APS: 125 years of progress of physiology as a scientific discipline and a profession

Robert G. Carroll,1 Martin Frank,2 Alice Ra’anani,2 and Marsha L. Matyas2

1Department of Physiology, Brody School of Medicine, East Carolina University, Greenville, North Carolina; and 2American Physiological Society, Bethesda, Maryland

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The Experimental Biology 2012 meeting in San Diego, CA, included events to celebrate the 125th anniversary of the founding of the American Physiological Society (APS) and reflect on the recent accomplishments of the society. Most of the APS activities in the past quarter century were guided by a series of strategic plans. Membership in the APS increased by 76% since 1987, and there are now 8,342 regular members of the society, including an expansion of international members to 26% of APS’s membership. The numbers of elected officers and committee members have expanded to accommodate this larger membership. APS Publications changed dramatically during this time, having adopted online submission and review of manuscripts as well as a streamlined review and publications process that have significantly shortened the period from submission to acceptance to publication. Compared with 1987, the number of manuscripts submitted has increased by 80% and the number of printed pages increased by 52%. In addition to the refinement of the Experimental Biology meeting (Federation of American Societies for Experimental Biology meeting before 1993) format, APS launched a specialty conference program in the 1990s. The educational offerings of APS also dramatically expanded in the past 25 yr, often supported by external grants and contracts. APS education programs now support physiology education and science awareness at K–12, undergraduate, graduate, and professional levels as well as continuing education of its members. The founding of APS was tied to the need for effective advocacy, and APS continues to meet those goals through its Science Policy Committee and Animal Care and Experimentation Committees. At its 125th birthday, APS continues to serve the discipline and the needs of its membership.

American Physiological Society; history; symposium

The 125th anniversary of the founding of the American Physiological Society (APS) provides a stimulus to reflect on the past as a prelude to the future. Quarter century intervals provide a convenient boundary for grouping and contrasting historical eras, and the activities of APS have previously been chronicled in those increments (2, 3, 5, 7, 10). The growth of the scientific research enterprise that began after World War II continued to accelerate in the past 25 yr (5). While 1962–1987 challenged physiologists with the exploration of space and the chemical basis for genetic replication and membrane function, the past 25 yr have opened new doors with the era of computing applications, genomic manipulation, and the World Wide Web.

Strategic Planning

Many activities that APS undertook from 1987 to 2012 were guided by a series of Strategic Plans. At its first strategic planning retreat in 1992, APS decided that it would use its financial resources to expand both membership and participation in the society (12). The creation of sectional affiliation increased participation in governance as well as growth in the quantity and quality of APS publications and meetings. Subsequent retreats produced new strategic plans in 2000, 2006, and 2010 (Table 1) (13–15).

Membership

At its founding, membership in the APS was restricted to individuals demonstrating mastery of modern experimental physiology. There were 28 founding members in 1887, and, within 2 yr, membership had expanded to 73 members (2). By the end of its first 100 yr, APS had 4,725 regular members and 6,476 total members (5). As a result of the activities outlined in the 1992 strategic plan, APS increased in both total and regular membership (Fig. 1). The effectiveness of the strategic plan’s membership emphasis is shown in the increases in membership in 1994 after the release of the strategic plan. As APS celebrated its 125th anniversary, regular membership had increased to 8,342 members and total membership to 11,289 members. In addition, the proportion of international members of APS increased from 17% in 2000 to 26% in 2012, reflecting a continuing globalization of scientific research.

During the past 25 yr, APS benefited from the dedication and skills of its volunteer leadership. APS membership annually elects a president who serves a 3-yr term, first as president-elect, then as president, and finally as past president. Councilors are elected by the membership at large for staggered 3-yr terms, with two new councilors elected annually though 2004 and three councilors elected annually since then. This structure, which provides both continuity and renewal, has served APS well (Table 2).

The skill and dedication of the elected officers has been complimented by the stability in the executive and administrative offices during the past 25 yr. Martin Frank, hired in 1985 as Executive Secretary-Treasurer, was advanced to Executive Director in 1987. Under his leadership, there has been growth and development of the APS staff so that now APS staff members provide leadership at national and international levels in publications, education, and science policy. Linda Allen, hired in 1981, has served as Director of Membership Services and Meetings since 2008. Alice Hellerstein Ra’anani, hired in 1992, has served as Director of Government Relations and Science Policy since 2008. Marsha Lakes Matyas joined APS in 1993 as the Education Officer and was advanced to Director of Education Programs in 2005. The stability and institutional memory provided by their long experiences is particularly valuable when the elected leadership terms are 3 yr.

An expanded committee structure allowed APS to better serve its members and to accomplish the goals set in the
Table 1. Strategic plan outcomes

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<th>1992 (for additional details, see Ref. 12)</th>
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| Publications
To promote the publication of the highest quality journals, books, and pamphlets; to foster and facilitate the dissemination and understanding of physiological knowledge; and to promote the image of APS. |
| Meetings
To make the scientific meetings of the APS so exciting that the best minds in science will be attracted to the field of physiology. |
| Education
To foster excellence in physiology education appropriate for each constituency of the APS. |
| Public policy
To develop and maintain a proactive program designed to influence governmental, professional, and institutional organizations as well as the public at large in their formulation of policies and activities related to the interests of APS. |
| Membership
To increase membership in the APS by attracting and retaining increased numbers of individuals who are part of the APS constituency and by improving membership benefits and services. |
| Organization/operation
To maintain and enhance the organization and operation of the APS in an efficient manner. |
| Finance
To maintain the fiscal health of the APS. |
| Awards and grants
To utilize the awards and grants program to strengthen the discipline and to recognize and recruit new members. |
| Society organization
To match headquarters staff to the needs of an annually reviewed strategic plan. |
| Governance
To develop representational governance. |

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<th>1999 (for additional details, see Ref. 13)</th>
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| APS Mission Statement
The APS provides leadership in the life sciences by promoting excellence and innovation in physiological research and education and by providing information to the scientific community and to the public. |
| Publications goal
To provide the highest quality publications with the greatest impact in the life sciences. |
| Meetings goal
To provide meetings of the highest quality and impact that integrate the life sciences. |
| Education goal
To promote awareness, understanding, and education in physiology at all levels. |
| Advocacy and public policy goal
To develop a dynamic advocacy program with strong member involvement to educate and inform the public, the government, and other key audiences about the importance of physiology and the critical role of animal research. |
| Membership goal
To increase the breadth and stature of membership in the APS and to improve membership benefits. |
| International physiology goal
To promote global interaction in the physiological sciences. |
| Governance goal
To ensure that governance adequately represents the membership. |
| Finance goal
To develop and implement a dynamic plan for sustained fiscal health. |
| Awards and grants goal
To strengthen the discipline of physiology through awards that support, recognize, and publicize the scholarly and research activities of the membership. |
| Society organization goal
To expand and improve the APS organization to meet the growing needs of APS and its strategic plan. |

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<th>2005 (for additional details, see Ref. 14)</th>
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| Mission Statement
APS promotes discovery, disseminates knowledge, and advances education in physiology. |
| Direction 1
APS will be the leader in advancing the life sciences that investigate biological function. |
| Direction 2
APS will enhance the future of the field, ensuring that next generation physiologists are supported through all stages of their careers. |
| Direction 3
APS will drive understanding of and appreciation for physiology and strengthen public and private support. |
| Direction 4
APS will be dynamic and relevant to an increasingly diverse and global membership. |
| Direction 5
APS will be a mission-directed, adaptable, and fiscally sound organization. |

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<th>2011 (for additional details, see Ref. 15)</th>
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| Mission Statement
The APS mission is to promote the discipline of physiology and thereby enhance human and animal health by disseminating research discoveries, facilitating research and scientific interaction, educating the public, and enabling future generations of physiologists. |
| Strategic priority 1
Increase efforts to ensure awareness of, and advocacy for, the discipline of physiology. |
| Strategic priority 2
Actively work to attract, meet the needs of, engage, and retain membership subgroups/ organizations as well as the public at large in their formulation of policies and activities related to the interests of APS. |
| Strategic priority 3
Develop strategies to strengthen the Society’s publications in a changing world. |
| Strategic priority 4
Enhance opportunities for scientific interaction and exchange. |
| Strategic priority 5
Increase the visibility of physiology in life sciences and health sciences education |

APS, American Physiological Society.

strategic plans. In 1987, APS had six standing committees: the Education Committee, Finance Committee, Membership Committee, Program Committee, Publications Committee, and Section Advisory Committee. APS function was assisted by 12 additional ad hoc committees. In the past 25 yr, the standing committees have been expanded to 22 committees. Committee membership is drawn from volunteers who apply for committee service. Their applications are reviewed, and candidates are recommended to the APS Council for approval by the Committee on Committees, which has served this role since 1974.

The development of “sections” in the 1980s (5) led to a substantial change to APS’s governance, including the addition of the Section Advisory Committee chair to the APS Council. The continuing empowerment of the sections was addressed in the 1992 strategic plan, which allowed increased member participation and an expansion of the roles of committees that serve in an advisory role to the APS Council. It also provided for hiring new professional managerial staff to administer the new programs and activities. The development and empowerment of sections necessitated an expanded role for the Section Advisory Committee and the transformation of the Program Committee into the Joint Program Committee. The development of state/regional chapters afforded another expanded opportunity for participation, and the nine active chapters (2012) are represented on the Chapter Advisory Committee. As physiology research became increasingly global, an Interna-
The Porter Physiology Committee was established to provide additional service to members, as was the Conference Program, which is overseen by the Conference Committee. The Porter Physiology Development and Women in Physiology Committees address the needs of minority and female physiologists, respectively. Finally, APS recognizes the contributions of its retired members through the Distinguished Physiologists Committee and special projects such as the “Living History” project, which arranges for video interviews of these members concerning their careers.

The role of APS in advocacy was also expanded based on the recommendations developed in the strategic plan. An expanded role for the Animal Care and Experimentation and Public Affairs (now Science Policy) Committees was a result of this, and a recent history of these activities is recounted below (in Advocacy).

The final aspect of the strategic planning process was to insure that APS continued to serve the needs of its members. Changes in publications, education, and meetings (discussed below) fit this goal, as does the expansion of APS awards and mentorship activities. The number and value of awards sponsored directly by APS and through bequests increased substantially in the past 25 yr, with the selection of awardees overseen by the Awards Committee and numerous other committees. Specific awards are overseen by the Ray G. Daggs Committee and John F. Perkins Memorial Award Committee. Many standing and ad hoc committees, such as the Education Committee, Section Steering Committee, Trainee Advisory Committee, Career Opportunities in Physiology Committee, Porter Physiology Committee, and Women in Physiology Committee, give awards in addition to their oversight of other programs. Similarly, awards are also provided by each of the 12 disciplinary sections and 6 interest groups within APS. Evidence of the overall expansion of awards was the recognition of 400 individuals as APS and Sectional awardees at the Experimental Biology 2012 business meeting.

Publications

It was as true in 1887 as it is today that publication of articles in scientific journals is the primary evidence of academic scholarship. At the time of the founding of APS, American physiologists published their English-language articles in the British Journal of Physiology and Journal of Experimental Medicine. In 1894, APS first discussed the development of an independent American publication, but no resolution was reached. In 1896, a United States scientific publication, the Journal of Experimental Medicine, was formed, stimulating further discussion of the role of publications in APS. An APS committee formed in 1897 recommended, and the membership approved, the formation of the American Journal of Physiology, to be published by William T. Porter, and established an “Editorial Board/Publications Committee” to both oversee the editorial management of the journal and to conduct the contract negotiations with the journal publisher and editor, Porter (5).

Volume 1 of the American Journal of Physiology was published in 1898 (4 issues, 32 articles, 522 pages), 11 yr after the founding of the society. Publication was changed to monthly in July 1899, a pattern that continues today for the print and online versions of the journal. Through a succession of 5-yr contracts, Porter edited the first 33 volumes of the American Journal of Physiology, stepping down from that position in 1914 (3).

As was the norm in that era, publication of scientific journals was done privately, as fledgling scientific societies could not afford the financial risks associated with publication. The deficits in the early years of the journal were offset by the APS contributions, including one to cover the publications of proceedings (abstracts) of the 1898 scientific meeting. By 1910, the journal was a viable financial enterprise. Porter transferred ownership of the journal to APS in 1914, making APS one of the first biological societies to assume full ownership and management of a journal (5). It was a move that still shapes the structure and finances of APS.

During the 20th century, APS developed into a significant scientific publisher. In 1986, over 1,600 manuscripts were published in the American Journal of Physiology, and another 800 manuscripts were published in two other society journals, the Journal of Applied Physiology and Journal of Neurophysiology, for a total of 22,746 published pages (5). Growth of the American Journal of Physiology led to its subdivision into specialty journals in 1976. In addition, APS published 11 sections of The Handbook of Physiology, which was updated intermittently, and 11 volumes in the Clinical Physiology series, which were derived from symposia. The publication enterprise generated significant income for APS, and, at the time of APS’s centennial, the primary perceived challenge was photocopying (5).

Past 25 Years of Publishing

From 1987 to 2012, APS’s publications were overseen by the Publications Committee and managed in the Bethesda, MD, office by Publications Managers/Directors Stephen Geiger (1987), Brenda Rauner (1987–1999), Margaret Reich (1999–2008), and Rita Scheman (2009-date). By 2011, APS was publishing 14 sections and 6 interest groups within APS.
Historical Perspectives

Table 2. APS Presidents and councillors: 1987–2013

<table>
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<tr>
<th>Year</th>
<th>President</th>
<th>President-Elect</th>
<th>Past President</th>
<th>Councillors</th>
</tr>
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<tbody>
<tr>
<td>1989–1990</td>
<td>Aubrey Taylor</td>
<td>Vernon Bishop</td>
<td>Harvey Sparks</td>
<td>Ken Baldwin, Dennis Brown, Ida Llewellyn-Smith, Patricia Molina, Usha Raj, Jane Reckelhoff, Curt Sigmund, Alan Sved</td>
</tr>
</tbody>
</table>

journals each year, consisting of 34,636 pages and receiving over 7,400 manuscripts for review. Technology reshaped the process and efficiency of APS publication operations over the past 25 yr. In 1993, authors were encouraged to submit manuscripts on disk to save time and to reduce typesetting costs. Also in 1993, APS initiated APStracts, the online publication of abstracts from accepted manuscripts, using a “Gopher” server, an early precursor to the World Wide Web. In 1998, the American Journal of Physiology marked its centennial, a celebration of history that stood in contrast to the innovative move to publish the Journal of Applied Physiology both online and in print. Other APS journals quickly followed the move to duplicate print and online publication, and by 2010, Physiological Genomics had transitioned to an online-only publishing format. With the migration to online publication through HighWire Press, APS was able to

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include materials not traditionally found in print journals. As a consequence from the start of their online presence, the journals were expanded to include data supplements, including video clips, in 2001. More recently, podcasts from the American Journal of Physiology-Heart and Circulatory Physiology, American Journal of Physiology-Renal Physiology, and Physiological Genomics were used to highlight articles of broader interest.

The online submission and Web-based peer review of manuscripts through the APS Central portal was initiated in 1999. The move to an online system accelerated both the time to first decision and publication process. By 2001, the review of galley proofs for the journals had been migrated to an online system. The time from acceptance to publication in print decreased from 3.5 mo in 1999 to 2.1 mo in 2008, and the online publication of accepted articles occurred within 1 wk of acceptance beginning in 2003. The increased speed of publication caused an increase in the number of published pages in 2007, as shown in Fig. 2B, as manuscripts “in the pipeline” were published at the accelerated rate. Figure 2B also shows that the general trend in increasing submissions and pages published was interrupted in 2008. The decline in submitted manuscripts and published pages after 2008 is a concern for APS but may reflect the general decline in activity associated with the global recession during these years or the increase in new journals, especially open access journals.

The scope of APS publications increased with the creation of the journal Physiological Genomics in 1999 and the revamping of News In Physiological Sciences to Physiology in 2004. In the years approaching its 125th anniversary, APS publication efforts continue to diversify. The quarterly journal Comprehensive Physiology, published as a joint effort with John Wiley & Sons, was established to fill the role previously played by the Handbook of Physiology series, and a book monograph series published as a joint effort with Springer is under development.

Recognizing the importance of the historical aspects of research, APS initiated a Legacy Project in 2001 to scan all APS journal content from 1898 through 1997 and make it available as searchable PDFs. Journals published after 1997 had already been put online. A companion article by Charles (Tip) Tipton in this issue reviews seminal articles published in APS journals (16).

This era also saw the advent of the open access publishing movement, in which the costs of publication are shifted from journal subscribers to authors. The ease of online access to the scientific literature resulted in calls to provide access to the scientific literature without subscription fees or charges. While APS and other Society publishers attempted to accommodate the movement by providing access to APS journal content with a delay until 12 mo after publication, there were still efforts being made to mandate a reduction in the embargo period to 6 mo or to eliminate it completely (9). While APS continued to fight external efforts to dictate the Society’s publication policy, it also offered authors who wanted to make their articles available right away the option of paying for immediate open access through an Author’s Choice program. In addition, 2012 saw APS join forces with The Physiological Society (United Kingdom) to plan for the 2013 launch of Physiological Reports, a joint open access physiology journal to serve the international physiological community.

One major challenge facing the publication enterprise has been maintaining high ethical standards. APS has taken a leadership role in this area and, in 2004, developed an ethical policy (http://www.the-aps.org/publications/journals/pseth.html) that is a model for other societies and journals (4, 18). APS takes its ethics-related responsibilities very seriously: its journal program is an integral part of the APS educational mission, designed to publish only papers that contribute to the advancement of science and that are ethically sound. The overall process involves many volunteer scientists in the review and selection of manuscripts for publication and APS staff to manage the peer review and editorial and production processes and engage in copy-editing and rendering illustrations in a high-quality format. Over the past 7 yr, the use of improved tools for detection has resulted in APS identifying an ever-increasing number of manuscripts containing ethical lapses (8). The issues raised by these cases involved plagiarism, falsification and/or duplication of data, authorship disputes, duplicate publication/submission, conflicts of interest, human/animal subject protocols, and figure manipulation. Each case requires time for investigation and communications with authors. As a result, our publications ethics program is now overseen by an Ethics Officer with input from the Publications Committee, journal editors, and APS Publications staff. In 2012, the APS Education and Publication Offices began the development of publication ethics teaching materials for online and responsible conduct research courses as well as an online community site where students and experienced researchers can discuss issues in publications ethics in an open forum.

Meetings and Conferences

In 1888, the newly founded APS sponsored two physiology sessions at the Congress of American Physicians and Surgeons in Washington, DC. Of the 400 Congress attendees, 12 attendees were APS members (5). The first annual meeting of APS was in Philadelphia, PA, later that year, and APS remained a component...
of the Congress of American Physicians and Surgeons and held their business meetings in conjunction with that larger Congress until 1907 and thereafter as a component of the American Association for the Advancement of Science (AAAS).

The early 20th century was a period of growth and specialization. APS members formed the founding core of the American Society of Biological Chemistry (1906) and the American Society for Pharmacology and Experimental Therapeutics (1908) (5). These societies continued to meet at a common location and in 1912 formed an umbrella organization, the Federation of American Societies for Experimental Biology (FASEB). The FASEB meeting became the annual meeting for the APS and other companion societies.

In 1948, APS opted to have an independent fall meeting, and by the time of its centennial, APS was holding two regular scientific meetings each year. A fall APS meeting was held annually, sometimes jointly with another society (5). At first these meetings were held on an academic campus. Later they were held on campuses in alternate years, but campus meetings became a rare occurrence after 1987. In the spring, APS continued to meet in conjunction with FASEB. By 1986, 1900 APS abstracts were submitted for this spring meeting, with 62% in poster format, and 600 papers were submitted for the fall meeting.

Past 25 Years of Meetings

In October 1990, APS combined the regular fall meeting with a specialty meeting for a conference subtitled “In Search of Physiological Principles: the Use of Animal Diversity and Novel Technology.” This meeting carried a generic topic category listing so abstracts were submitted outside the theme. All oral sessions, however, fell within the conference theme. In 1991, APS initiated a completely independent conference program, starting with “From Channels to Cross Bridges.” This conference was intended to focus attention on an emerging area of research, and, after the success of this first meeting, APS conferences were held annually.

As a result of an organizational restructuring in 1993, the name of the spring FASEB meeting was changed to “Experimental Biology” (EB), and those programming it took advantage of the multiple participating societies to develop interdisciplinary themes. The reorganized EB meeting included an increased emphasis on posters as a research presentation format as well as techniques workshops. For APS, the introduction of annual lectureship, selected by the sections, increased the prominence of the EB 1994 meeting. In 1995, APS added other innovations, such as the introduction of a refresher course preceding the meeting and the development of an “In Focus” program and “Hot Topics” symposia.

The increased emphasis on posters was effective, and by 1998, the EB poster sessions were left unopposed by oral presentations. APS also established a “Joint Program Committee” to program the abstracts for the EB meeting, expanding membership of the Program Committee to include representatives from each of the APS sections and interest groups. The unopposed poster session at EB 2001 was expanded to 3 h, and poster abstracts were clustered for presentation.

The EB 2005 meeting in San Diego, CA, was unique because it also included the XXXV International Union of Physiological Sciences (IUPS) meeting. The number of abstracts programmed by the joint APS/IUPS program committee was 21% higher than the average number of abstracts programmed at EB from 2000 to 2011. This meeting also set a tone for an increased emphasis on international collaboration, and by 2008, APS had participated jointly in meetings with the Chinese and the Spanish Physiological Societies. Internationalization continued with a large APS presence at the 2009 IUPS meeting in Kyoto, Japan, and an ongoing exchange of annual meeting symposia with The Physiological Society.

Over the past 25 yr, APS has used the EB meeting and its conference program as an opportunity for physiologists to share their work with colleagues. They have also provided an opportunity for graduate students and postdoctoral fellows to present their work, to seek future professional opportunities, and to develop their professional careers. In that regard, the APS meeting program has fulfilled its mission, serving as the venue of choice for many physiologists.

Education

The early focus of APS was to promote and advocate for research. Education was viewed as a component of research, and early meeting presentations did address education components, including teaching methods, demonstrations (1889), and a working model of the eye (1895). Meetings were hosted by active researchers in the home city, and laboratory tours allowed the demonstration of research apparatus and the sharing of research and educational approaches (5).

An APS Committee on Education was formed in 1953, and, under its direction, an annual Refresher Course began in 1954. In 1956, APS selected Ray G. Daggs as Executive Secretary-Treasurer, and he also served as Executive Director of Educational Programs, a position that was designated after 1970 as the Education Officer. In 1969, the Long-Range Planning Committee had identified education as an area where APS should seek to have an impact on physiologists and departments of physiology. The Physiology Teacher was introduced in April 1971 and continued as a stand-alone publication until 1978. From 1970 to 1981, the APS Education Program consisted of the Education Officer, a physiologist, a graphic artist, and a clerical administrative assistant. Education also emerged as a component of the meetings with the introduction of a Learning Resource Center (1978). In addition, a series of illustrated slide/tapes was developed (1960–1980). Financial support for the Education Office ceased in 1981, and it was disbanded. However, Orr E. Reynolds, APS Executive Secretary-Treasurer, continued to serve as the APS Education Officer.

At the APS centennial, there was renewed pressure from members for the society to become more involved in teaching through the formation of a Teaching of Physiology Section (1985) and the efforts of the Association of Chairs of Departments of Physiology (ACDP). In addition, collaboration with IUPS resulted in the founding of News in Physiological Sciences in 1986 as a journal to bridge the gap between research and education (5).

Past 25 Years of Education and Professional Development

As was true at its founding, the majority of APS education and professional development activities takes place through its journals and scientific meetings (described above). There have been two notable changes in APS’s education efforts in the past 25 yr. The first has been the emergence of physiology educa-
tion as a scholarly activity. The journal *Advances in Physiology Education* was launched as a section of the *American Journal of Physiology* in 1989. In 2000, the journal was spun off as a stand-alone journal. *Advances* increased both the visibility and stature of scholar-educators within the Society and the expansion of the scholarship of teaching and learning among physiologists. The Society elected to make the online version of *Advances in Physiological Education* a free journal, providing an important scholarly resource to both the physiology and broader education communities. The second change in the past 25 yr was the expansion of APS educational efforts into the university and K–12 environments in an effort to improve general scientific literacy and to increase the number of students considering physiology as a career option.

When Martin Frank became the Society’s Executive Secretary-Treasurer in 1985, he also assumed the role of Education Officer. Under his leadership, APS initiated the minority travel fellowship program in 1987 (with funding support from the National Institute of Diabetes and Digestive and Kidney Diseases) and the summer teacher’s program in 1991. An expansion of APS’s education program occurred with the hiring of Marsha Lakes Matyas as the Society’s Education Officer in 1993. By 1994, APS was leveraging Society funds to compete successfully for National Science Foundation (NSF) and National Institutes of Health (NIH) grants. From 2000 to 2012, APS received more than $10 million in external grants to support the educational and outreach mission of the Society. The combination of internal and external funding allowed the addition of new staff with advanced degrees in physiology and education and the expansion of all aspects of the education programs from K–12 through continuing education, with an increased emphasis on increasing participation among women and underrepresented minorities.

At the precollege level, APS developed programs to engage physiologists with K-12 schools, educators, and students in their local communities. The original summer teacher program was expanded in 1993 to a year-long professional development program that involved teachers in research experiences and helped them transform their lessons into student-centered, inquiry-based experiences. In 1997, APS established local outreach teams of physiologists and teachers to provide physiology professional development workshops for K–12 teachers. The local outreach model expanded further with the launch of Physiology Understanding Week (“PhUn Week”) in 2005. APS also works with teachers, students, and parents nationwide through workshops at EB, local and national science fairs, and special events such as the United States of America Science and Engineering Festival (http://www.usasciencefestival.org/).

APS has greatly expanded its involvement with college and university undergraduate education, recognizing both the importance of undergraduate research experiences in developing future scientists and the growth nationwide of physiology as an undergraduate major (6). At the undergraduate level, APS seeks to promote both excellence in physiology education and interest in physiology careers. Efforts to promote interest in physiology as a career range from the development of a resource-rich career web for undergraduate students to the initiation of an undergraduate student video contest. Programs to engage undergraduate students in physiology research include Undergraduate Summer Research Fellowships that were launched in 2000 and the addition in 2004 of David Bruce Undergraduate Research Excellence Awards to recognize the best undergraduate posters presented at EB. In 2009, APS also established a new membership category for undergraduate students. APS is also a partner with AAAS in the transformative “Vision and Change” initiative for undergraduate biology education (1).

APS established its leadership role in graduate education and career development for trainees with the development and publication of the APS/ACDP List of Professional Skills for Physiologists and Trainees in 2004. This list provides a framework for the continuing development of a series of live and online professional skills courses addressing the specific competencies. Recognizing the importance of mentoring in science careers, the APS Women in Physiology Committee established a one-on-one mentoring program for trainees in the 1990s. Currently the program is run in conjunction with the award-winning MentorNet program (http://mentornet.net). In 2011, APS expanded its leadership in graduate education by becoming a partner in the National Directors of Graduate Studies in Physiology and Pharmacology meeting.

Because physiology is a key component of medical education, the APS and ACDP jointly developed and published the “Medical Physiology Learning Objectives” in 2002. This set of learning objectives established the depth and breadth of physiology content that should be mastered in the preclinical years of medical education. APS support of medical educators also includes the development of a “Physiology Course and Block Directors” website and webinars of the annual EB Refresher Course in Physiology, providing talks focused on critical updates for the medical educator.

In 1997, APS initiated a project to establish an online digital library, the APS Archive of Teaching Resources. The Archive is an online community, with contributions from both individual educators and collaborating partners (Society for Developmental Biology, Human Anatomy and Physiology Society, American Association of Anatomists, Northwest Association for Biomedical Research, Massachusetts Society for Medical Research, and more). The Archive currently offers >5,200 peer-reviewed teaching resources and has >6,500 registered community members. It is searchable at the APS website (www.apsarchive.org), through BioSciEd Net, the National Science Digital Library Pathways Portal to the Life Sciences at the AAAS, and the National Science Digital Library (www.nsdl.org). In 2011, the Archive began an expansion to include not only digital resources but to support communities of practice for educators at the K–12 through graduate/professional levels, engaging participants in discussions and recommendations and interactions through both blogs and social media.

All APS programs are grounded in the Society’s long-term effort to promote diversity. Since its inception in 1987, the APS-National Institute of Diabetes and Digestive and Kidney Diseases Minority Travel Fellowship Program has awarded nearly 700 travel fellowships to >450 undergraduate, graduate, and postdoctoral minority students and to faculty members at minority institutions. The Porter Physiology Development Program, launched in 1967, has provided >225 full-time graduate fellowships to >100 graduate trainees. In addition, all APS education programs make special efforts to involve diverse participants. This systemic approach to diversity was recognized by the selection of APS as a recipient of the 2003 Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring.
Currently, education is interwoven through most of APS activities. APS educational programs are developed in response to strategic plans and have measurable goals and strong evaluation components. They reach a broad audience with specific activities directed to the general public, K–12 teachers and students, undergraduate students and educators, medical and professional school faculty, graduate students and trainees, and continuing education of APS members. Importantly, these programs involve thousands of APS members in outreach, educational scholarship, and mentoring to engage and prepare the next generation of physiologists.

Past 25 Years of Advocacy

The APS has been engaged in research advocacy since its earliest days, when its main focus was to defend the role of animal studies in advancing physiological knowledge. APS’s recent engagement in animal research advocacy was addressed in detail in an earlier article (17). However, as the NIH, NSF, Department of Veterans Affairs, National Aeronautics and Space Administration, and other agencies became more important sources of extramural research funding, APS increased its advocacy in this area. APS had intermittently had a government relations or public affairs committee dedicated to promoting research support, but such a panel has been in continuous existence since the early 1990s. The committee’s name was changed from “Public Affairs” to “Science Policy” in 2010 to better describe its focus.

In the early 1980s, APS hired a part-time Public Affairs Officer, William Samuels. As a result of the expanded public policy goals of the 1992 strategic plan, APS converted this into a full-time position. The Society began submitting annual statements to Congressional committees in support of research funding and used various new technologies to encourage APS members to also make their voices heard. At the beginning of this period, letters and phone calls were the only ways to alert the membership to contact Congress about an upcoming vote. For a brief time, this was replaced by a bulk fax system, which was dubbed “Net Alert.” This soon gave way to e-mail communications, and in 2003, APS established an online Legislative Action Center.

During the past quarter century, APS expanded and diversified its advocacy activities. The Office of Science Policy now has three full-time staff members who work with the Animal Care and Experimentation and Science Policy Committees and disseminate policy information via e-mail and the APS website (http://www.the-aps.org/mm/SciencePolicy). APS regularly comments on both legislative and regulatory proposals that would affect how scientists do their work. In addition, many APS members play a prominent role in FASEB’s science policy and advocacy activities, and APS also works closely with the Ad Hoc Group for Medical Research Funding, Coalition for National Science Funding, and the Friends of VA to advocate for NIH, NSF, and the Department of Veterans Affairs, respectively.


Looking forward, APS hopes to increase the involvement of the membership in advocacy activities through its Chapters and the Sections. The two Committees also continue to offer programming on topics of interest at the EB meeting.

Summary

In 2012, APS is an international leader in science, education, and member development. The expanding membership represents the global scientific community, providing venues for international collaboration. The expanding publications program has transitioned to an online submission and review, enhancing the speed and quality of the review and publication process. The diverse and high-quality educational offerings serve both members and the scientific community, as do APS’s advocacy efforts. The leadership and organizational structure support the current needs of the APS and set the stage for moving the society into the next quarter century.

DISCLOSURES

The authors have served (R. G. Carroll) or are employed by (M. Frank, A. Ra’anan, and M. L. Matyas) the American Physiological Society. R. G. Carroll is currently the Editor for Advances in Physiology Education.

AUTHOR CONTRIBUTIONS

Author contributions: M.F. and A.R. conception and design of research; M.F., A.R., and M.L.M. drafted manuscript; M.F., A.R., and M.L.M. edited and revised manuscript; M.F., A.R., and M.L.M. approved final version of manuscript.

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