From the President

Donald French
NABT President-2012

Collaborate with a Scientist – They Need You!

As an association dedicated to empowering educators to provide the best possible biology and life science education for all students, we encompass educators at all educational levels in both formal and informal education. Embodied in our mission is the desire to improve the teaching of biology through mechanisms and experiences that exchange scientific and pedagogical content knowledge. Because membership in NABT is open to "any person sympathetic with the purpose of the Association," we offer opportunities for dissemination to fellow professionals and the public and for creative collaborations among those working at different educational levels. As president, I know that building partnerships strengthens the association and helps broaden the impact we have on the quality of biology education. As a scientist at a university, I know that biological scientists need help from biology educators of all kinds. Let me offer my own rewarding experiences as examples.

Scientists at colleges and universities are typically seen as content experts who serve to develop the content knowledge and research skills of their students. Depending on the institution in which they work, they put more or less of their time into scientific research and the pursuit of funds to support their research. In doing so, they are used to forming collaborations with others whose expertise and resources are different from their own. For those who do pursue extramural funding, there is often an expectation that the research being done have a "broader impact" on society, and these broader-impact activities often involve working with pre-college students and teachers. Workshops and websites are common activities. Teaming graduate students with K–12 teachers has been effective (Page et al., 2011), as has providing research experiences for teachers (Silverstein et al., 2009).

Last summer, I was asked to teach a graduate course called "Current Topics in Biology for Teachers." The students enrolled in the course included masters and doctoral students and a senior, undergraduate, preservice teacher. The graduate students were in-service teachers at the middle, junior high, high school, or career and technical levels. Some were working toward careers as teacher educators; most specialized in biology. Facing such a broad topic and varied audience in a graduate-level course was daunting. What would engage them? How should I accommodate their prior knowledge, skills, interests, and areas of strength or weakness? My solution was to encourage collaborations between each student and a research scientist and to build on the students' common interest in and knowledge of teaching. Each student was to produce a grade-leveled, standards-based lesson that used research from a laboratory as the engagement and/or extension component. Each was to be supported by a teaching guide that incorporated detailed explanations of the science and science problem with appropriate reference to the scientist's published research. Each student also had to produce a flyer aimed at piquing the interests of secondary school students that each researcher could distribute to students and teachers. Our weekly meetings involved science updates and explanations driven by the students' questions about science and their critiques of lesson ideas. Final products were quite good to truly outstanding. Teachers learned about cutting-edge research, updated their content knowledge and library search and statistical skills, gained some new technology skills, and had new lesson plans. The collaborating scientists had new ways to disseminate their work and educate the public and, in some cases, began longer-term relationships with a teacher, even collaborating on the pursuit of future funding. It was clear that the scientists had not thought previously of engaging teachers in this way yet immediately saw and gained the benefit. We anticipate future similar interactions with other scientists, and it should not take a university faculty member in science or education to get this started. The teachers all contacted the faculty themselves, and I suspect that similar opportunities await others who offer to collaborate.

The other collaboration involves the introductory inquiry-based laboratory, which graduate teaching assistants (GTAs) from the life sciences teach. The secondary science teacher education program in the School of Teaching & Curriculum Leadership has always wanted preservice teachers (PSTs) to gain as much experience teaching through inquiry as possible, but is constrained by a lack of suitable secondary school classrooms nearby. So the secondary methods teacher and I entered into a collaboration in which the PSTs assist the GTAs. The PSTs get to participate in similar inquiry-based teaching experiences, observe the challenges and responses, practice their questioning and facilitating skills, and observe what incoming students are prepared to do (or not) when leaving high school (Weld & French, 2001; J. Angle, unpubl. data). Their science research skills may also improve if teaching inquiry labs affects them in the same way that it does GTAs (French & Russell, 2002; Felden et al., 2011). The GTAs benefit by having an assistant who is learning about inquiry practices and educational theory, the students benefit from two teachers, my colleague benefits from PSTs with a common experience on which to base lessons and discussion, I benefit from additional input about student thinking and obstacles to success, and my colleague and I benefit from a rich data set for investigating the development of inquiry teaching skills and improving the experience.

There are many other inter-departmental, inter-institutional, cross-level opportunities for partnerships. For example, funding limits for course innovation through the NSF-TUES program are higher for collaborations between 2-year and 4-year faculty. I am sure you have more examples, and NABT would like to hear about them and help with their dissemination, if it can (you can always contact me at dfrench@okstate.edu). This journal, our conference, and our electronic communications (News & Views, website, blog, etc.) serve as dissemination mechanisms for excellent practice and research, but because scientists at colleges and universities are familiar with the practice of and need for dissemination, they are the most frequent contributors. We would like broader participation. I encourage you to submit your ideas and maybe to seek out a colleague with more experience in authoring to help you if you feel the need. Find collaborators – we will all benefit and so will our students.

Donald P. French

Donald French
NABT President – 2012

References

Feldon, D.F., Peugh, J., Timmerman, B.E., Maher, M.A., Hurst, M., Strickland, D., Gilmore, J.A. & Stiegelmeyer, C. (2011). Graduate students' teaching experiences improve their methodological research skills. *Science*, *333*, 1037–1039.

French, D.P. & Russell, C.P. (2002). Do graduate teaching assistants benefit from teaching inquiry-based laboratories? *BioScience*, *52*, 1036–1041.

Page, M., Wilhelm, M.S. & Regens, N. (2011). Preparing graduate students for teaching: expected and unexpected outcomes from participation in a GK–12 classroom fellowship. *Journal of College Science Teaching*, *40*, 32–37.

Silverstein, S.C., Dubner, J., Miller, J., Glied, S. & Loike, J.D. (2009). Teachers' participation in research programs improves their students' achievement in science. *Science*, *326*, 440–442.

Weld, J.D. & French, D.P. (2001). An undergraduate science laboratory field experience for pre-service science teachers. *Journal of Science Teacher Education*, 12, 133–142.

DOI: 10.1525/abt.2012.74.3.1

LETTERS

I have been a high school biology teacher for 37 years and began my career before the taxonomic designations called "Domains" existed. Something that has always bothered me about the current three-domain, six-kingdom system is that it defies biological sense and common sense. Why do two of the domains have a single kingdom? That arrangement does not make sense in terms of organization and in terms of teaching. I also believe that the current system is not reflective of the biological reality.

I propose an alternative arrangement:

- Have two domains: Prokarya and Eukarya
- Prokarya would include two kingdoms: Eubacteria and Archaebacteria
- Eukarya would include four kingdoms: Protist, Fungi, Plant, and Animal

This arrangement seems to me to better meet the demands of biology and common sense.

Thomas J. Peri
Science Department
Notre Dame Preparatory School
815 Hampton Lane
Towson, MD 21286
perit@notredameprep.com

One of Mendel's seven genes in peas is the I gene on chromosome 1. Peas with at least one dominant allele, I, are yellow at maturity, whereas peas with two recessive genes, ii, are green at maturity. In the paper "Mendel's Peas and the Nature of the Gene: Genes Code for Proteins and Proteins Determine Phenotype" (Offner, 2011), I described the I gene as coding for PAO, an enzyme involved in the degradation of chlorophyll. It turns out that the situation is more complicated than this.

The I gene codes for a protein called "stay green" (SGR). The function of this protein is not known. It is not PAO, because the gene that codes for PAO has been mapped to pea chromosome 7 (Moffet & Weeden, 2005). For some unknown reason, the reaction catalyzed by PAO does not occur unless the SGR protein is present. Because ii peas do not make the SGR protein, they do not degrade their chlorophyll and they have a green phenotype. I thank Stefan Hörtensteiner for pointing out this correction. Further details of what is known about SGR function can be found in Hörtensteiner (2009).

So now, nearly 150 years after Mendel published his work, we can say that two of his genes are well understood at the biochemical level (tall/short plants; round/wrinkled peas), two are partially understood (red/white flowers; yellow/green peas), and three are not understood at all (axial/terminal flowers; inflated/constricted pods; green/yellow pods).

Susan Offner
Biology teacher
Lexington High School
251 Waltham Street
Lexington, MA 02421
soffner@ix.netcom.com

References

Hörtensteiner, S. (2009). Stay-green regulates chlorophyll and chlorophyll-binding protein degradation during senesence. *Trends in Plant Science*, *14*, 155–162.

Moffet, M.D. & Weeden, N.F. (2005). Pheophorbide a monooxygenase (Pao) is located on LG VII near Amy in pea and lentil. *Pisum Genetics*, *37*, 24–29.

Offner, S. (2011). Mendel's peas & the nature of the gene: genes code for proteins & proteins determine phenotype. *American Biology Teacher*, *73*, 382–387.

DOI: 10.1525/abt.2012.74.3.2