

APS Education Committee Report, 2001-2006

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Promoting Physiology Education for All

APS Education
Committee Report
2001-2006



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About the American Physiological Society

The American Physiological Society (APS) is a nonprofit organization devoted to fostering education, scientific research, and dissemination of information in the physiological sciences. The Society was founded in 1887 with 27 members. APS now has over 10,500 members. Most members have doctoral degrees in physiology and/or medicine (or other health professions).

The APS supports a variety of educational activities, including programs and fellowships to encourage the development of young scientists at the undergraduate and graduate levels, with a particular focus on women and underrepresented minorities.

About APS Education Programs

The APS has activities addressing educational and career issues at the K-12, undergraduate, and graduate/professional levels as well as continuing education for physiologists. At the K-12 level, the APS programs focus on providing resources and professional development for excellence in science education. At the undergraduate level, APS programs and fellowships encourage excellence in physiology education and the development of young scientists. Programs and activities are available for students and faculty, and resources for undergraduate education and career exploration are provided. At the graduate level, APS programs and fellowships provide opportunities for student study, travel, and interaction with experienced physiologists. Educational materials offer tools to improve teaching and learning at both the graduate and professional levels. APS also provides awards, refresher courses, mentoring resources, and educational materials to promote continuing professional development for its members and excellence in physiology education for their students.

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Executive Summary

The Education Committee is one of the standing committees of the American Physiological Society (APS). The Society's bylaws state that the Committee "...shall conduct such educational, teaching, and recruitment programs as may be required or deemed advisable." This report provides an overview of the progress on the major committee initiatives between 2001 and 2006.

The Committee's work was guided by the 2000 APS Strategic Plan, which clearly focused on providing programs and services at all educational levels. Therefore, the Education Committee targeted its efforts over the past 6 years to create a balanced set of effective programs addressing each major educational level.

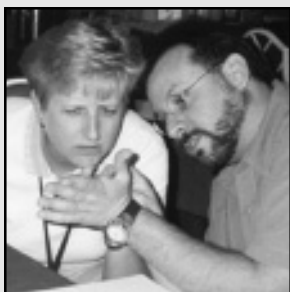
Most physiology continuing education occurs through the journals and scientific meetings. However, the Committee contributes to this effort by coordinating physiology refresher courses at the Society's annual meeting, Experimental Biology (EB). These courses are designed to provide both an intensive overview of content in one of the areas of physiology and opportunities to review new teaching methods and materials for physiology instruction. In recent years, the Committee focused on developing online dissemination methods to expand the accessibility of the interactive materials that are developed through the courses.

At the graduate level, Committee efforts focused on the development of professional skills among physiology trainees. In 2003, the Committee, in partnership with the Association of Chairs of Departments of Physiology (ACDP), published the *List of Professional Skills for Physiologists and Trainees*. The list includes skills that should be developed by trainees and was designed to serve as a professional development tool for physiology trainees and their mentors. Building on the list, the APS is developing and disseminating live, web, and CD-ROM short courses that focus on two critical professional skills areas: 1) writing and reviewing for journals and 2) presentation skills. This effort will develop resources to be used for live workshops and on-demand professional development at the APS website.

In the area of medical physiology education, the Committee worked extensively with the ACDP. First, they completed the first edition of the *APS/ACDP Medical Physiology Learning Objectives*. These core competency criteria provide guidelines for the breadth and depth of knowledge in the physiological principles and concepts that are considered minimal and essential for further progress in understanding mechanisms of disease and body defenses. Second, they developed an online site to support excellence in medical physiology education and, in particular, to provide resources for those who play an integral role in the development and coordination of medical physiology instruction. This Medical Physiology Course Directors website is a dynamic and growing collection of resources for physiology course directors.

At the undergraduate level, the Committee significantly expanded its programs over the past 6 years. It continued and expanded its involvement in professional development for undergraduate faculty, working with other professional societies to provide professional development through presentations/workshops and by sharing teaching resources through exhibits. It also launched the David Bruce Awards for Undergraduate Research in 2004. These awards are presented annually at EB to undergraduate students who have submitted abstracts for the meeting. The awards presentation coincides with another new activity, the EB





Undergraduate Research Poster Session. At this special weekend session, all undergraduate students who are presenting posters as first authors are invited to present their posters. In 2006, 125 undergraduate posters were presented to more than 200 attendees.

With support from Council, the Committee is seeking to further expand the Society's outreach at the undergraduate level. In September 2006, the Committee convened an Undergraduate Physiology Brainstorming Summit in Bethesda, MD. Attendees included faculty from 2- and 4-year colleges, universities, medical schools, and historically minority institutions, and discussion focused on both existing models for undergraduate physiology education and new models that could significantly expand the presence of physiology at the undergraduate level.

At the K-12 level, the Committee focused on continuing and expanding outreach to K-12 classrooms, especially through science teachers. Since 1990 the highly successful Frontiers in Physiology Summer Research Fellowship has worked with more than 400 middle and high schools science teachers from across the nation.

The APS also conducts an annual EB workshop for high school teachers and students and trains and supports Local Outreach Teams to provide effective professional development for science teachers in their communities and regions. Nearly 30 teams have been trained over the past 12 years, and many continue to work with teachers in their communities each year.

Most recently, a new K-12 initiative, Physiology Understanding Week, was pilot tested and will launch nationwide in fall 2007. This annual national event focuses on physiology awareness and understanding. The event encourages physiologists to visit a local school or classroom and give an interactive demonstration about some area of physiology.

Some Committee activities span the educational levels. The APS Archive of Teaching Resources is a database-driven, digital library with standardized metadata. The Archive serves as a model of a digital library that shares metadata with the National Science Digital Library Pathways Portal to the Life Sciences, the BioSciEd Net Portal. It also serves as a model of a professional society digital library that shares its cyberstructure with smaller societies. A number of significant milestones in 2001-2006 contributed to the development of the Archive in the areas of infrastructure, populating the database, and building productive partnerships.

In 2004, members of the Education and ACE Committees developed a policy statement and rationale that describes how the use of animal laboratories provides a unique and effective educational experience for physiology education at all levels. Both the policy statement and rationale were released in summer 2005 and received considerable publicity both from K-12 and undergraduate educator organizations and publications.

In summary, the APS Education Committee has worked to develop a comprehensive set of programs that address the 2000 Strategic Plan charge to "...promote awareness, understanding, and education in physiology at all levels." In 2006, the Committee turned its focus on the new Strategic Plan charge to "enhance the future of the field, ensuring that next generation physiologists are supported through all stages of their careers" and looks forward to continued support for the APS for its education efforts.

Introduction

The APS Education Committee is one of the standing committees of the American Physiological Society. The Society's bylaws state that the Committee "...shall conduct such educational, teaching, and recruitment programs as may be required or deemed advisable." Over the past 6 years (2001-2006), the Committee has made significant progress in a number of areas; this report provides an overview of progress on major committee initiatives during this time.

The Committee's work was guided by the 2000 APS Strategic Plan (Table 1). Each existing and proposed activity was evaluated for its contribution to accomplishing the Strategic Plan education goal and objectives. It is important to note, however, that four other APS Committees (Careers in Physiology, Porter Physiology Development, Women in Physiology, and Trainee Advisory) also develop and oversee educational activities that address one or more of the objectives listed in Table 1. Therefore, this report does not provide a comprehensive review of all APS education programs. It also should be noted that APS Education programs are supported by a combination of APS funds and external grants. Between 2000 and 2006, the APS received more than \$5,730,000 in grants for education programs (Appendix A).

Table 1
2000 APS Strategic Plan education goal and objectives

Goal	To promote awareness, understanding, and education in physiology at all levels.
Objectives:	
1.	To promote physiology education at all educational levels.
2.	To provide effective continuing education opportunities for physiologists engaged in research and/or teaching.
3.	To promote interest in and understanding of careers in the physiological sciences.
4.	To enhance the prestige of physiology in schools, universities, and colleges.

The 2000 Strategic Plan clearly focused on providing programs and services at all educational levels. Therefore, the Education Committee targeted its efforts over the past 6 years on creating a balanced set of effective programs addressing each educational level (K-12, undergraduate, graduate/professional, and continuing education). This report will provide highlights on selected programs and projects at each level (Table 2).

Table 2
Selected program highlights, by education level

Level	Program
Continuing education	Experimental Biology refresher courses
Graduate/professional	Professional skills development
	Medical physiology course support
Undergraduate	Faculty professional development
	Undergraduate research promotion and support
K-12	Promoting excellence in science education
	High school student research promotion
Multilevel	Use of animals in teaching
	APS Archive of Teaching Resources



...creating a balanced set of effective programs addressing each educational level.



Continuing Education Programs

Refresher Courses at Experimental Biology

(www.the-aps.org/education/refresher)

The APS Education Committee and Teaching Section sponsor courses on physiology topics during Experimental Biology (EB). Courses are designed to provide both an intensive overview of content in one of the areas of physiology and opportunities to review new teaching methods and materials for physiology instruction. They are targeted especially for nonspecialists who have teaching responsibilities in the refresher course's content area. For the EB 2001-2006 refresher courses, attendees consistently gave high usefulness ratings to the presentations and print materials provided. The sessions regularly attract the nonspecialists they are designed to assist. The attendees prefer that courses focus on specific physiology content topics rather than teaching methods for the course content.

In 2001, the Education Committee felt that, while papers from the EB refresher courses are typically published in *Advances in Physiology Education*, many of the outstanding resources developed for the courses were not accessible to either those who attend or those who did not attend EB. These include PowerPoint slides and additional handouts and images. The Committee considered how to more widely disseminate these materials. Starting in 2002, presenters were asked to provide their PowerPoint files for editing and posting on the APS website and cataloguing into the APS Archive of Teaching Resources (Table 3). In 2006, the Education Office obtained software to allow the integration of audio recordings with the slides to create a dynamic and easily downloadable Flash presentation. In fall 2006, the first APS refresher course multimedia presentations were added to the website (Table 3). These can be accessed at www.the-aps.org/education/refresher/GenderDifferences.htm. The Committee plans to annually monitor the use of these online materials via web statistics and online feedback forms.

Table 3
Dissemination routes for refresher course materials

Year	Topic	<i>Advances</i> Articles	PowerPoint to Download	Macromedia Flash With Audio
2001	Endocrinology and problem-based learning	X		
2002	Neuroscience	X	X	
2003	Muscle physiology	X	X	
2004	Cellular homeostasis	X	X	
2005	Integrating genomics into physiology courses	X	X	
2006	Gender differences in physiology	X	X	X
2007	Gastrointestinal physiology	TBA	TBA	TBA

Graduate and Professional Programs

Professional Skills Development for Trainees

In 2001, the Committee began discussions on the need for key professional skills for graduate and postdoctoral students. Although there are numerous EB workshops on these topics, they reach only a limited number of students. The Committee, therefore, sought to develop web-based, self-directed mini-tutorials on topics such as presentation skills, writing, and mentoring. The inspiration for these tutorials was the highly successful Women Committees workshops at EB. The sessions are jointly sponsored by the APS and the Association for Pharmacology and Experimental Therapeutics (ASPET). These discussions led to a significant set of new programs and publications focused on the professional development of physiology trainees. A number of these efforts were led by the Education Committee, often in conjunction with other APS committees and the Association of Chairs of Departments of Physiology (ACDP).

A. APS/ACDP List of Professional Skills for Physiologists and Trainees

(www.the-aps.org/education/skills.htm)

In 2003, a working group representing three APS Committees (Education, Career Opportunities in Physiology, and Women in Physiology) and the ACDP developed a listing of skills that should be developed by trainees at the graduate, postdoctoral, and early career levels. The group was co-chaired by Robert Carroll (for APS) and William H. Danzler (for ACDP). Feedback on an initial draft was provided by APS and ACDP members as well as the APS Council. The final listing is freely accessible on the APS website.

The primary purpose of the list is to serve as a professional development tool for physiology trainees and their mentors. The listing was not designed to serve as a set of standards for graduate or postdoctoral training. In the process of becoming a physiologist, some, but not all, learning experiences are provided by graduate departments and postdoctoral employment. Others must be sought individually and customized to the specific needs of the trainee. Second, it does not represent a “one-size-fits-all” checklist for professional development. The list was developed with the wide variety of career areas that trained physiologists enter in mind. Finally, it does not provide a detailed list of the core biomedical science knowledge or laboratory techniques needed for a successful research career in physiology. These differ by the specific academic department and the specific research field and topics selected.

The listing has been widely used by individual students and mentors, lab groups, and departments. It also has served as the basis for:

- Selecting topics for EB workshops developed by APS Committees
- Selecting topics and soliciting funding for professional skills training materials and courses (see below); and
- Discussions and recommendations from the 2005 APS Strategic Planning process.

Most recently, the list was transformed to html web pages with hyperlinks provided to many of the more than 5,000 resources at the APS Careers Web (see, for example, www.the-aps.org/careers/careers1/GradProf/gintervie.htm).



...developed with the wide variety of career areas that trained physiologists enter in mind.



...developing and disseminating two live, web, and CD-ROM short courses that focus on critical professional skills

B. Trainee Member Listserv

(www.the-aps.org/committees/trainee/Traineenewsletter.htm)

In spring 2003, the Education Office launched a new e-mail listserv for APS student members, postdoctoral fellows, and other trainees to provide information and discussion options for student members of the APS. The listserv allows student members to receive notices and information of special interest to them and allows student discussions to proceed outside specific Section listservs. The listserv has proven instrumental in disseminating information on professional skills training opportunities (below), EB workshops and sessions, and activities of the Trainee Advisory Committee.

C. Professional Skills Training for Graduate and Postdoctoral Students

(www.the-aps.org/education/professionalSkills)

As noted above, in 2001, the Education Committee began developing plans for a series of web-based, self-directed mini-tutorials for graduate and postdoctoral students on key professional skills. By the end of 2002, the APS Education Office had identified a potential funding source and submitted a proposal to develop a series of interactive, online courses, using the programming structure developed for the APS' online course, Promoting Effective Program Evaluation (www.the-aps.org/education/promote/promote.html). Although the specific proposal was targeted toward minority students, the professional skills courses would provide training to diverse students in a variety of physiology and biomedical fields. The National Institute for General Medical Sciences (NIGMS) selected the proposal for funding in 2004. APS is developing and disseminating two live, web, and CD-ROM short courses that focus on critical professional skills areas: writing and reviewing for journals and presentation skills. Each course will include a strong focus on the interaction of racial/ethnic background and culture with the development of these skills. Students who complete the course(s) will:

- Improve their performance in specific professional skills areas;
- Increase their understanding of how these skills can impact career opportunities and advancement in biomedicine;
- Increase their understanding of how diversity issues, especially cultural influences and background experiences, can interact with the development of professional skills targeted by the course; and
- Increase their knowledge of resources and materials that can further assist in their development of these key professional skills.

The project is guided by an advisory board with representation from a number of APS committees, as well as past and present Council members. The Education Committee is the lead committee overseeing the project.

In 2005, two live workshops were held to field-test the skills training materials on writing and reviewing for journals. The workshops were rated as "excellent" by both the student participants and the APS members who served as speakers and instructors. The materials are now being developed into interactive, online courses. In January and March 2007, the second set of live workshops was held, focusing on poster development and presentation skills. In addition, the APS staff is working to develop the IT capability to allow APS to house these interactive courses in-house rather than at a third-party site.

Medical Physiology Course Support

A. Medical Physiology Learning Objectives

(www.the-aps.org/education/MedPhysObj/medcor.htm)

The Committee, in collaboration with the ACDP, completed the first edition of the APS/ACDP *Medical Physiology Learning Objectives* in spring 2002. These core competency criteria provide guidelines for the breadth and depth of knowledge in the physiological principles and concepts that are considered minimal and essential for further progress in understanding mechanisms of disease and body defenses. While the *Learning Objectives* are freely available online, many departments have ordered print copies for use in curriculum revision; more than 1,000 copies have been requested over the past 4 years.

The *Learning Objectives* also were used in the development of the APS Archive of Teaching Resources. Each Archive resource that is appropriate for graduate/professional level use is coded to the related learning objective. Therefore, Archive users can search by specific learning objectives to identify resources to allow them to more effectively teach these critical concepts.

The *Learning Objectives* are not static. The ACDP is coordinating a periodic review of the topics and regular updates to ensure that the objectives represent current concepts. The renal, fluid balance, and acid-base objectives were updated in January 2005, and the cardiovascular and respiratory objectives were updated in August 2006. Members from related APS Sections are being asked to provide updates for their related objectives.

B. Develop Resource Site for Medical Physiology Course Directors

(www.the-aps.org/education/course_director1)

In 2001, the Committee, in collaboration with the ACDP, began discussions about an online resource site for medical physiology course directors that could be available through the "Members Only" section of the APS website. The APS Council authorized funds for the development of a template in 2004. The goal of the website is to support excellence in medical physiology education and, in particular, to provide resources for its members who play an integral role in the development and coordination of medical physiology courses. The website includes resources in 10 major areas:

- Course administration
- APS/ACDP *Medical Physiology Learning Objectives*
- Teaching methods and materials
- Content resources
- Assessment of students
- Evaluation of course
- Curriculum design
- Course director roster
- Educational meetings and conferences
- Faculty development resources

Course directors met at both the International Union of Physiological Sciences (IUPS)/EB 2005 and EB 2006 meetings to discuss the website content and accessibility. The group has asked to meet regularly at EB to discuss both the website and other issues that arise concerning medical physiology education.



...provide guidelines for the breadth and depth of knowledge in the physiological principles and concepts that are considered minimal and essential...



Undergraduate Programs

Supporting Undergraduate Faculty Development

The APS has coordinated a number of projects to provide professional development opportunities for undergraduate faculty. In 2001-2006, the Education Committee focused on working with other professional societies such as the Human Anatomy and Physiology Society (HAPS), Society for the Advancement of Chicanos and Native Americans in Science (SACNAS), National Association of Biology Teachers (NABT), and Council for Undergraduate Research (CUR) to provide professional development through presentations/workshops and teaching resources through exhibits.

A. Human Anatomy and Physiology Society (HAPS)

The Committee works most closely with HAPS, providing a keynote speaker at the HAPS annual meeting. APS speakers focus on updates in physiology research and biomedicine for the 2- and 4-year faculty who are the primary members of HAPS. Recent APS keynote speakers have included:

Table 4
APS sponsored keynote speakers at HAPS annual meetings, 2001-2006

Year	Speaker	Topic
2001	Alfred Bove, Temple University School of Medicine	Deep sea diving physiology
2002	Barbara Horwitz, University of California, Davis	Obesity/endocrinology
2003	Withrow Gil Wier, University of Maryland	Muscle physiology
2004	Paul Kubes, University of Calgary	Inflammatory response
2005	Paul Quinton, University of California-San Diego	Cystic fibrosis
2006	Robert Carroll, East Carolina University School of Medicine	Temperature regulation

B. Explorations in Biomedicine

(www.the-aps.org/education/expl)

The APS' 8-year collaboration with the American Indian Research Opportunities consortium (Montana State University and the Tribal Colleges of Montana) has been supported by grants from the NIGMS. Explorations holds dynamic fall retreats for Tribal College faculty and middle and high school teachers from reservations across Montana to learn about both best practices in teaching and the latest in physiology research, especially on issues of particular interest to Native Americans. This program is ending in 2007.

C. Physiology Insights

(www.the-aps.org/education/PhysInsts/dc)

With support from the National Science Foundation (NSF), the APS sponsored a series of undergraduate faculty development workshops. These were held starting with EB 2000 in San Diego. The 2000-2001 workshops included:

- Online Resources for Undergraduate Life Sciences: Finding Them, Using Them, September 2000, Warrenton, VA. Coordinated by Marsha Matyas & Alta Wallington, APS and Yolanda George, AAAS. Cosponsored by the APS and AAAS.

- Teaching Physiology: Updating Pedagogy and Content, September 2000, Chicago, IL. Coordinated by Joel Michael, Rush Medical College, Harold Modell, Resources for Computers in Life Science Education, and Mary Pat Wenderoth, University of Washington. Cosponsored by the APS and Rush Medical College.
- Physiology Insights at Experimental Biology 2001, April 2001, Orlando, FL. Coordinated by Marsha Matyas with Dee Silverthorn, Univ. of Texas – Austin and Penny Hansen, Memorial University Faculty of Medicine, Newfoundland.

Supporting Undergraduate Student Research in Physiology

The APS Career Opportunities in Physiology Committee coordinates the Society's flagship program for engaging undergraduate students in physiology research. Since 2001, the Education Committee also has developed a number of programs that build upon the success of the APS Undergraduate Summer Research Fellowship.

A. The David Bruce Awards for Undergraduate Research

(www.the-aps.org/awards/student/bruce.htm)

David Bruce (1939 – 2000) served as Chair of the APS Teaching Section and as a professor of physiology at Wheaton College from 1978-2000. Dr. Bruce was a dedicated physiology educator who played active roles in both the APS and HAPS. As an undergraduate educator at Wheaton College, Dr. Bruce had a particular interest in engaging undergraduate students in scientific research. He not only encouraged and supported his students in participating in research, but he also regularly brought undergraduate students to the EB meeting, often to present their research findings. In 2000, Dr. Bruce died at the age of 61 of complications following a kidney transplant.

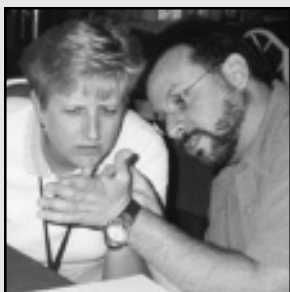
In 2001, the Committee proposed the David Bruce Awards for Undergraduate Research to honor Dr. Bruce's commitment to promoting undergraduate involvement in research, in the APS annual meeting, and, ultimately, in research careers. The Council approved the awards, to be presented annually at EB to up to four undergraduate students who have submitted both abstracts for the meeting and award application materials. The first awards were made at EB 2004. Listings of finalists and awardees can be found at the APS website.

B. The EB Undergraduate Research Poster Session

At EB 2004, the Education Committee coordinated the first APS Undergraduate Research Poster Session. All undergraduate students who were presenting posters as first authors were contacted and invited to present their posters at a special session held on Sunday afternoon. This time was selected because many of the undergraduates are not able to stay for the entire EB meeting and often have to leave Sunday evening to return to classes. The session proved to be a great success both for the 87 students and the more than 100 APS members who attended. As a result, the Council approved this as an annual EB event. In subsequent years both the number of students and attendees has grown, with 125 undergraduate posters presented to more than 200 attendees in 2006. Program enhancements have included: providing a mini-program with each student's



...to honor Dr. Bruce's commitment to promoting undergraduate involvement in research, in the APS annual meeting, and, ultimately, in research careers.



...developing a set of strategies to increase exposure of undergraduate students to physiology.

name, affiliation, and abstract title to all attendees; giving each student an “Undergraduate Researcher” banner to place on their poster at the regular poster session; giving each student a special APS “Physiology Researcher” pin; and providing opportunities for graduate departments to help sponsor the session and have an information table to share information on their programs.

C. Explorations in Biomedicine Undergraduate Retreat (www.the-aps.org/education/expl)

In June 2006, the APS held its first undergraduate student retreat. The Explorations in Biomedicine Undergraduate Physiology Retreat attracted 40 undergraduates from across the US, including Alaska. The workshop was especially designed to attract Native American and other minority students. APS members in various physiology careers came to give plenary talks, lead hands-on laboratories, and meet students in small groups to discuss career opportunities in physiology. Student evaluations were very positive, suggesting this as a possible undergraduate outreach activity in the future.

Initiative to Increase Undergraduate Programs in Physiology

In 2004, the APS Council began discussions on how to not only increase the pool of applicants interested in pursuing graduate training in physiology, but also to increase the overall “presence” of physiology at the undergraduate level. The Society had already established a summer research program in physiology and undergraduate research awards; these strategies capitalized on the clear relationship between undergraduate research experiences in a field and student interest in related graduate studies and careers. However, the Council wanted to explore options for extending its impact beyond the number of students it could reach through these programs. Toward that end, the Council charged the Education Committee with developing a set of strategies to increase exposure of undergraduate students to physiology. These may include but are not limited to:

- Increasing the number of undergraduate institutions that offer physiology as a major, focus, or minor/concentration; and
- Developing methods and materials to facilitate partnerships between medical physiology departments and undergraduate life sciences/biology departments to add new physiology courses or enrich existing courses.

Toward this end, the Education Committee and ACDP formed a working group to explore options and present possible activities to Council.

A. APS List of Institutions Granting Degrees in Physiology

(www.the-aps.org/education/degrees)

The group’s initial work focused on updating the APS’ list of institutions that grant degrees in physiology. This listing had been provided in print and then in PDF format for a number of years. However, the Committee and staff worked to both update the information and convert the listing to a searchable online database where new institutions can be easily added and current information quickly updated.

B. Undergraduate Physiology Brainstorming Summit

Most recently, the working group convened an Undergraduate Physiology Brainstorming Summit in Bethesda, MD in September 2006. Attendees included faculty from 2- and 4-year colleges, universities, medical schools, and historically minority institutions. The Summit focused on:

- Identifying existing models of physiology instruction, undergraduate physiology majors and minors, and collaborations between medical/graduate school departments and undergraduate departments;
- Brainstorming new models for promoting an increased physiology “presence” at undergraduate institutions, as well as supporting excellence in physiology education in existing courses; and
- Setting initial priorities for APS’ role in supporting undergraduate physiology education.

The two-day meeting included excellent discussions and the generation of a significant list of ideas. In addition, the Summit participants were interested in continuing work with the APS, as a group, to move the undergraduate agenda forward. The Education Committee is developing a report on the Summit to be presented to the APS Council in spring 2007 and an article to be submitted to *Advances in Physiology Education* in the spring.





...deepening the understanding of both teachers and students of how biomedical research is done and how animals are used in research.

Precollege (K-12) Programs

APS Frontiers in Physiology Summer Research Program

(www.the-aps.org/education/frontiers)

Since 1990, the APS Summer Research Program has worked with more than 400 middle and high schools science teachers from across the nation:

- Engaging them in biomedical research;
- Building connections at the local level between teachers, students, and researchers;
- Improving the teaching methods and curricular materials used by the teachers; and
- Deepening the understanding of both teachers and students of how biomedical research is done and how animals are used in research.

The outstanding evaluations of this program have led to multiple federal grants from the NSF and the National Institutes of Health (NIH). Member support for this program continues to be strong, with many members volunteering to host teachers in their laboratories and to provide the needed lab materials and supplies for their research. Many members also provide partial stipend or travel support for the teacher. At EB 2001, Robert D. Foreman, University of Oklahoma Health Sciences Center, was honored for hosting six teachers between 1993 and 2000. Dr. Foreman's first Summer Research Teacher, Bob Melton, went on to become the President of the Oklahoma Science Teachers Association and has been a strong advocate both for the APS programs and for the use of animals in the teaching of life sciences.

APS members also are using the program to enhance their own local outreach. George Tempel at the Medical University of South Carolina, with NSF funding, sponsored several teachers in the program in 2002-2004. The University of Texas Health Science Center-San Antonio coordinated its new physiology master's degree program for high school science teachers with an APS summer research fellowship.

It is important to note that this program has served as the basis for much of APS' grassroots outreach to K-12 classrooms. The outreach has not only been through the teacher fellows themselves but also by developing local, regional, and national networks of physiologists and K-12 educators who want to improve science education. These networks have allowed the development of the Local Outreach/Local Site Teams programs and Physiology Understanding Week (see below).

EB Workshop for High School Teachers and Students

Each year during EB, the APS invites local/regional high school teachers and their students to attend a special day-long workshop designed to introduce them to physiology research and careers and to help them experience the excitement of sharing science at the EB meeting. The morning session includes a special keynote speaker (Table 5) and a career panel comprised of APS members, both new and experienced. At lunchtime, students and teachers form small groups and are joined by APS volunteers who have lunch with their group and take them on a tour of the exhibits and posters. Many students comment on their evaluation form that they are amazed that a physiologist would want to take time from the meeting to visit with them. In the afternoon, students have a separate

workshop where they do experiments on flow rates through tubing, deriving Poiseuille's law through experimentation. The workshop annually draws more than 50 teachers and 100 local students. In most years, more requests for spaces at the workshop are received than can be accommodated.

Table 5
**Keynote speakers at EB high school teacher/
student workshops, 2001-2006**

Year	Speaker	Topic
2001	Anne E. Kwitek Black Medical College of Wisconsin	Physiological Genomics in High Blood Pressure: SNPs, Chips, and Salty Potato Chips
2002	Susan Glueck Boston Brigham & Women's Hospital – & deputy editor, <i>Physiological Genomics</i>	When I Grow Up, I Want to Clone Piglets: Fun Explorations of the Post-Genomic Era
2003	John B. West UC-San Diego, School of Medicine	High Living: Physiology Studies on the Summit of Mt. Everest
2004	Gregory L. Florant Colorado State University	To Be Fat and Fit: Lessons About Food Intake, Insulin, and Obesity From Mammalian Hibernators
2005	No workshop – IUPS meeting	
2006	James A. Pawelcyk Penn State University & former NASA payload specialist astronaut	What Price a Martian? Human Limits to Exploring the Red Planet

Local Outreach Teams and Local Site Teams

(www.the-aps.org/education/lot)

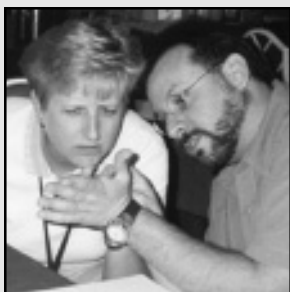
Support from the Frontiers in Physiology grants has also allowed the APS to train and support Local Outreach Teams to provide effective professional development for science teachers in their communities and regions. Nearly 30 outreach teams have been trained over the past 12 years, and many continue to work with teachers in their communities each year. Most recently, two APS physiologists (Nancy R. Stevenson, Department of Physiology & Biophysics, UMDNJ-Robert Wood Johnson Medical School and Janet E. Steele, Department of Biology, University of Nebraska at Kearney) have developed active Local Outreach Teams.

Grant support and APS member involvement also have allowed the development of new materials; teams now have proven workshop materials on topics such as cardiovascular physiology, neurophysiology, cell structure and function, the sense of taste, the sense of touch, bacterial contamination in organically grown foods, environmental influences on human health, and experimenting with natural dyes in Native American art. Each of these units has been field-tested and reviewed for scientific accuracy, and all include an Internet component. Several of them are entirely interactive, online units that are available to teachers nationwide through an APS collaboration with the University of California – Berkeley's Project WISE website.

Some Local Outreach Teams seek to coordinate more extensive outreach activities; these are designated as Local Site Teams. With support from the National Center for Research Resources (NCRR), the APS has developed training methods and support materials for Frontiers in Physiology Local Site Teams. These teams have paid time for a lead faculty member and teacher coordinator to build a local team of teachers and researchers and



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provide annual workshops for elementary, middle, or high school science teachers. Currently, four Local Site Teams are conducting workshops for teachers in their regions (Table 6).

Table 6
Frontiers in Physiology Local Site Teams, 2003-2006

Site	Team Leader/Institution	Target Audience
Indianapolis, IN	C. Subah Packer Indiana University School of Medicine	High school
Vermillion, SD	Barbara Goodman University of South Dakota School of Medicine	Middle and high school
Louisville, KY	Irving Joshua University of Louisville Health Sciences Center	Middle and high school
Birmingham, AL	Dale Benos University of Alabama at Birmingham	Elementary school

APS Awards at the International Science and Engineering Fair

(www.the-aps.org/education/isef)

The Intel International Science and Engineering Fair (Intel ISEF) is the World Series of science competitions. Held annually in May, the Intel ISEF brings together over 1,200 students from 41 nations to compete for scholarships, tuition grants, internships, scientific field trips, and the grand prize: a trip to attend the Nobel Prize Ceremonies in Stockholm, Sweden. Science Service founded the ISEF in 1950. APS participates as a Special Awards Sponsor for ISEF. Each year, the APS recognizes outstanding high school research projects in life sciences. Four students receive cash awards and a year's subscription to *Physiology*. In addition, the judging team can award a year's subscription to *Physiology* to additional finalists who have outstanding physiology projects. Each year, a member of the Education Committee coordinates a team of local APS members to select awardees. A listing of APS award winners for 2001-2006 is provided in Table 7.

Table 7
APS winners at ISEF, 2001-2006

Year	Student	Project Title
2001	1 st : Angela Catherine Lee, Brooklyn, NY	Group I Metabotropic Glutamate Receptors in Epilepsy
	2 nd : Eugenia Chum, Evans, GA	Neuroprotection and Neurotransmitter Release by a Dopamine D3 Receptor Agonist
	2 nd : Effie M. Wang, Louisville, KY	Pulmonary Function by Hypoxic Preconditioning Involves eNOS and MCT1
	2 nd : Alan Robert Stern, Great Neck, NY	Rage and Cellular Perturbation in Alzheimer's Disease
2002	1 st : Jennifer Oakley Tshorn, Katonah, NY	Action of Indole-3 Carbinol in Breast Cancer
	2 nd : Philippe Bouchard, Birmingham, AL	The Role of Osteopontin Gene Expression on the Vasoprotective Effects of Estrogen on Vascular Injury
	3 rd : Elizabeth K. Tronsor, Ephrata, PA	Quercetin, a Nitric Oxide Inhibitor in Raw 264.7 Cells
	3 rd : Megan Clarke Roberts, Carlisle, PA	Effect of FGFR and EFGR Antibodies on the Growth Rate of HL-60 Cells

2003	1 st : Irene Yuan Sun, Indianapolis, IN	Gene Expression Analysis of Synovial Cells in Response to Impulsive Shock
	2 nd : Daniel Jacob Sachs, Katonah, NY	Simvastatin Activation of Ryanodine Receptor-Mediated Calcium Channels May Promote Myolysis
	3 rd : Anila Madiraju, Montreal, Quebec	Silencing Cancer With RNA
	3 rd : Truc Thanh Pham, Riviera Beach, FL	Effect of Age on B-Cell Responsiveness to Stromal Cell-Derived Factor-1 (SDF-1) and B-Lymphocyte Chemoattractant (BLC)
2004	1 st : Alison Jaye Landstrom, Beaverton, OR	The Effects of the Relaxin Hormone on the Laxity of Male and Female Anterior Cruciate Ligament Tissue, In Vitro
	2 nd : Samuel Finlayson, Danville, CA	Effect of Chlorine on Lung Function of Outdoor Swimmers
	3 rd : John Zeqi Luo, Warwick, RI	Alternative Medicine, A Relief for Diabetes, Phase 3
	3 rd : Jason Scott Pellegrino, Manhasset, NY	Analysis of Metformin's Effect on Brain Insulin Receptors
2005	1 st : Sarah S. Mousa, Greenbush, NY	Implications of Nicotine's Pro-angiogenesis Activity
	2 nd : Yahya Mohammed, Niceville, FL	Ascorbic Acid Induced Enhancement of Laminin in Schwann Cells: Application for Peripheral Nerve Regeneration
	3 rd : Ketaki Rawal, Greenfield Park, Quebec	Saliva, the Stress Code
	3 rd : Lauren Toub, Anjuli Kannan (team project), Yorktown Heights, NY	The Possible Role of Bone Morphogenetic Protein in the Effect of the Choroid Plexus on Cortical Neurons
2006	1 st : Jonathan Blake Sellon, Westport, CT	Modeling Auditory Attention by Implementing IHC Movement Into Frequency Selectivity of the Inner Ear: A Novel Approach to Stimuli Separation
	2 nd : Sarah S. Mousa, Greenbush, NY ¹	Cellular and Molecular Mechanisms of Nicotine's Pro-angiogenesis Activity: Potential Impact on Disease Processes
	3 rd : Sabrina Lakshmi Prabakaran, Fort Myers, FL	Treatment of Age-Related Macular Degeneration: Effect of Intraocular Steroid on Choroidal Neovasculation and Vitreal Vascular Endothelial Growth Factor Level
	3 rd : Sheel Tyle, Pittsford, NY	Impact of Muller Cell Reactivity During Retinal Degeneration



...this interaction of physiologists with K-12 students is vital to increasing their understanding and appreciation of what physiology is and what physiologists do.

Physiology Understanding Week ("PhUn Week")

(www.phunweek.org)

In 2001, the Education Committee was considering ways to increase and expand the resources that APS members find online for doing outreach presentations at both K-12 and undergraduate institutions. By 2005, the Committee had developed a plan for pilot testing a proposed annual national event focusing on physiology awareness and understanding. The event, modeled after the Society for Neuroscience's successful "Brain Awareness Week," would encourage physiologists to visit a local school or classroom and give an interactive demonstration about some area of physiology. The Committee believes that this interaction of physiologists with K-12 students is vital to increasing their understanding and appreciation of what physiology is and what physiologists do. The Committee's concept echoes Bruce Alberts' 2005 call for "hundreds of thousands of 'citizen scientists,' who devote at least part of each week to spreading an understanding of science, its methods, and its values to non-scientists."²

¹ In 2005, Ms. Mousa presented her research using a chick egg angiogenesis model and cultured epithelial cells to examine growth-promoting effects of nicotine. After receiving a patent for her 2005 work, Ms. Mousa extended her research to examine the mechanism of the angiogenic effect of nicotine including using antagonists to determine the signaling pathway of nicotine in cultured endothelial and epithelial cells.

² From Bruce Alberts' farewell address as president of the National Academy of Sciences, May 3, 2005.



The APS Council approved pilot testing of the program in both 2005 and 2006 with plans for a national launch in fall 2007. The first program theme is exercise and cardiovascular physiology, capitalizing on the many program resources developed through the Frontiers in Physiology program. External funding is being sought to partially support materials development and publicity in future years.



Multilevel Programs

APS Archive of Teaching Resources

(www.apsarchive.org)

The APS Archive was originally envisioned by the Committee as a set of web pages where APS members could share teaching resources that they had developed. As the concept of digital libraries developed, the Committee proposed that the scope of the project be expanded to develop a full, database-driven, digital library with standardized metadata. With support from the APS and the NSF, this goal has been not only realized, but far surpassed. At the present time, the APS Archive contains nearly 1,000 peer-reviewed teaching resources and serves as a nationwide model, sharing metadata with the National Science Digital Library Pathways Portal to the Life Sciences, the BioSciEd Net (BEN) Portal. It also serves as a national model of a professional society digital library that shares its cyberstructure with smaller societies. A number of significant milestones in 2001-2006 contributed to the development of the Archive in the areas of building infrastructure, populating the database, and building productive partnerships.

A. Infrastructure Milestones

- The collaborative development of the database structure, metadata variables, and controlled vocabularies that correspond with international digital library standards; this ensures that the Archive will be able to share data with other digital libraries now and in the future.
- The development of online submission, review, and activation tools to allow for easy submission and review.
- The development and implementation of *My Archive* features that allow users to save search parameters and results, share them with colleagues, and be notified of new materials that match their search parameters.

B. Database Population Milestones

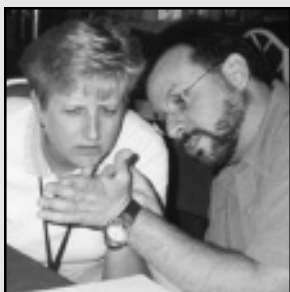
- Development of review criteria and procedures, training materials for reviewers, and recruitment and training of review panels.
- Cataloguing existing APS resources (*Advances in Physiology Education* articles, *Physiology in Medicine* articles, *Physiology* articles, Education Office resources, Refresher Course materials, etc.)
- Recruiting and reviewing submissions from APS members and other physiology educators.

C. Productive Partnerships Milestones

- Promotion of Archive use and submissions via national and international presentations at, for example, HAPS, NABT, CUR, EB, IUPS, International Society of Pathophysiology, International Association for Medical Science Education (IAMSE), SACNAS, and MERLOT.
- Working with AAAS and each of the BEN partners on the development of the BEN Portal to Life Sciences Resources (www.biosciencednet.org) and the selection of BEN as the National Science Digital Library (www.nsdli.org) Pathways to the Biological Sciences.
- Recruitment of four partner societies to contribute materials to the Archive (HAPS, IUPS, Society for Developmental Biology, and the National Association for Health and Science Education Partnerships).



...the APS Archive contains nearly 1,000 peer-reviewed teaching resources and serves as a nationwide model, sharing metadata with the National Science Digital Library Pathways Portal to the Life Sciences, the BioSciEd Net (BEN) Portal.



...well-designed animal laboratories provide vivid, exciting opportunities for the direct study of how living systems work.

- Publishing abstracts of recent Archive submissions in *Advances in Physiology Education*, giving submitters academic credit for their contributions.
- Successfully solicited more than \$424,000 in NSF funding, in collaboration with BEN partners.

Use of Animals in Teaching

(www.the-aps.org/pa/resources/policyStmnts/paPolicyStmnts_teaching.htm)

With Council approval, members of the Education and Animal Care and Use (ACE) Committees developed a policy statement and rationale that describes how the use of laboratories, specifically including animal laboratories, provides a unique and effective educational experience for physiology education at all levels. The policy statement was accepted by Council at its fall 2004 meeting. The rationale was completed by Robert Carroll following the Council Meeting, and Alice Ra'anan's overview of the significant body of educational research on animal use was accepted for publication in *Advances in Physiology Education*. Both the policy statement and rationale were released in summer 2005 and received considerable publicity both from K-12 and undergraduate educator organizations and publications. These materials proved useful as a basis for responding to a Physicians Committee for Responsible Medicine (PCRM) challenge of animal use in education in Milwaukee in March 2006, and in responding to a PCRM letter to the Animal and Plant Health Inspection Service (APHIS) in May 2006.

Table 8
APS position statement on the use of animals in teaching

The study of living systems is an essential component of physiology instruction. Teaching laboratories that actively engage students in observation of and interaction with living systems enhance student understanding of physiology, providing experiences that are qualitatively and quantitatively different from those gained through lecture, small group discussion, or multimedia presentations. In addition, the active participation and discovery learning opportunities provided by teaching laboratories allow students to hone independent and life-long learning skills such as analytical and problem-solving skills. The hands-on approach used in laboratories offers active learning opportunities for all students, whether they be strong visual, auditory, or kinesthetic learners. These advantages significantly outweigh the drawbacks of limited curricular time and facilities as well as potentially greater costs and increased resources required for regulatory compliance for laboratories involving human or animal subjects.

Whether working individually or in groups, well-designed animal laboratories provide vivid, exciting opportunities for the direct study of how living systems work. Not only do these lessons foster active learning and the development of critical thinking skills in students, but they provide a unique opportunity for students to develop a lasting appreciation of the complexity of living systems and an abiding respect for living organisms. Animal laboratories should be offered for valid educational reasons, where the use of the laboratory builds important knowledge, skills, and/or attitudes. Instructors who incorporate animal laboratories into their course or curriculum must ensure that the students are appropriately prepared for the experience and that the laboratory is conducted humanely. The American Physiological Society is committed to the continuing development of resources that enhance the student laboratory experience for all types of learners. A description of various laboratory options is included in the rationale document supporting this position statement.

Adopted by the APS Council, November 2004

Published in *The Physiologist* (August 2005 Vol. 48, No. 4, p. 206-208.)

Setting a Course for the Future

The Education Committee was pleased to be involved in the 2005 APS strategic planning process, offering input before, during, and after the Strategic Planning meeting. As with the 2000 Strategic Plan, the Committee has already begun to use the 2006 APS Strategic Plan as a guide to the development and expansion of education activities for the Society. Specific directions and strategies that relate to the Committee's work are detailed in Table 9.

Table 9
2006 APS Strategic Plan directions and
strategies related to Education Committee charge

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1. APS will be the leader in advancing the life sciences that investigate biological function.
 2. APS will enhance the future of the field, ensuring that next-generation physiologists are supported through all stages of their careers.
 - a. Support trainees and early career physiologists in career development and transitions to help them become successful and competitive physiologists
 - b. Increase the visibility and presence of physiology in undergraduate education
 - c. Continue to develop and expand K-12 outreach by strengthening member involvement in K-12 education and supporting high school teachers
 3. APS will drive understanding of and appreciation for physiology and strengthen public and private support.
 - a. Strengthen and expand existing programs, and create new approaches to enhance public awareness of the physiological sciences
 4. APS will be dynamic and relevant to an increasingly diverse and global membership.
 - a. Utilize new technologies to enhance the appeal of, and access to, scientific meetings, publications, and programs for diverse members
 - b. Broaden APS membership to embrace a wider variety of constituencies in the life sciences, creating new membership categories if needed
 - c. Develop a global discourse on physiology and support international members
 5. APS will be a mission-directed, adaptable, and fiscally sound organization.
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Acknowledgments

The projects described in this report resulted from an extraordinary committee, an exceptionally supportive environment, and a phenomenal staff. The members of the Education Committee organize and execute the projects with support from the APS Education Office and other committee members. The diversity of committee members' interests and expertise allows members to find a "niche" in the wide list of APS educational projects. The APS Council has generously allocated fiscal and material support but, more importantly, provided direction and encouragement throughout the past 6 years. The Education Office leadership and staff put a very welcome face on all of the Education Office activities as they organize meetings, workshops, and projects of exceptional quality.

**Appendix A:
External Funding for
Education Committee Activities,
2001-2006**



APS Education Office: External Funding 2001-2006

Title	PI	Award Inst.	Start Date	End Date	Funder	APS Award	Project Goal
Conference Fellowship for Minority Physiologists	Frank	APS	2000	2005	NIDDK	\$588,705	Provide the opportunity for minority students and scientists to attend the meetings of the APS.
Further Explorations in Biomedicine	Matyas	APS	2000	2006	NIGMS Marc	\$1,133,962	Increase Native American students' interests in and preparedness for scientific studies & careers.
Expanding Frontiers: Integrating Inquiry, Equity, & Technology	Matyas	APS	2000	2005	NCCR-SEPA	\$810,000	Provide summer research experiences for middle & high school science teachers and create grassroots outreach teams of teachers and researchers.
BioSci Ed Net I	Matyas	APS	2000	2002	NSF-DUE	\$136,754	Develop an interactive online portal for the dissemination of undergraduate teaching resources developed by partnering organizations.
BioSci Ed Net II	Matyas	AAAS	2002	2004	NSF-DUE	\$100,000	Expand and enhance an interactive online portal for the dissemination of undergraduate teaching resources developed by partnering organizations.
MicroMatters	Matyas	Baylor College of Medicine	2003	2008	NCCR-SEPA	\$43,200	Develop & disseminate high-quality education materials, focusing on infectious disease, including HIV/AIDS. Target: middle school.
PAESMEM Award	Frank	APS	2003	2004	NSF	\$10,000	Presidential Award for excellence in mentoring. Funds contributed to Porter program.
Frontiers in Physiology: Local Site Model	Matyas	APS	2003	2006	NCCR-SEPA	\$939,514	Continue the APS Summer Research Program and develop it into a site model that can be used by physiology departments.

Title	PI	Award Inst.	Start Date	End Date	Funder	APS Award	Project Goal
Physiology for the 21st Century	Matyas	U of TX - Austin	2004	2007	NSF-DUE	\$76,740	APS is collaborating with IUPS Teaching Section to develop and disseminate high-quality physiology experiments for undergraduate education, adapted from older APS materials. The APS will 1) host the project website, 2) conduct the project evaluation, and 3) publish the materials at the APS Archive of Teaching Resources.
Science of Alcohol	Matyas	Baylor College of Medicine	2004	2006	NCRR-SEPA	\$12,000	Develop and disseminate education materials, focusing on the physical, chemical, and biological effects of alcohol.
Planning an Effective Program Evaluation: NSBRI Projects	Matyas	APS	2005	2005	NSBRI	\$39,559	Provides training in evaluation methods for NSBRI educational grants awardees.
Professional Skills for Minority Students: Interactive & Online Development Tools	Matyas	APS	2005	2008	NIGMS Marc	\$983,466	Develop interactive, online professional skills tutorials for graduate students with a specific focus on issues related to underrepresented minority students.
Conference Fellowship for Minority Physiologists	Frank	APS	2005	2010	NIDDK	\$670,611	Provide the opportunity for minority students and scientists to attend the meetings of the APS.
BioSciEd Net 3: Pathways Project	Matyas	AAAS	2005	2009	NSF-DUE	\$187,588	Add materials to the APS Archive & provide undergraduate faculty professional development.

Appendix B: Education Committee Members, 2001-2006



APS Education Committee Members, 2001-2006

Robert G. Carroll, Ph.D., Chair	Brody School of Medicine at East Carolina Univ.	Greenville, NC
Mouhamed S. Awayda, Ph.D.	SUNY at Buffalo	Buffalo, NY
Joseph N. Benoit, Ph.D.	Univ. of North Dakota	Grand Forks, ND
Martha L. Blair, Ph.D.	Univ. of Rochester School of Medicine	Rochester, NY
J. Thomas Cunningham, Ph.D.	Univ. of Missouri	Columbia, MO
Jeffery R. Demarest, Ph.D.	Juniata College	Huntingdon, PA
Peter A. Farrell, Ph.D.	East Carolina Univ.	Greenville, NC
Jeffrey C. Freedman, Ph.D.	SUNY Upstate Med Univ.	Syracuse, NY
Barbara E. Goodman, Ph.D.	Univ. of South Dakota School of Medicine	Vermillion, SD
Meredith M. Hay, Ph.D.	Univ. of Missouri	Columbia, MO
Cheryl M. Heesch, Ph.D.	Univ. of Missouri	Columbia, MO
Robert L. Hester, Ph.D.	Univ. of Mississippi Medical Center	Jackson, MS
William F. Jackson, Ph.D.	Michigan State Univ.	East Lansing, MI
Nancy L. Kanagy, Ph.D.	Univ. of New Mexico	Albuquerque, NM
Robin C. Looft-Wilson, Ph.D.	College of William & Mary	Williamsburg, VA
Diane H. Munzenmaier, Ph.D.	Medical College of Wisconsin	Milwaukee, WI
George A. Ordway, Ph.D.	Univ. of Texas Southwestern Medical Center	Dallas, TX
Jeffrey L. Osborn, Ph.D.	Univ. of Kentucky	Lexington, KY
Jennifer S. Pollock, Ph.D.	Medical College of Georgia	Augusta, GA
Thomas A. Pressley, Ph.D.	Texas Tech Univ. Health Science Center	Lubbock, TX
P.K. Rangachari, MBBS, Ph.D.	Univ. of Calgary	Calgary, Alberta
Michael F. Romero, Ph.D.	Case Western Reserve Univ.	Cleveland, OH
Whitney M. Schlegel, Ph.D.	Indiana Univ. School of Medicine	Bloomington, IN
Thomas J. Schmidt, Ph.D.	Univ. of Iowa, College of Medicine	Iowa City, IA
Virginia L. Shepherd, Ph.D.	VA Medical Center/Research Service	Nashville, TN
Dexter F. Speck, Ph.D.	Univ. of Kentucky College of Medicine	Lexington, KY
Richard C. Vari, Ph.D.	Univ. of North Dakota School of Medical & Health Sciences	Grand Forks, ND
Walter F. Ward, Ph.D.	Univ. of Texas Health Science Center at San Antonio	San Antonio, TX
L. Britt Wilson, Ph.D.	Univ. of South Carolina School of Medicine	Columbia, SC
John G. Wood, Ph.D.	Univ. of Kansas Medical Center	Kansas City, KS
J. Michael Wyss, Ph.D.	Univ. of Alabama, Birmingham	Birmingham, AL



Appendix C: Education Office Staff, 2001-2006

Education Office Staff, 2001-2006

Director of Education Programs	Marsha Lakes Matyas, Ph.D. (1993-present)
Higher Education Programs Coordinator	Melinda E. Lowy (2001-present)
K-12 Programs Coordinator	Melvin Limson, Ph.D. (2006-present) Kathleen Kelly (2002-2006) Alta E. Wallington (2000-2001)
Office Manager & Minority Programs Project Assistant	Brooke Bruthers (2001-present) Scarletta Whitsett (2003-present)
Web Editor	Yang Yang (2005-present) Kesang Tshering (2004-2005) Joelle Grossnickle (2000-2004)
Office Assistant	Janet Jackson (2004-present)



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