surgical operations.” After the Exposition closed in the autumn of 1867, Colton wintered with Evans, during which the two administered more than 1,000 nitrous-oxide anesthetics.

In spring and summer of 1868, Evans and Colton popularized nitrous oxide for dental anesthesia in Great Britain. Colton boarded for a week in the home of Charles J. Fox, addressing there a meeting of physicians and dentists. Colton encouraged pinching shut the patient’s nose and tight fitting of the mouth-piece to ensure that “no particle of common air…enter and dilute the gas.” He also recommended looking for “stertorous breathing or “twitching of the fingers” as signs of a patient’s proper level of anesthesia for dental extraction. In a series of professional articles, Fox extolled the virtues of the Colton-recommended Sprague apparatus. As eventual president of the Odontological Society of Great Britain, Fox witnessed developments like the Clover facemask, Cattlin (reservoir) bag, and the Coleman economizing (lime-filled) apparatus. Respectively, these controlled room air, recycled exhaled air, and absorbed carbon dioxide. By 1869 Fox had adapted a Cloverian approach of allowing room air into his nitrous-oxide anesthetics. Colton would visit Londoners again in 1871 to advocate on behalf of Wells’ legacy.

Another “Colton disciple” from the Exposition Universelle was German-born, American-trained Jean-Baptiste Rottenstein (1832-1897) who had shifted his dental practice from Frankfurt to Paris. Rottenstein relished his “close contacts” in Paris with Evans and Colton. Personally and through his articles and textbook, Rottenstein popularized nitrous oxide anesthesia among German- and French-speaking peoples.

However, Colton’s most famous disciple may be Evan’s co-preceptee in dentistry, his lifelong friend and fellow prizewinner at the Exposition Universelle, Samuel S. White (1822-1879). Impressed with Colton’s “laughing gas,” White published advertisements of his company’s “Fused Nitrate of Ammonia” and “Nitrous Oxide Gas Apparatus” in his Dental Cosmos.

The North’s S.S. White Outlives the South’s J.B. Bean (1867-86)

After America’s Civil War had erupted, Colton’s future disciple, Philadelphia’s S.S. White spearheaded the purchasing of War Bonds to back the Union forces. Advertising his patriotism, White subscribed to the First War Loan organized by President Lincoln’s Secretary of Treasury, Salmon P. Chase. Abolishing contracts with Southern suppliers and consumers, White threw himself and the full resources of his S.S. White Company behind the Northern side.

Meanwhile a Tennessee native, James B. Bean, MD, DDS (1834-1870) after completing dental school in Baltimore, was serving as a Confederate Dental Officer in Georgia and finally Virginia. He garnered fame for inventing the Bean (interdental) splint for treating jaw fractures. At war’s end, Bean resumed civilian dental practice in Baltimore, barely 100 miles across the infamous Mason-Dixon line from Philadelphia’s S.S. White.
After inventing a 50-gallon gasometer for storing and metering nitrous oxide, Bean developed a more streamlined model.26 (See lower left of Figure 2)

Among the few American gasometers available in 1867, Bean’s posed the greatest competitive threat to S.S. White’s unit. Unlike the two-to-four-wash-bottle system of Sprague, White offered gas washed through seven glass tumblers; Bean, through moist lime layers separated by wire gauze disks.24,26 (Contrast Figures 1 and 2). The Bean-White rivalry was a most civil of wars. After Bean’s tragic mountaineering death, S.S. White’s proprietary journal, The Dental Cosmos, extolled the “mechanical ingenuity and skill” of the late “gentlemanly” Bean.27

More than twenty years after Colton had first administered nitrous oxide to Wells, a third Vermont native, Edmund W. Andrews, MD, (1824-1904) began mixing oxygen with nitrous oxide in gasometers. Andrews lamented the killing by “Chloroform, in American and European hospitals” of “one out of about every 3600 patients.” In contrast, Andrews cited, in 1868, his local Chicago branch of “the Colton Dental Association, a company with branches in all…principal [American] cities, established for the sole purpose of extracting teeth, …[having] on its books over 60,000 cases of anaesthesia by nitrous oxide, without a single death….28 Having failed to safely anesthetize patients with experimental alternatives to ether and chloroform, Andrews suggested that nitrous oxide should be supplemented with an end-mixture of 20% oxygen to mimic the proportion of oxygen in room air. Sadly, Andrews was ahead of his time, and his suggestion was ignored by many dentists and physicians.

As energy- and steel-based industries expanded along waterways in the American Midwest, new gasometers were invented in New York, Pennsylvania, Ohio, and Michigan—
surrounding Lake Erie, the southernmost of the Great Lakes. These gasometers ranged from crude zinc-lined barrels by Cleveland’s Hurd Brothers to the guide-scaled “flexible receivers” of Toledo’s Nevius. Direct or indirect trainees of New York’s Colton, several of these dentists had already been forced to design interdental appliances to defeat the jaw clenching resulting from their still-asphyxial nitrous-oxide anesthetics.²⁹,³⁰

In the 1880s, continental Europeans began using gasometers and additional apparatus to mix varying proportions of oxygen with nitrous oxide to extend the duration of safe analgesia or anesthesia. Pioneers in this approach included Saint Petersburg’s Klikowitsch, Paris’ Bert, and Vienna’s Hillischer.³¹-³³ However, Britain’s Frederic W. Hewitt (1857–1916) soon publicized just how much greater anesthetic skill was required to master nitrous-oxide/oxygen anesthesia.³⁴,³⁵

Ironically, as conscientious dentists improved valvular performance (of their gasometers and facemasks) and air-exclusion (by both maskfit and connections), these practitioners were unwittingly worsening the asphyxial nature of their gases. By 1883 American dentists located west of Lake Erie began designing nitrous oxide apparatus which hybridized dry gasometers with compressed gas cylinders.³⁶,³⁷ The same or double the size of a modern-day household’s hot water tank, these gasometers neared extinction as dental office dinosaurs. New technology based strictly on compressed gas technology emerged.

**Hayes Preaches Against S.S. White’s “Asphyxial Anaesthetics” (1881-97)**

Unlike Colton’s European disciples or the late Bean from Maryland, S.S. White’s next competitor was a fellow Pennsylvanian, Reverend Samuel J. Hayes, DDS (1833–1897). Ordained consecutively by two separate Protestant denominations, Rev. Dr. Hayes was also a mechanical genius. From 1881 to 1895, he launched his Hayes Apparatus Nos. 1, 2, and 3— America’s first patented series of bubble-through anesthetic vaporizers.³⁸ Decrying fellow dentists’ “asphyxial” use of 100% nitrous oxide, Hayes pumped room air by foot bellows through thermoregulated vaporizers designed for “Hayes Hypnotic” and his other proprietary anesthetic mixtures. (See Figure 3.) These mixtures consisted of ethyl alcohol, chloroform, ether, and/or other volatile anesthetics in various combinations.

The proprietary journal of the S.S. White Dental Manufacturing Company (SSW-DMC), The Dental Cosmos, lost no time in assailing Hayes’ “proprietary and secret compounds, [as] highly indorsed [sic] by…the reverend clergy, and by the editors of religious journals.” Unhappy with the “testimony of a non-medical man,” the late S.S. White’s younger brother, Editor James W. White, M.D., D.D.S. attacked the “reverend gentleman” [Rev. Dr. S.J. Hayes] for assuring “the world that a certain preparation is ‘infinitely superior’ to nitrous oxide.” Observing that “various anesthetics produce their effects…by entirely different methods and that remedies and treatment [of anesthetic dangers] differ accordingly,” Editor White considered Hayes’ proprietary mixtures irrational.³⁹ In state, national, and international dental journals over the next dozen years, Hayes would retaliate with the publication and reprintings of his brilliant essay, “Anaesthesia vs. Asphyxia.” Redefining anesthesia, Hayes preached that “there can be no anaesthetic without a proper admixture of atmospheric air….”⁴⁰

In May of 1891, as The Dental Cosmos mourned the sudden cardiac death of Editor J.W. White in Philadelphia, a competitive threat...
loomed from the opposite side of Pennsylvania. In Pittsburgh, Rev. Dr. S.J. Hayes was collating the July inaugural issue of his *Dental and Surgical Microcosm*. In contrast to S.S. White’s thicker monthly *Cosmos*, Hayes offered a modest 80-page quarterly *Microcosm*. The Reverend Doctor’s unrelenting sermons against S.S. White culminated with his editorial that nitrous oxide was “unpopular in most sections of the country from the numerous cases of insanity [brain damage] and death due to asphyxia...results the dental journals published by the dental dealers in nitrous oxide and gas apparatuses refuse to publish....”

**Compressed Gas Tanks Help American Dentists Oxygenate Anesthetics (1888-98)**

As revealed by articles and advertisements in S.S. White’s proprietary *Dental Cosmos*, the British firm Coxeter & Son compressed nitrous oxide into liquid form inside iron cylinders for at least two of Colton’s disciples, London’s C.J. Fox and Philadelphia’s S.S. White. The latter modified the cylinder’s valve by 1870 for S.S. White’s corporate role as sales agent of Coxeter apparatus to Americans. By the following year, the sons of a physics professor, the Johnston Brothers of New York, were outcompeting White by liquefying laughing gas with their patented commercial processes at Williamsburg on Long Island.

In 1896 Hayes’ proprietary *Dental and Surgical Microcosm* reviewed efforts to oxygenate nitrous oxide, many pioneered in the late 1880s and early 1890s by London’s Hewitt. Not surprisingly, this review immediately ushered in Hayes’ mass-production from Pittsburgh of “Hayes Apparatus for Oxygenating the Air,” the oxygen-supplemented version of his Hayes Anaesthetic Apparatus No. 3. Caught between manufacturers who were oxygen-supplementing anesthetic apparatus—Hayes to the West and Hewitt’s suppliers to the East—White’s legacy firm, the SSW-DMC, was squeezed into oxygenating its nitrous oxide machinery (See Figure 4.)

Embarrassment may have contributed some pressure. After all, the SSW-DMC, a full seven years after merging with Johnston Brothers, had been supplying therapeutic oxygen in cylinders to physicians and dentists since 1888. Yet somehow, over the ensuing decade, the SSW-DMC had failed to generate anesthetic machinery with any option for routine or emergency use of oxygen, save by fixed-ratio N₂O-O₂ cylinders. In contrast, mixing nitrous oxide with oxygen as early as 1887, Hewitt had published illustrations of his oxygen-cylinder-supplied apparatus in 1892; as had Hayes in 1897. According to its own corporate history, more than ten years after first compressing oxygen, the SSW-DMC finally managed to mass-produce its “Non-Asphyxial Nitrous Oxid-Oxygen Apparatus” [sic] in 1899.

**Hayes vs. Colton: Final Showdown for “Anaesthesia vs. Asphyxia”? (1892-98)**

As early as 1892 Colton began responding to the “asphyxial nitrous oxide” sermons of Rev. S.J. Hayes, in the latter’s own journal, *The Dental and Surgical Microcosm*. Arguing that “any gas that supports a flame...supports life,” Colton reminded Hayes that on striking “a match...into a jar of nitrous oxide...the combustion is intense.” Hayes retorted that applying “nitrous oxide...to a lighted match...[will] decompose the two chemical elements and...the set free oxygen...supports the combustion and not the nitrous oxide...” Unfazed by Editor Hayes, Professor Colton dusted off some discredited 42-year-old research and retorted with “…Prof. Ziegler...treats...chloroform...asphyxia...[by administering] nitrous oxide...to restore the patient...” Dismayed with Colton’s citation of decades-old research, Hayes queried back, “If small animals...live...[an average of 80] seconds in [100%] nitrous oxide...how can it resuscitate an asphyxiated patient?”

Next Colton trotted out his oldest warhorse, his infamous roll of thousands of names of patients who had survived nitrous-oxide administrations at branches of his Colton Dental Association. For many, Colton’s list paled in the wake of Hayes’ previously published tick list of nitrous oxide “after effects...nervous disorders...incurable epilepsy...congestive apoplexy...unremitting headaches.
After receiving the blessing of Hewitt and his British colleagues as “ingeniously made” and “absolutely efficient,” oxygen-supplemented nitrous oxide apparatus from SSW-DMC would, over the next 20 years, reach corporate branches in Germany, Russia, Canada, Great Britain and Brazil; as well as International Dental Congresses in Paris, St. Louis, Berlin and London. Defying Colton’s legacy, dentists worldwide would begin joining the groundswell of American dentists who dismissed anesthetizing patients with 100%-nitrous-oxide as “a most charming method of smothering.”

Conclusion

In summary, by the mid-1840s American dentists had introduced nitrous oxide and then ether into international dental, surgical, and obstetric practice. Within half a century, American dentists would help redefine anesthetic gas mixtures as ones requiring aeration or oxygenation for patient safety. Apparatus invented by these dentists and their firms would serve as templates or catalysts for designing anesthetic machinery worldwide.
References


Figure 4. Oxygenating Competitors to the East and West. To anaesthetists, Hewitt’s suppliers from London and then Hayes from Pittsburgh offered apparatus with discrete compressed cylinders of oxygen for use alongside ones for nitrous oxide. Their competitive marketing soon forced America’s leading dental supplier, Philadelphia’s S.S. White Dental Manufacturing Company, to begin pairing oxygen with nitrous-oxide cylinders on anesthesia apparatus. [All images courtesy of the Wood Library-Museum of Anesthesiology, Park Ridge, Illinois.]
9. Ziegler, G.J. “Toxicological applications of nitrous oxide”.


10. Ziegler, G.J. “Experimental investigations on the antidotal and revivifying properties of nitrous oxide”.


11. Ziegler, G.J. “Nitrous oxide in asphyxia”.


12. Ziegler, G.J. “Periscope of medical and general science in their relations to dentistry”.

*Dent Cosmos* 1869;11: 41-46.


14. Sprague, A.W. “Improved apparatus for generating and washing gases for inhalation”.

US Patent 55,548, June 12, 1866.


18. Fox, C.J. “On the manufacture of nitrous oxide”.


19. Fox, C.J. “On nitrous oxide”.


*Dent Cosmos* 1867;9:292-293, 304. [advertisements]


*Chicago Med Examiner* 1868;9:656-661.


*Arch Gynaekol* 1881;18:81-108.

32. Bert, P. “Anesthésie prolongée obtenue par le protoxyde d’azote à la pression normale”.


*All images and ephemera are courtesy of the Wood Library-Museum of Anesthesiology, Park Ridge, Illinois.*
This unused antique postcard was printed circa 1908. Its caption reads, “Here’s something to look into,” a whimsical play on words. The illustration depicts a dentist peering into the oversized open mouth of a male patient, whose body is completely draped. His four anterior maxillary incisors are prominently displayed. The fellow stares upwards, his eyes unfocused. He appears to be passively submitting to the immanent procedure. The dentist, with his short hair parted in the middle, moustache and *pince-nez* eyeglasses, bears a striking resemblance to Theodore Roosevelt, who was President of the United States at the time this card was printed (1901-1909). This practitioner has unusually long fingers and thumbs, which he uses to pry the patient’s mouth open as wide as possible. The dentist’s nose is inappropriately close to the patient’s mouth, and his left arm and elbow rest improperly on the patient’s chest. The card’s playful spoof on these breaches of ethical dentistry add levity to the other, perhaps intimidating objects on the table to the left: the extraction forceps and medication bottle, ready to be used by the operator.
Hartshorn’s-No. 18, circa 1885. Lithograph. 4 1/4” x 2 3/4”

Lebanon Medical Co.’s Remedies, circa 1885. Lithograph. 4 7/16” x 2 7/8”
These two cards are typical of the concept of “stock” trade cards, which would be used by different companies or individuals. They exemplify the outrageous claims made for patent medicines of that era, which were not regulated until passage of the Pure Food and Drug Act of June 30th, 1906. The purchaser would select a preprinted card from the printer or printer’s representative, and then supply the desired text for production on the front and/or back of the card. This “Jolly Jim” motif was chosen by both E. Hartshorn & Sons of Boston, Massachusetts, and the Lebanon Medical Company of Lebanon, Pennsylvania, to showcase their respective wide assortments of remedies. *Dr. Hartshorn’s No. 18* was recommended for “Sprains, Bruises, Swelling, Numbness, Lameness, Pain anywhere, Stings, Poisons, Neuralgia, Rheumatism, Cramp, Burns, Sore Throat, Diphtheria, and Toothache.” Lebanon Medical offered “Standard Cough Syrup,” “Childrens [sic] Cough and Croup Syrup,” “Universal Liniment,” “Radical Rheumatic & Neuralgia Remedy,” “Whooping Cough Mixture,” “Standard Sarsaparilla,” “Infant Colic Mixture,” “Standard Female Tonic,” and “Acme Diarrhoea & Cramp Mixture.” No wonder Jim was so jolly—it was impossible for him to be ill with all these marvelous remedies available!
Dentistry on Stamps

Hannelore T. Loevy, CD, PhD
Aletha A. Kowitz, MA

PRESIDENT CLINTON’S VISIT TO THE CARIBBEAN 1997
PRESIDENT BILL CLINTON
PRESIDENT CHEDDI JAGAN
Dr. Cheddi Jagan, Dentist & Head of State

Dr. Cheddi Berret Jagan was born March 22nd, 1918, in Georgetown, Guyana. Jagan was President of independent Guyana from 1992 to 1997. Formerly known as British Guyana, this South American nation is a tropical land with large sugar plantations and rice farms. The country’s name is derived from guiana, a word meaning “land of many waters” in the language of the Taíno people native to the region. Great Britain established the crown colony of British Guyana in 1881, with Georgetown as its capital and largest city. Much of the population is descended from East Indians brought over by the British to serve as laborers for the sugar industry.

Dr. Jagan was the son of ethnic East Indians, and was educated at Queen’s College in Georgetown, later traveling to the US to receive his DDS in 1942 from Northwestern University. Jagan returned to Guyana in the 1940s and established a practice in Georgetown. In 1950, Jagan, his wife Janet (later President of Guyana herself), and future Guyanese prime minister Forbes Burnham founded the leftist People’s Progressive Party (PPP). In 1953, the British crown granted to Guyana a liberal constitution. The PPP received a majority of seats in the legislature, but the British ousted the party five months later. Decades later in 1992, the PPP won voters’ support once again and Jagan became President of Guyana. In 1997, Jagan suffered a heart attack and was transported to Walter Reed Army Hospital in Washington, D.C., where he died following heart surgery, March 6th, 1997.

Guyana has issued several stamps honoring Dr. Jagan. Stamps were issued on December 17th, 1993 (Scott #2757) and on June 27th, 1997, calling attention to the visit of President Bill Clinton to the Caribbean (Scott #3201 and #3202), and again on July 29th, 1997 (Scott #3232 and #3203).2

References


2. The authors would like to acknowledge the help of Dr. Mario Alves and Brian Chapnick.
From the Archives: Vol. 2, Nos. 7 & 8

Volume II, No. 7  BULLETIN OF THE HISTORY OF DENTISTRY  July 1954

OFFICIAL MONTHLY PUBLICATION OF THE AMERICAN ACADEMY OF THE HISTORY OF DENTISTRY

HISTORY OF THE AMERICAN DENTAL ASSOCIATION

The committee charged with producing a history of the American Dental Association and the historian working on this project would like to collect more original documents. An effort will be made to discover material on the early history of dental societies which, according to Dr. B. W. Weinberger, should be found in the Army Medical Library. The Bureau of Library and Indexing Service is now organizing the record material in the Association archives and is desirous of adding to its incomplete early records. Past officers, council members, committeemen and any persons holding documentary material bearing on the history of the Association are urged to correspond with Dr. Donald Washburn, director of the Library, Central Office, 222 East Superior Street, Chicago 11.

STILL MORE ABOUT TOOTHBRUSHES

Accumulating information in the editor's mail indicates that he has overlooked considerable obvious material on the history of the toothbrush. B. W. Weinberger, in the second volume of his Introduction to the History of Dentistry reproduces advertisements of Isaac and John Greenwood and of Josiah Flagg, showing toothbrushes of a modern pattern (p. 128, 131, 132, 200, 203, 228, 229) as early as 1788 to 1795.

Dr. Curt Proskaure has contributed a photograph of an illustration of an eighteenth century toothbrush in an article by him in the Beitrage of Zahnarztliche Mitteilungen, 1933. The toothbrush has a silver handle and is from the time of Frederick the Great (about 1730).

The editor was aware of the illustration in Weinberger's Introduction, vol. 1, p. 44, of a Chinese toothbrush of great antiquity, reproduced from Proskaure's article in Ciba Symposia (see Bulletin, no. 5, May 1954), but he has always questioned the influence of early Oriental dentistry on that of Western Europe. Upper dentures with palates must have existed in Japan hundreds of years before their appearance in Europe or America if the specimens exhibited by Dr. Isamu Tashiro at the Atlantic City meeting of the A.D.A. were correctly dated. No connection between these advanced dental developments in the Orient and those late in the Western World, separated by at least two centuries, have ever been traced.

DEVELOPMENT OF ORTHODONTICS

The American Journal of Orthodontics for April (40:272-280) contains an article on "Orthodontic trends--past and present" by Dr. H. C. Pollock. The July 1954 number of the same journal publishes a long letter from B. W. Weinberger (40:549-551) supplementing Dr. Pollock's views.

ANGELO MARIA DE VERGANI

The request (June Bulletin) concerning the dentist Angelo Maria de Vergani has been in some measure answered by Dr. Curt Proskauer. Apparently Vergani published a book in French entitled Observations sur les dents et leurs maladies..., Venice, 1809.

"In the catalogue MEDECINE ANCIENNE by Il Polifilo (Cat. XVII) I found under no. 197: De Vergani, A.M.--osservazioni sopra i denti e le loro malattie. Firenze, Carli, 1815. In-8, cart. 28 pp. Edition originale (This is, however, a mistake, since this is the Italian translation of the above mentioned book.)"

The catalogue continues:

"A. M. de Vergani, medecin du Grand-Duc de Toscane, n'oublie pas de publier les temoignages de nombre de personnages soignes par lui. A la fin de l'ouvrage, l'auteur a laisse une place en blanc, pour pouvoir y marquer son adresse provisoire, en quelque pays qu'il se trouvat."

Recently, a manuscript has been offered by a London bookseller: VERGANI (A.M.) Dissertation sur les dents et leurs maladies, ou l'on demontre que l'art du dentiste forme und des branches interessantes de la medecine. Par Angelo Maria de Vergani ci-devant chirurgien-dentiste de S. M. Le Roi de Hollande. S.l.n.d. (c. 1800). 4to. Boards. Manuscript of 30 ff. Of extreme interest for the history of dentistry. After discoursing on the function of teeth, their diseases and their care, the author attacks at length the prejudice which prevents a large number of people from using artificial teeth, one of the principal obstacles being that they imagine these teeth to be drawn from human corpses. We can find no record of this author, who, from the position he held, was evidently a dentist of eminence. The manuscript was probably prepared for the press.

Dr. Proskauer comments to the effect that this manuscript "was not 'probably prepared for the press,' it was the manuscript which is certainly identical with the book published in 1809."
BULLETN OF THE HISTORY OF DENTISTRY

official monthly publication of
American Academy of the History of Dentistry

FASTLICHT'S BIBLIOGRAPHY OF MEXICAN DENTISTRY

A scholarly and useful bibliography of dental publications in Mexico prepared by Samuel Fastlicht, well known dental historian and member of A.A.H.D., was published early last July. It is entitled Bibliografia Odontologica Mexicana.

The listing includes manuscripts and books from the sixteenth century to date; the dental journals of Mexico from the earliest in 1887 to the present; the dental theses of the odontological Faculty of the National University and of the faculties of the provincial universities. Much historical and other explanatory material is given in the preface, the introductions to sections and footnotes.

The volume is well illustrated with replicas of title pages of books and journals; the typography is excellent; and the formal details of the volume are all that could be asked. This book of 220 pages is an excellent piece of bibliographical work which the historian of Latin-American dentistry will find indispensable.

UNPUBLISHED MS OF ALBUCASIS

Dental Cadmos (22:669-674 July 1954) reprints from Monitore Medico (no. 12, 1953) an article entitled "L'Odontoiatria di Albucasis in un manoscritto inedito del XIV Secolo" (The dentistry of Albucasis in an unpublished manuscript of the fourteenth century) by Luigi Stroppiana.

A CRITICAL PERIOD IN THE CONNECTICUT SOCIETY

An excerpt from the forthcoming history of the Connecticut State Dental Association by Jacob Sharp is published in the Journal of that association (28:14-15 Aug. 1954). It deals with the critical period from 1878-1888 when the society was dormant.

DENTISTRY AT THE COURT OF ARAGON

Antonio Cardoner of Barcelona contributes to Revista Espanola de Estomologia (2:283-288 May-June 1954) an article on dentistry at the court of Aragon during the Middle Ages (La Odontologia en la Corona de Aragon durante la Edad Media).

AN EIGHTEENTH CENTURY DENTAL TEACHER

Carl August Andree was appointed Lehrer der Zahnchirurgie at the Collegium medico-chirurgicum of Dresden June 24, 1786 at a salary of 200 Thaler. Dr. Proskauer believes this to be the earliest appointment for dental instruction at a medical college and will shortly publish a biography of this early dentist. In 1784 Andree published his thesis on the mechanics of extraction instruments.
DENTAL INSTRUMENTS
Luigi Casotti contributes an article entitled "Antichi cagnoli, pellicani e levrieri della collezione Sini," to Clinica Odontoiatrica 9:Parte Varia, p. 115-124, May 31, 1954. This article describes extraction instruments from the extensive collection of Michele Sini, a Bolognese dentist, who wrote on this subject in 1908. The present article recalls the comments of various authors on extraction instruments and their history.

A. Mingoli, also in Clinica Odontoiatrica (9:Parte Varia, p. 147-152 June 30, 1954) contributes an article entitled "Strumenti dentari nei secoli passati" (Dental instruments of past centuries).

PHILOSOPHY OF DENTAL HISTORY
Willy Geier in Zahnärztliche Mitteilungen (42:447-450, July 1, 1954) presents a philosophy of history applied to dentistry which he entitles "Die historische Interferenz in der Zahnheilkunde." His thesis is that all historical developments consist of two phases--"the spiritual incubation" and the "realization of this spiritual situation." The initial phase precedes the realization by a considerable period during which the initiation of a new idea produces doubts, errors and confusions--"interference" to the realization of the earlier conceived development. Thus, current usage is always "behind the times" and in opposition to the future outlook.

Geier applies this philosophy to developments in pulp treatment, prosthetics and social and specialized dentistry.

HISTORY OF SURGICAL RETENTION FOR DENTAL PROSTHESIS
Of special current interest is the article by L. Marziani "Dental implants and implant dentures: their theory, history and practice" in International Dental Journal 1:459-481 June 1954, with an extensive bibliography. The article does not present the early history of "bone transfixed," or "intra-osseous surgical retention," which was dealt with by G. B. Denton in an article entitled "Suspended maxillary dentures," (Illinois D. J. 8:328-333 Aug. 1939).

DENTAL ANTIQUITIES
T. G. H. Drake's article on "Antiques of dental interest" in the Journal of the Canadian Dental Association (20:316-327 June 1954) pictures (page 323) a toothbrush of modern type dated 1799.

HISTORY OF DENTISTRY IN OKLAHOMA
Harry H. Sorrels reports that the history of dentistry in Oklahoma prepared by Stanley Clark, historian, is about ready for the Oklahoma University Press. The history committee is searching for an attractive title that will appeal to dental readers in general.
Photographs from our 58th Annual Meeting

Dr. Jack Gottschalk & Dr. Hannelore Loey, at the presentation of the Frank & Phyllis Orland Award to Dr. Gottschalk.

Dr. Brian Dolan answers questions during a panel discussion.

Ms. Joan Christen
Dr. Charles Millstein
Dr. Hannelore Loey
Dr. Arden Christen
Mary Kreinbring, ADA Librarian and former Academy president, presents an unusual teaching model from the collection of the ADA Museum and Library.
Photographs from our 58th Annual Meeting

Dr. Jack Gottschalk
Dr. Kathleen O’Loughlin, Executive Director, American Dental Association
Ms. Mary Kreinbring
Dr. David Chernin

Dr. Samuel Wexler
Dr. Allen Fred Goldberg
Dr. James Gutmann
Mr. John Woods
(back row, left to right) Dr. Samuel Wexler, Dr. Allen Fred Goldberg, Dr. Morton Rivo, Dr. Jack Gottschalk, Dr. Peter Meyerhoff, Dr. Charles Millstein, Mr. John Woods, Ms. Zoe Piel, Dr. Brian Dolan, Ms. Stine Grumsen, Dr. George Bause, Dr. Alyssa Picard, Dr. David Chernin, Mr. Gregory Bennett, Ms. Shannon O’Dell, Dr. Arden Christen, Dr. Ronald Wilcox

(front row) Ms. Nancy Gottschalk, Dr. Hannelore Loeyv, Ms. Joan Christen, Ms. Mary Kreinbring, Ms. Andrea Matlak
A History of Dentistry in the US Army to World War II

By John M. Hyson, Jr., Joseph W.A. Whitehorne & John T. Greenwood
890 pages hardcover

Dental health has been a core requirement for soldiers since the earliest military history. When the muzzle-loading rifle made strong teeth critical to the operation of weapons, dentistry as a profession did not yet exist to assure this element of soldier fitness. This book documents the reciprocal influence of the maturation of the dental profession, and establishment of Army dental care programs. The theme of symbiosis of civilian and Army dentistry defines this period of dentistry's history, in this well-illustrated volume, written by three accomplished historians. The project took over ten years and was initiated and supported by the Office of the Chief of the U.S. Army Dental Corps, and sustained during the tenures of five of the men who occupied that position.

Use the search function where the subject, title, first author (Hyson), Stock Number (008-023-00137-5) or ISBN (9780160821592) can be entered to locate the book.
PDF file version will be available for download by May 2009 at the publisher's website (The Borden Institute). http://www.bordeninstitute.army.mil

Intriguing and Eccentric Characters & Stories from the World of Dentistry

by Arden G. Christen, DDS, MSD, MA & Joan A. Christen, BGS, MS

In this 230-page book, the authors have glimpsed into the lives of 32 dental characters: professionals who range from the noble to the bizarre. Introducing this work is a chapter on one of the most memorable and controversial characters of all time, Dr. Painless Parker (1872-1952). All of these fascinating individuals have left indelible marks on their chosen profession. The stories from this collection may be inspiring or infuriating, ingenious or absurd, credible or questionable—but seldom are they dull.

Price: $20, postage paid. Available from:
Dr. Arden G. Christen, 7112 Sylvan Ridge Road, Indianapolis, IN 46240-3541 (US check only)

Limericks With A Smile:
Dental, Oral and Facial Limericks of Yesterday and Today

by Joan A. Christen, BGS, MA & Arden G. Christen, DDS, MSD, MA

The authors have compiled 188 previously-published limericks related to dental, oral and facial themes; plus they offer an additional 384 personally-composed limericks. The humorous verses in this collection are at once bawdy, whimsical, ludicrous and cynical, and though simple in format, they communicate in few words their strong, sometimes paradoxical message. 159 pages with complete index.

Price: $20, postage paid. Available from:
Dr. Arden G. Christen, 7112 Sylvan Ridge Road, Indianapolis, IN 46240-3541 (US check only)

A Little Treatise on the Teeth:
The First Authoritative Book on Dentistry (1563)

by Bartholomæus Eustachius
Edited by David A. Chernin, DMD, MLS & Gerald Shklar, DDS, MS

One of the greatest anatomists of all time, Eustachius’ major studies remained unknown until their eventual Dutch translation and publication in 1714. Eustachius contributed substantially to the development of dental science. His conceptual advances concerning tooth development and function, based on anatomical dissections, were further buttressed by detailed plates of the musculature of the face, floor of the mouth, the neck, the tongue, and the roots and crowns of the teeth. In addition to giving us the first clear description of the dental pulp and root canal, Eustachius also conceived of the periodontal membrane as a gomphosis.

This volume presents the first direct English translation from the original Latin Libellus De Dentibus, and maintains the Latin and English texts on facing pages. Eustachius’ observations are an illuminating precursor to 21st-century medical science, and still represent a timely and relevant reference for any practicing dentist.

Price: $60. Available from: Maro Publications
Maro Pub. Ltd., P.O. Box 145, Waban, MA 02468 www.maropub.com
The printing of the book has the left-hand pages as an exact facsimile of the original French text, with the English translation on the right facing page. The work is divided into six chapters such as "How the teeth come and what is a tooth," "The cause of the pain of the teeth," "Why and what are the considerations to draw the teeth and which is necessary to pull them."

M. Arnauld Gilles was a Parisian dental practitioner who was fully recognized by the state licensing authorities as "Operator for the Ache in the Teeth."

The first French text on dentistry and the diseases of the teeth. This work was published in 1621, more than 100 years before Pierre Fauchard's classic work Le Chirurgien Dentiste. This work is known to exist in only two locations. Re-discovered by Dr. Jacques R. Foure, who translated the work into English, he has provided us with an insight into the clinical treatments that were available in early 17th century France. Prior to Fauchard, it was generally believed that any dentistry was performed by traveling mountebanks, charlatans and quacks. M. Arnauld Gilles was a Parisian dental practitioner who was fully recognized by the state licensing authorities as "Operator for the Ache in the Teeth."
AMERICAN ACADEMY OF THE HISTORY OF DENTISTRY

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Correspondence
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If other than English abbreviations are used, they must be defined with first use: i.e., American College of Dentists (ACD).

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Tables should be typed one-to-a-page and numbered consecutively. Each table must have a title. Explanatory captions are to be used whenever possible to eliminate a separate “Remarks” section. References in table captions are cited in the same manner as in the text. Tables must be self-explanatory so that the reader will not have to consult the text to understand the captions. Additionally, all tables should be provided as figures in electronic format as discussed below.

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Dental Biography
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