1. Questions(s) or issue(s) for dialogue at Learning Network Conference session:

The involvement of scientists in professional society-mediated partnerships with high school teaching colleagues can yield many benefits. One potential barrier to wider adoption of similar, national-scale programs is the fact that the workshops that initiate these relationships, by offering the professional development and building the rapport needed for partners to begin substantive collaboration, are expensive. What business model can help sustain this type of partnership-building project when the federal funding is exhausted?

The results of the GENA project suggest that a professional society can be fundamentally changed by its involvement in an MSP and can help support its members to become engaged in long-term outreach partnerships. However, the American Society of Human Genetics, as the first professional society to host an MSP, may have been atypically receptive to intra-institutional change. Other than serving as an example of what is possible, what can ASHG do—recognizing that there are limited resources and competing interests at all scientific membership societies—to encourage the adoption of similar programs by other societies? Indeed, is it reasonable to assume that a GENA-type model is exportable? If so, what are the strategies and tactics that are likely to be most successful?

2. Context of the work within the STEM education literature and within your MSP project:

The Change and Sustainability in Higher Education (CASHE) project at the University of Maryland studied how Math-Science Partnerships (MSPs) involved science, technology, engineering, and math faculty at institutions of higher learning in efforts to improve undergraduate science teaching and K-12 outreach. Among the CASHE project’s findings were: 1) STEM faculty interest in course redesign was highest for courses targeting pre-service and in-service K-12 teachers but can extend to major and general education STEM courses, especially if faculty are engaged in P-16 curriculum issues; 2) the structures and reward systems at colleges and universities typically do not reward participation in K-12 outreach; and 3) to be successful and sustainable, STEM faculty participation must be supported by administration leadership, for example, at the department chair and dean level, because those positions can influence policy.

To address those challenges and help accelerate improvements in STEM education, the GENA project, an MSP RETA, is exploring ways that a professional scientific society can facilitate outreach by its members so that outreach plays a beneficial role in their career development, which in turn should provide positive feedback that encourages other scientists to engage in outreach. Member geneticists partner directly with high school biology teachers to develop
exemplary teaching materials and implement them (together) in the classroom. Their lesson plans focus on misconceptions in genetics, and the pedagogy is structured by inquiry and strong assessment. Each partnership offers an opportunity to see how faculty use that experience in their broader professional lives, for example whether they actively promote outreach among colleagues who do not work with K-12 students and teachers, whether the experience affects their own teaching, and whether outreach has any effect on the recognition they receive from peers and supervisors. In addition, the fact that GENA is hosted by ASHG, not by a university, offers the chance to explore the effects an MSP might have on a professional society.

3. Claim(s) or hypothesis(es) examined in the work (anticipating that veteran projects will have claims, newer projects will have hypotheses):

Claim 1: The development of scientifically robust and pedagogically sound lesson plans centered around misconceptions is an effective way for scientific-society partnership projects to link member scientists with high school teachers and get the scientists into the classroom, and the partnership experience can lead scientists to recognize the benefits of K-12 outreach.

Claim 2: Science outreach can be an effective vehicle for promoting recognition of genetics faculty by peers and supervisors when it is adequately supported by the infrastructure and commitment of a professional society.

Claim 3: The deep engagement of a professional society with K-12 outreach can profoundly alter the vision, infrastructure, and programming of the professional society with respect to the importance of STEM education in schools.

4. Evaluation and/or research design, data collection and analysis:

A three-year impact study addressed five questions. The questions were:

1. How successful were the GENA geneticist-teacher partnerships?
2. What was the project’s impact on teachers at the end of their GENA experience?
3. What was the project’s impact on geneticists at the end of their GENA experience?
4. What was the long-term impact of GENA participation on geneticists?
5. What was GENA’s impact on ASHG and other FASEB societies?

GENA’s external evaluators, The Study Group Inc. (TSG), carried out a three-year impact study using a mixed-methods convergent design. Evaluation data were collected from GENA staff, Cohorts I and II teachers and geneticists, and ASHG executives using documentary, survey, and interview data-collection methods. The study design called for multiple data-collection activities involving different data-collection methods to counteract problems with respondent bias and validity often associated with self-report data. For example, responses of GENA participants to electronic survey(s) were verified through interviews with participants. Documentary evidence was reviewed, analyzed, and confirmed by two evaluators. Furthermore, individual data-
collection activities, such as electronic surveys of participants, were repeated to confirm that impact claims were programmatic and not situational.

Survey, interview, and documentary data were analyzed using valid and generally accepted data-analysis procedures. Survey data were analyzed using various measures of central tendency (i.e., descriptive statistics). Content analysis and descriptive analysis using pre-established indicators and criteria were employed to examine qualitative data from interviews and documents. Findings from the various data-collection activities were then integrated and sorted by evaluation question. A brief description of key evaluation data-collection activities follows.

A census of all Cohorts I and II GENA participants were conducted through an electronic survey. Electronic surveys were distributed to all Cohort I and II geneticists and teachers near the end of the GENA experience. Response rates were well above acceptable levels (i.e., between 85 and 100% of all participating geneticists and teachers). The surveys asked GENA participants about the effectiveness of their partnerships; changes in their knowledge and understanding of genetics, confidence and skills in teaching genetics, inquiry-based instruction, and/or educational outreach; their intentions to turn their immediate learning into long-term outcomes for teaching, scientist-teacher partnerships, career and professional development, and/or educational outreach as appropriate.

TSG interviewed a 27% random sample of Cohort II geneticists to verify and explore further geneticists’ responses to the electronic survey. The interview protocol solicited geneticists’ accounts of their partnerships, participation in future outreach activities, interest in writing an article about their GENA experiences, interest in more professional development in teaching genetics, addressing student misconceptions, benefits of participation in GENA, documenting the GENA experience for use in tenure or promotion, and their institution’s position on educational outreach.

Finally, all Cohort I geneticists (100%) were interviewed to verify responses to the electronic survey and to identify longer-term results of the project for these participants. This was one year after the Cohort I geneticists had officially satisfied their GENA requirements (and two years after their initial workshop). The interview protocol solicited geneticists’ views on actual changes in their own teaching, participation in professional development on the teaching of genetics, participation in subsequent education outreach activities, writing and presentation activities, experience with tenure and promotion evaluations, and changes in their department’s views of education outreach. At the level of ASHG institutional infrastructure, the TSG team reviewed ASHG policy and program documents and interviewed the ASHG Executive Director in September 2009.

5. Key insights (retrospective for veteran projects, prospective for newer projects) that have value for the Learning Network:

Major findings of the project include the following:

- 87% of geneticists became more skillful in accommodating students’ misconceptions.
- 54% of geneticists changed their teaching style to be more inquiry-oriented.
• 63% of geneticists reported increased confidence in participating in education outreach.
• 93% of geneticists will definitely or probably participate in another outreach program.
• 75% of geneticists have encouraged colleagues to participate in education outreach.
• 75% of geneticists are using GENA when documenting performance for tenure.
• The ASHG Board has adopted a statement on the importance of K-12 STEM outreach.
• ASHG leadership has expanded its support for K-12 genetics education, including an ongoing analysis of state science standards and funding to support genetics education research.

Secondary to the major findings of the project, several of which are mentioned above, the GENA project has reinforced some previous findings and identified ways to circumvent certain problems that are likely common to MSPs. First, the cultural and professional differences between university faculty and K-12 faculty should not be underestimated. Activities that promote an awareness of the similarities and differences between the work lives of these two groups and that help build rapport between them can promote productive partnerships. Second, it is absolutely the case that many colleges and universities do not adequately recognize and reward faculty who spend considerable time developing excellence in their own undergraduate teaching or in K-12 outreach. However, this situation appears to be slowly changing, and many institutions are taking steps to more appropriately value STEM teaching at all levels. PRISM has demonstrated what is possible at the highest policy levels, but “scientists in the classroom” STEM outreach programs also can promote recognition as long as they demonstrate that the teaching or outreach work have some national significance and/or that the work can lead to publications and funding. MSP projects, by virtue of their provenance, may fulfill the criterion of work at a “national” level, at least during the term of a project’s life, which emphasizes the importance of their continuation.

Professional societies—to the extent they support such work indefinitely—can be a continuing “national” presence in the lives of member scientists and thus are a pivotal linchpin in increasing the visibility and value of STEM teaching. Professional societies are also in a position to nudge administrative leadership by leveraging their influence within their own discipline. Department chairs are, in general, members of the same professional societies as their faculty and thus are part of the same audience that is receiving supportive messages regarding STEM teaching and outreach, for example, through the annual meeting, in newsletter articles, etc. To a lesser degree, professional societies may also exert some influence on deans and presidents because the societies are recognized as arbiters of quality (e.g., scholarly journals) and thus also may be perceived (deservedly or undeservedly) as fair judges of quality in outreach and teaching. All MSPs, whether programmatically tied to scientific professional societies or not, should consider establishing relationships with the relevant professional societies to take advantage of these important levers.