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The Academy of Dental Materials: Providing roots and wings

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ABSTRACT

Objectives. The long history of the Academy of Dental Materials (ADM) is documented with its strategies (a) to rapidly communicate science among its members, (b) to establish special awards to stimulate new science, and (c) to develop new dental materials scientists.

Methods. We searched the history of the last 35 years of the ADM newsletters, transactions, journals, and officer notes. We document the (a) presidents, (b) meeting history, (c) membership growth, and (d) development of special awards through 2019 with the recent creation of the ADM Marshall Post-Doctoral Award.

Results. There are 36 years of recent ADM history, 42 international meetings, membership growth to 400 individuals from 15 countries, service of 19 presidents, Paffenbarger annual Awardees since 1989, induction of >200 fellows, and recognition of the first winner of Marshall Post-Doctoral Award in 2018. New directions for recruiting members are suggested. Three potential new thrusts for the organization are presented: artificial intelligence, genetic engineering, and intensive member mentoring.

Significance. These suggestions for the ADM provide a path for the ADM to continue to adapt to the ever changing scientific landscape.

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1. Introduction

The Academy of Dental Materials (ADM) recently established a new award, namely the Marshalls Post-Doctoral Award. In honor of the creation of this special award, the authors wanted to provide a perspective on the past, present, and future of the ADM. We have included an additional colleague who also contributed to the early establishment of the ADM and who was intertwined with our own ADM involvement.

To paraphrase a key concept, there are only two lasting bequests we can embed in our students and junior colleagues

— one is “roots”, the other “wings.” The “roots” lie in our traditions and outstanding scientific programs. The “wings” are our efforts to collaborate, mentor and inspire our colleagues. This examination of the ADM is divided into several parts: (1) Introduction. (2) Roots and Beginnings of the ADM. (3) The Goals and tactics used to form and develop the “roots” of the ADM to create its foundation. (4) Examples of how the ADM has made progress. (5) Visions of the ADM role in the “Near Future” as we continue to enhance efforts to provide new wings for our organization. (6) Ways the ADM can fly higher.

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2. Beginnings of ADM

During the 1982 Chicago Dental Society (CDS) Midwinter Meeting Drs. Evan Greener and Bernard Marker walked into a room on the first floor of Blackstone Hotel near Michigan Avenue and encountered two people sitting in the dark who turned out to be the remaining two members of the American Academy for Plastics Research in Dentistry (AAPRD). After quick introductions and explanations, they were promptly asked to join the AAPRD. At the next meeting, only Dr. Richard Plymale (the remaining member from the AAPRD) and Dr. Bernard Marker were eligible to vote since the original bylaws only permitted dentists to be members. They voted to change the bylaws and allow scientists with PhDs to join and many of us did so. At the same time, the original AAPRD was renamed and thus began the Academy of Dental Materials.

The original goals of the AAPRD (promote advancement of plastics in dentistry) were expanded. The ADM now included the dissemination of dental materials science, creation of a journal for communication of research, organization of meetings to present science and promote connections, and expansion of membership internationally.

A brief history of the founding of the Academy of Dental Materials is available in the first article published in *Dental Materials* in 1985 [1]. The ADM emerged when the AAPRD recognized that revitalization after 42 years was pivotal. AAPRD was founded in 1941 by dentists who wanted to expand the possibilities for using polymers in dentistry. It held meetings in conjunction with the Chicago Dental Society's Midwinter Meeting in Chicago, IL. They adopted the bumble bee as an icon because it seemingly should not be able to fly and this fact celebrated the challenges for dental materials. This also represented their belief that polymers would assume a key role in the future of dentistry (Fig. 1a).

By 1983 the AAPRD's original objectives had been accomplished, but their membership had dramatically diminished. It had become impractical to hold regular meetings. The new ADM members accepted the responsibility to rescue the AAPRD. Several of us (mostly affiliated with Northwestern University (NU)) banded together to explore broadened opportunities. Included were Professors Greener; Sally and Grayson Marshall who were younger faculty; Stephen Bayne, a recent graduate who was Assistant Professor at the University of Mississippi; James Overberger, Professor at West Virginia University; Professor Lawrence Gettleman from LSU; and Victoria Marker, a PhD student at NU. This group restructured the organization and reinvented it scientifically.

At the same time, a new logo (Fig. 1b) was created to represent the history of the AAPRD and symbolize the goals for of this revitalized academy. It consisted of a shield divided in half with the left side alternating vertical waves of black and yellow representing the bumble bee of the AAPRD. On the right half three stars represented metallic, ceramic, and polymeric materials of the new academy. The shield was surrounded by a circle with the Academy of Dental Materials name and the years 1941 and 1983 marking the founding and reorganization dates for the Academy.

The leadership worked diligently to develop an ADM Constitution and Bylaws, to elect officers, establish two-year

Table 1 – The ADM Presidents.

Dates	President
1983–1984	Evan H. Greener
1985–1986	Lawrence Gettleman
1987–1988	Sally J. Marshall
1989–1990	Stephen C. Bayne
1991–1992	Grayson W. Marshall, Jr
1993–1994	Lyle D. Zardiackas
1995–1996	Kenneth Anusavice
1997–1998	Jack Ferracane
1999–2000	Robert Erickson
2001–2002	James Drummond
2003–2004	Susanne Scherrer
2005–2006	N. Dorin Ruse
2007–2008	Jason Griggs
2009–2010	Marco Ferrari
2011–2012	Alvaro Dela Bona
2013–2014	Lorenzo Breschi
2015–2016	J. Robert Kelly
2017–2018	Paulo F. Cesar
2019–2020	Jeff Stansbury

terms, and then elected Evan Greener as the first President. A list of the Presidents is shown in Table 1. The first Treasurer was Sally J. Marshall, followed by Stephen C. Bayne, then James Overberger, who subsequently served as Treasurer for many years. An Editor (Professor Franklin Young of the Medical University of South Carolina) was appointed for the newly established journal (*Dental Materials*). An Executive Secretary (initially Grayson W Marshall of Northwestern University) was appointed. Later he became Chair of the newly created Credentials and Awards Committee until 1991. This effort developed a foundation to stimulate membership and create recognition for members. All positions were volunteer ones.

The fundamental idea was to significantly expand opportunities for dental materials scientists and dentists beyond those offered by the Dental Materials Group of the International Association for Dental Research (IADR-DMG). Many of the IADR scientific sessions were time-limited and the number of overlapping sessions grew dramatically as our field grew. We envisioned ADM meetings with expanded opportunities for presentations, discussions, and social interactions to promote our discipline, provide collaborations, increase networking, and build professional friendships. Meetings were arranged in locations and with focuses to accomplish these ends.

There were both annual meetings and special meetings which all had targeted themes. Eventually annual meetings moved from Chicago to international venues. The first ADM meeting was held in Chicago in 1983 and featured many of the initial organizing group. During the first year, the ADM went from approximately 10 members to 330. By 1989 the ADM had established joint meetings at 4 year intervals in Hawaii with the Japanese Society for Dental Materials and Devices This led to the formalization of the ADM Transactions which provided manuscripts for all major speakers and which was delivered to both meeting registrants and other ADM members at the time of the meeting. These authoritative papers on key meeting topics were of paramount interest to all the membership and served as a bridge to members unable to travel or schedule to

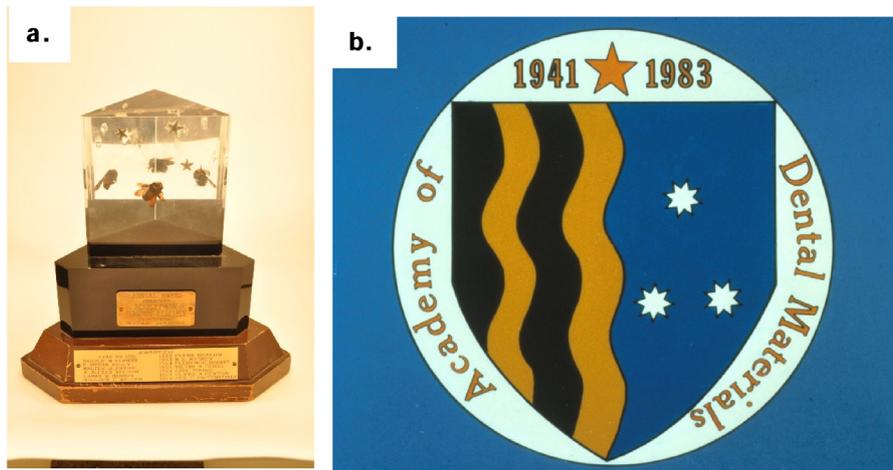


Fig. 1 – a. AARPD perpetual trophy (bumble bee award). b. ADM logo.



Fig. 2 – Map of ADM Conferences. Size of the red dots and numbers are indicative of multiple meetings in same location. Many early meeting were in Chicago and Hawaii.

attend ADM meetings. These efforts have continued ever since that time. Fig. 2 shows a world map of all the locations of ADM meetings to date. Over the course of 35 years, meetings have spread to many venues in Europe and an increasing number in Brazil. This reflects the character of the membership growth.

A second goal was the development of a scientific journal. The journal was established as *Dental Materials* in 1985 with Professor Franklin Young as first editor and Munskaard as the

first publisher. Later the journal was co-published by IADR and ADM with Professor Victoria Marker of Baylor University as the editor/publisher in 1990. Subsequently, the journal has been published by Elsevier with Professor David Watts of the University of Manchester as Editor. The journal has grown and prospered and is now recognized as one of the major dental journals. It is usually in the top three or four based on impact factors for dental journals. This is partly reflected by

DENTAL MATERIALS

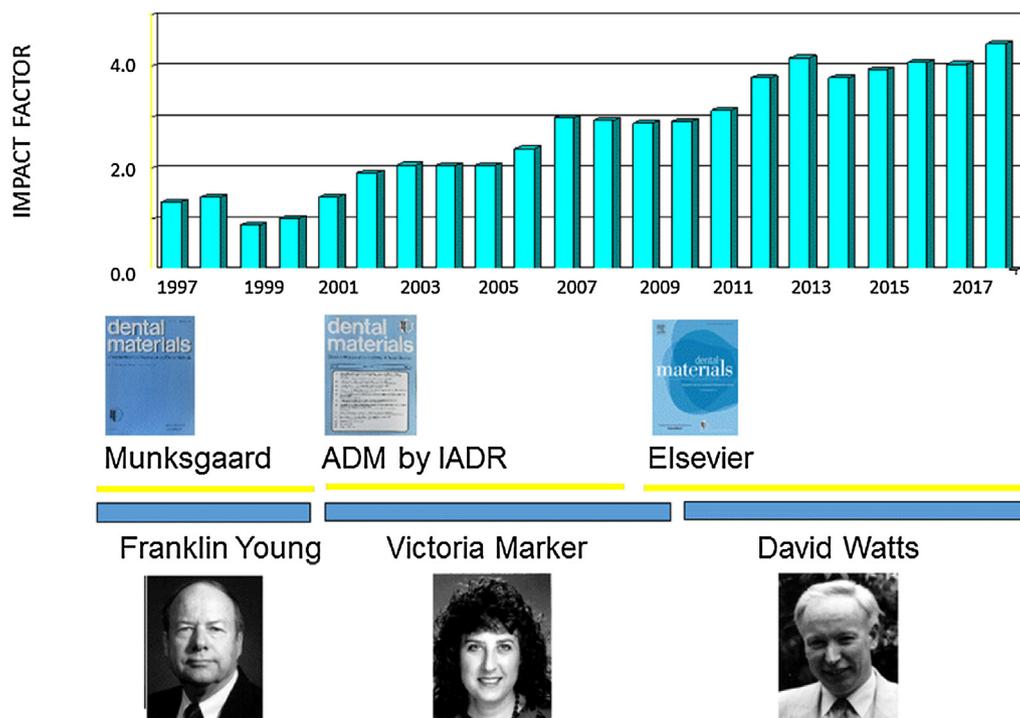


Fig. 3 – The success of the ADM journal is evidenced by the increased impact factor over the years as it has become a leading dental journal. This was achieved under our three editors, Franklin Young, Victoria Marker, and long term current editor, David Watts.

the growth of its impact factor over several decades as shown in Fig. 3.

The goal of promoting recognition of our discipline, developing collegiality, and encouraging collaboration among members and student members was developed via the ADM's awards program. Initial awards provided for Fellows of the ADM, recognizing members with strong research records (Fig. 4). Subsequently, the Founders Award was created to recognize members who contributed significantly to the development of the ADM. Additionally, student awards for dental students at institutions of participating members were launched as an initiative by Professor Grayson Marshall and President Lawrence Gettleman. Student awards were expanded to recognize excellence of meeting presentations by competition for the Paffenbarger Award under President Lyle Zardiackas. Most recently, the Marshalls Post-Doctoral Award was added in 2018. Examples of some of these awards are shown in Fig. 5.

3. Near history of ADM

Clearly many of the ADM's early objectives have been accomplished. Success of the ADM has exceeded most of initial hopes and expectations. Meetings focused on a wide variety of hot topics related to dentistry and biomaterials science. A recent invited paper summarizes key progress and evolution of the discipline [2]. ADM meetings are documented in the

form of the Transactions. Dental Materials as a journal has grown and developed into one of the top dental journals as reflected by the growth of its impact factor. Our membership has grown slowly to a level of about 400 active members. While most of the early leaders have retired or are nearing retirement, energized young scientists from around the world are keeping the ADM vibrant and exciting.

4. Present ADM: providing wings

The ADM objectives certainly helped to shape our own careers, by providing us with opportunities, colleagues, and mentors. It helped us realize that our formal education was only the first step in learning and applying the scientific method. To succeed in future studies and in new areas of our science required that we continuously reinvent ourselves. This continual introspection and reinvention is pivotal both individually and as an organization. Our own mentors willingly helped us along early research paths by including us on their teams. For example, Greener and colleagues were working on new amalgam formulations in the 1970s. We were able to adapt our expertise in scanning microscopy and x-ray diffraction to focus on dental amalgam and later enamel bonding. As we gained stature and experience, we entered new fields that seemed worthy of study. These areas included calcified tissues and bioactive glasses, some of which were non-traditional dental materials for the Marshalls. Clinical research formed a key part of



Fig. 4 – ADM Member Awards. a, Fellowship plaque b. Fellowship medal c. Founders Award.

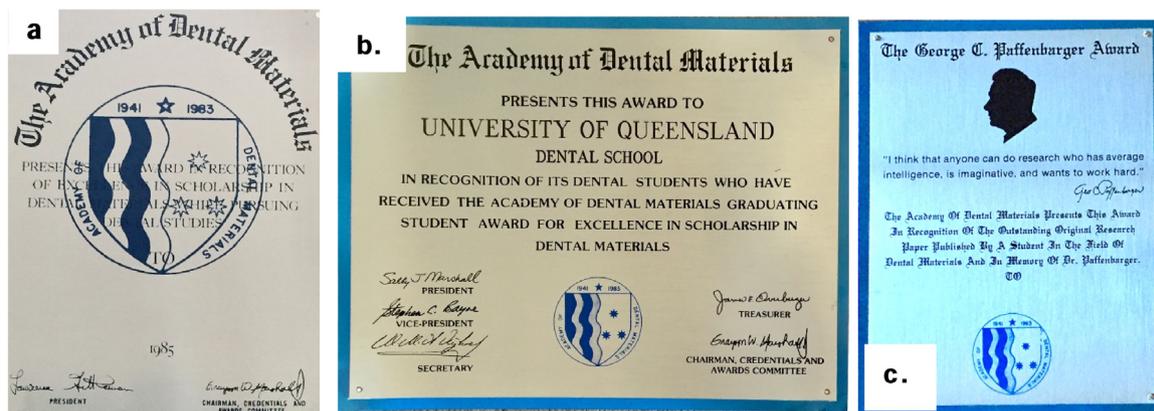


Fig. 5 – Early Student Awards. a. Graduating dental student award from each dental school. b. Institutional Award recognizing annual awardees. c. George C. Paffenbarger Award for dental/ graduate student excellence in dental materials research.

Bayne's career. We recognized and sought talented collaborators, PhD students, and post docs. Our successes led to key job offers and leadership opportunities. The Marshalls joined UCSF. Bayne migrated from Northwestern to Mississippi, and University of North Carolina, and eventually the University of Michigan as a Department Chair. Leadership roles that started in the ADM later moved on to Presidential stewardship roles within the ADM, AADR and IADR.

Sally Marshall served as the first female AADR and second female IADR President. She already was the first female ADM President. At UCSF, she served as department Vice Chair for Research and various campus leadership positions, ultimately as the UCSF Vice Provost, creating programs for faculty mentoring, development, wellness and leadership. Grayson Marshall served as Director of UCSF Presidio Clinical Research Unit, Division Chair of Biomaterials and Bioengineering, chair of the Oral and Craniofacial Sciences PhD program. He was Director of 4 NIH training programs, several of which continue at this time. In addition he served as DMG-IADR, AADR and ADM President. Stephen Bayne served as ADM President, President of the Mississippi Medical Faculty Senate, DMG-IADR President, AADR President, and finally IADR President. He has received special DMG-IADR recognitions for work in clinical research. Similar leadership roles were assumed for many

other of our early colleagues who founded the ADM. These opportunities continue to be available for young scientists.

5. Future ADM: spreading our wings

We speculate here on potential new approaches to enhance and grow the ADM. We make no claim to having a crystal ball to reveal what may be coming. It has been very difficult to predict the historical evolution of the dental materials discipline [2]. Yet, it is still exciting to speculate on the changes that might enhance the ADM.

Mentoring is a magical ingredient necessary for most success [3]. We strongly recommend that the ADM leadership look toward becoming internationally recognized as the “major mentoring organization” for professionals interested in our discipline. The ADM should lead future efforts to build the discipline, recruit new members, enhance collaborations, and provide leadership paths. Imagine the ADM as a “Ment-organization.”

ADM's membership has been relatively stable for many years. At the start the new programs noted earlier, created a strong draw for new members. Thereafter, membership grew only slowly. Engaging new members is a critical feature for the success of the present Academy. The breadth of dental materi-

als and related areas has expanded dramatically. The current membership and potential new members have quite varied interests. We need to appeal to this ever broadening spectrum of interests and approaches for research and become scientifically diverse and inclusive. We must ask “What is needed to provide future ‘wings’ for our organization?”

We believe we must provide broader opportunities to promote careers. Mentoring includes helping someone develop not only into a successful dental materials scientist but also helping them to become a strong member of the scientific world. The ADM should provide opportunities for members to grow as role models, advisors, and consultants. ADM meetings form a small, friendly, less intimidating environment than generally experienced in much larger IADR meetings.

At the same time, members should be developing new and enriching collaborations in interdisciplinary areas. An ADM meeting’s structure eliminates competing sessions. This guarantees that we all have the opportunity to hear interesting presentations in related areas and learn potentially useful science and discuss new ideas together. A polymer expert might learn applicable ideas from a presentation by a ceramics expert or biologist.

A mentor should be continually opening new doors to opportunities, as well as be intellectually, emotionally, and perhaps financially supportive for mentees. The Academy can serve this role by providing an annual meeting with a positive collegial environment and do so with potentially no-cost registration for junior faculty or other scientists crossing over into dental materials. The future of the Academy rests with the success of each new generation of scientists, not on a static or graying membership. It must explore new models for creating these mentoring opportunities.

At the same time, mentoring is required for a lifetime. Becoming more experienced and older does not guarantee that one is well-prepared for an every changing future. Older scientists need mentoring as well. Members are mentees even at the end of their career. The same opportunities at meetings serve older members as well [4].

Special consideration needs to be paid to new faculty and scientists in industry and those entering our field from related fields. We propose to encourage this process by identifying new appointees through our members at each institution and encouraging them to participate in the ADM with free membership and free registration for 3 years. This would allow them to engage us and explore the organization’s opportunities to assist their career advancement, meet new colleagues, move to grander positions, develop new grant applications, and seek higher promotions.

ADM programs should be a research resource for all participants. Programs should be the highest level continuing scientific education for members. Through the ADM junior faculty and postdocs can find career mentors among senior people and peer mentors whose research is complementary. Programs should guarantee member awareness of the leading edge of advanced materials science, dental materials evolution, and new analytical techniques.

For career success a junior person requires goals [4] and a position from which he/she can achieve them. One needs to know what is required in terms of effort and accomplishment within one’s position for research, teaching, clinical practice,

and service. One needs to know how a position is funded and requirements to generate portions of your own salary. One should be well-versed in the research support available at your parent institution in terms of facilities, core faculty, financial support and time commitment. ADM colleagues often can supplement your work and help you. The ADM should provide workshops on publications and promotion. What is important (number of publications, various metrics and indices, quality of journals, first or senior authorship) for promotion? The ADM is a source of senior people who can provide positive evaluations of your research and suggestions on career development.

Collegial networking is valuable for more than just mentee relationships. They provide opportunities for great research collaboration. The authors have benefitted from such collaborations for decades. The presence of the internet, email, and high speed connections permit long distance collaborations even among scientists from different countries. One of the great advantages of networking within the ADM is developing strong personal relationships during ADM meetings that naturally foster the formation of such collaborations. Another potential role for the ADM is to more formally encourage and organize these working relationships. This is also a perfect path for a younger scientist to become part of a team that otherwise would not exist at their home location.

6. ADM future: flying higher

Today is an exciting time in research for our members and prospective members. There are new opportunities for professional growth. The ADM should lead the way by exposing members to the latest tools, techniques, problem-solving methods, and ways of thinking. The ADM is a vehicle to expose members to non-traditional things. Obvious extensions include tissue engineering and stem cells, 3D printing, additive fabrication methods [5,6] advanced digital dentistry, and new imaging modalities. Some of these topics are part of the 2019 ADM program [7]. But others are beyond most of our bounds of familiarity or comfortability. Life is change, or in the words of Nobel Laureate Bob Dylan “There is nothing so stable as change”.

Artificial Intelligence (AI) is one major example of a field that is about to quickly change and impact all our lives. It includes topics from health to transportation. We will work differently in the future because of it. While AI started as a discipline in 1956, during 1990 to 2020 there was an explosion of new investment with expanding applications (e.g., human speech recognition, autonomous cars, sophisticated simulations). AI exists at: (1) analytical levels, (2) human-inspired (cognitive and emotional intelligence for decision-making), and humanized AI (cognitive, emotional, and social intelligence with the capability for self-awareness) [8]. AI employs information about a particular environment (typically large data sets). Then its algorithms (ranging widely in complexity) recognize patterns and develop decisions or predictions. While huge computer systems have the capacity to deal with large data sets, AI systems face the challenge of data volume, velocity, variety, and veracity [9]. This becomes more complicated when approaching humanized AI. Analytical AI is the most commonly encountered application. There are already

a huge number of applications being explored in medicine and dentistry [10]. Interpreting images from radiographs or other diagnostic outputs are major examples. Analyzing patient data to determine medical diagnoses and controlling advanced surgical tools are other examples. Providing real time consultation to practitioners has incredible value. Imagine a world with virtual assistants in health practices. AI also has tremendous application in research for experimental design, interpretation of multifactorial results, and conduct of meta-analyses. AI has the capacity to produce much more powerful results from clinical trials by processing large data sets of real-time clinical data. It also offers the capacity for combining analyses across many investigators or sites in real-time. AI is also useful for managing large and complex experiments. It has the capacity to look at non-traditional fields for behaviors or causes that might explain observations in one's experiments.

The capacity of AI at the moment is limited to the availability of AI computing systems (e.g., IBM's Watson) [11] and the ability to collect and feed rational data sets into the algorithms. There are no doubts that the impact will be both positive for medicine and dentistry (better patient care) and negative (elimination of many existing jobs) but will get us closer to the goal of the best possible medical care. Imagine the day when as a scientist you say "Okay, Leonardo (your AI lab assistant) — what would be a good design for an experiment to investigate outcomes for a new bone replacement material?" Imagine your AI assistant helping with design, conduct, and interpretation of results. It may even be possible for AI robotic assistance in conducting the experiment, preparing solutions, timing the experiments, running microscopes and spectroscopes to analyze results.

In a similar fashion, other sciences should be used to provide insights in new areas. Most likely the modern dental materials researcher should have strong familiarity with genetics and gene editing, and revolutionary approaches such as the use of CRISPR-Cas9 have dramatically altered approaches to studying biological systems [12]. Dental Materials, whether bio-inspired or traditional metals, ceramics, polymers, and composites, all have important biological interactions that may be supplemented or mitigated by controlling immune system responses. It is extremely important to engineer these interactions to insure long term success of all materials. It is also important to consider differences in biological reactions to materials that might occur due to prior genetic modifications of human systems. Dental materials scientists should embrace this knowledge and lead in understanding these interactions.

ADM leadership should continue to strategically examine all aspects of the ADM. How could the scope of the journal be broadened? Should there be special themed issues that are associated with focused meetings? Should ADM develop additional journals to capture new scientific emphases? In the first few years of the ADM, it partnered with the Japanese Society for Dental Materials and Devices. We might examine the possibility for something similar with partners in

alternative scientific areas that could enhance our research efforts. Collaborative meetings might be formulated as special joint or satellite programs. How could the range of membership be broadened? Should ADM have regional components to accomplish objectives more readily? How should ADM recruit members in new geographic areas and plan for local meetings in those places? One of the great legacies which the AAPRD passed on to ADM was a continuous re-examination and reinvention.

If we continue to mentor and support our young scientists and maintain a vision focused on progress and possibilities, the ADM will continue to be a vital and healthy organization.

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