



# Frontiers in Physiology

## Professional Development Fellowship for Teachers

[www.frontiersinphys.org](http://www.frontiersinphys.org)



The American Physiological Society

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### Six Star Science for Student-Centered Learning

The APS Frontiers in Physiology Fellowship program is built on Six Star Science, the APS research-based framework for supporting excellence in science education for diverse students. The "Six Stars" are:

- ★ **Instruction:** Student-centered instruction is at the heart of exemplary science education.
- ★ **Diversity:** Valuing diversity among students is a defining characteristic of excellence in education.
- ★ **Technology:** Integrating technology to enhance learning is particularly important in science.
- ★ **Authentic Assessment:** To be authentic, assessment must focus on both content and process skills.
- ★ **Current Content:** Utilizing accurate and timely content information is central to scientific study.
- ★ **Reflection:** Reflecting on teaching and learning is essential to maintaining excellence in education.

### Objectives

#### Frontiers in Physiology Research Teachers (RTs):

- **Experience science "in action,"** learning how the research process works and what research scientists do, and experiencing the intrinsic satisfaction and excitement of conducting scientific research.
- **Deepen their understanding and use of national and state standards** in guiding their curriculum choices.
- **Increase their use of effective science teaching strategies,** especially inquiry, diversity methods, and authentic assessment.
- **Expand their use of web-based teaching materials** and their skills in developing effective web-based materials for their own lessons.
- **Develop dynamic working relationships with physiology researchers** and with other RTs from across the nation.

### Program Activities

#### Experiencing Scientific Research

##### Conducting Physiology Research

*What do research scientists do? How do they decide which research questions to explore? How do they share their findings? How and why do they use animals in research? How do they train future scientists? How does research contribute to our understanding of diseases and how to treat them? What does it feel like to investigate a question that no one has tackled before?*

These are some of the questions that RTs explore during their Summer Research Experience. Each RT spends seven to eight weeks working full-time on a research project in a physiology research lab close to their home. RTs work closely with an APS member, as well as the graduate students and postdoctoral fellows in the laboratory group. They also participate in other professional activities such as seminars and journal clubs.

##### Sharing Research Among Scientists

The culminating event of the research experience is attending the **Experimental Biology Meeting**

in the spring. At the meeting, RTs:

- Learn about research findings presented by nearly 10,000 scientists;
- Participate in the presentation of their own research;
- Attend a full-day workshop for middle and high school teachers; and
- Are honored at a special APS luncheon.



#### Exploring Effective Pedagogy

##### Doing Professional Development Online

Because RTs hail from across the nation, most discussions and reflections are done online in partnership with the University of California-Berkeley's Project WISE website (<http://wise.berkeley.edu>). RTs participate in interactive discussions, do inquiry-based activities and reflect on their teaching via the WISE site, as well as network with fellow RTs. Online assignment topics include:

- Inquiry-based teaching and learning;
- Equity and diversity strategies;
- Effective use of technology in science teaching;
- Field-testing a new lesson;
- Transforming "cookbook" labs into student-centered labs; and
- Setting an agenda for continued improvement in the classroom.



##### Learning to Reflect

Each of the online assignments has RTs write personal reflections on their teaching. For many RTs, the reflection process has a deep and lasting impact on their teaching: *"As a summer research fellow, I was introduced to Reflection Activities for the first time. To be honest, I didn't like them at all and I only did them begrudgingly. A year later I was asked to return as a teacher trainer (instructor). As I prepared for the retreat, one of the items I reread was my reflections. Surprise, I found them to be rather informative. A number of the topics and issues I had reflected on were ones I have encountered and had to deal with. My opinion of reflections changed that day..."*

##### Attending the Science Teaching Forum

In July, RTs take a break from their research to gather for a dynamic week of exploration, sharing, and brainstorming. Fellows work with physiologists and mentor/instructors to explore and practice effective teaching methods focused on how to integrate inquiry, equity and the Internet into their classrooms. Each day includes modeling of hands-on laboratories that demonstrate the integrated lessons:

- Cardiovascular physiology (guided inquiry);
- Neurophysiology (open inquiry);
- *Betta splendens* behavior (inquiry using animals); and
- Sense of touch and taste (inquiry using an online learning environment).



#### Developing New Materials

##### Transforming Cookbook Labs

RTs work with their mentors and APS staff to transform a cookbook lab into an activity that is more inquiry-based and addresses the Six Star Science framework. The activities are field tested with students, and a mini-grant is awarded for classroom supplies. Each RT completes an online assignment to guide them through the planning and follow-up from their activity field test. Activities are published by the APS in print, on the APS website, and in the APS Archive of Teaching Resources (a part of the National Science Digital Library).

##### Producing "Bench to Bedside" Primers and Podcasts

RTs develop and produce a four-page primer that highlights their summer research project and an associated audio/video podcast by interviewing their research host. Components of the primer and podcast include a section on each of the following:

- The normal physiology of the system with which they are working;
- Disease or conditions that affect that system, particularly related to their research;
- A layperson research description of their summer work; and
- A description of clinical research that has been done or is currently underway in that particular area.

### Program Impacts

More than 400 teachers have been involved in the program since its inception in 1990. The program has grown from a simple summer research experience to a full-year professional development experience.

Evaluation data indicate that through the biomedical research experience, RTs:

- Gain important new perspectives on their students' reactions to new material;
- Increase their confidence in their understanding of what scientific research entails; and
- Gain a greater sense of authority when discussing the research process with their students.

The overall program has important impacts on RTs pedagogical choices, including:

- Improved skills and increased confidence in using inquiry-based teaching strategies;
- Increased preparedness to use technology;
- Increased use of technology with students in their classrooms;
- Increased confidence in evaluating websites; and
- Increasingly asking students to review websites used in conjunction with lessons.

Finally, many teachers in the program have used the portfolio of professional development lessons, the classroom lessons they have developed and adapted, and their field-testing activities as the basis for segments of the Board Certification process and numerous teaching awards.

#### For More Information

Information on program components and resources, applications, past participants, lessons and activities, and evaluation results are available at the program website:

[www.frontiersinphys.org](http://www.frontiersinphys.org)

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