A VISION FOR IMPLEMENTING CHANGE

The recommendations discussed in this report include the following action items aimed at ensuring that the vision of the conference becomes an agenda for change:

1. **Integrate Core Concepts and Competencies throughout the Curriculum**
   - Introduce the scientific process to students early, and integrate it into all undergraduate biology courses.
   - Define learning goals so that they focus on teaching students the core concepts, and align assessments so that they assess the students' understanding of these concepts.
   - Relate abstract concepts in biology to real-world examples on a regular basis, and make biology content relevant by presenting problems in a real-life context.
   - Develop lifelong science-learning competencies.
   - Introduce fewer concepts, but present them in greater depth. Less really is more.
   - Stimulate the curiosity students have for learning about the natural world.
   - Demonstrate both the passion scientists have for their discipline and their delight in sharing their understanding of the world with students.
2. **Focus on Student-Centered Learning**
   - Engage students as active participants, not passive recipients, in all undergraduate biology courses.
   - Use multiple modes of instruction in addition to the traditional lecture.
   - Ensure that undergraduate biology courses are active, outcome oriented, inquiry driven, and relevant.
   - Facilitate student learning within a cooperative context.
   - Introduce research experiences as an integral component of biology education for all students, regardless of their major.
   - Integrate multiple forms of assessment to track student learning.
   - Give students ongoing, frequent, and multiple forms of feedback on their progress.
   - View the assessment of course success as similar to scientific research, centered on the students involved, and apply the assessment data to improve and enhance the learning environment.
3. **Promote a Campuswide Commitment to Change**
   - Mobilize all stakeholders, from students to administrators, to commit to improving the quality of undergraduate biology education.
   - Support the development of a true community of scholars dedicated to advancing the life sciences and the science of teaching.
   - Advocate for increased status, recognition, and rewards for innovation in teaching, student success, and other educational outcomes.
   - Require graduate students on training grants in the biological sciences to participate in training in how to teach biology.
   - Provide teaching support and training for all faculty, but especially postdoctoral fellows and early-career faculty, who are in their formative years as teachers.

4. **Engage the Biology Community in the Implementation of Change**
    - Promote more concept-oriented undergraduate biology courses, and help all students learn how to integrate facts into larger conceptual contexts.
    - Ensure that all undergraduates have authentic opportunities to experience the processes, nature, and limits of science.
    - Provide all biology faculty with access to the teaching and learning research referenced throughout this report, and encourage its application when developing courses.
    - Create active-learning environments for all students, even those in first-year biology courses.
    - Encourage all biologists to move beyond the "depth versus breadth" debate. Less really is more.

The time has come for all biology faculty, particularly those who teach undergraduates, to develop a coordinated and sustainable plan for implementing sound principles of teaching and learning to improve the quality of undergraduate biology education nationwide. The stakes are too high for all biologists not to get involved with this national call for change.