Future of Geoscience Undergraduate Education

Summit Organization:

The Summit will be organized to allow for a thorough discussion of each of the 5 topics by all participants and time to produce written summaries of the discussion results for incorporation into a final report. We will have a Keynote speaker to start the summit, with a second later in the meeting. Each topic will be introduced in a Plenary Session by a panel discussion and Q&A session. Afterwards, smaller groups will discuss different aspects of each topic in breakout sessions. Each group will have a scribe, and an organizing committee member will act as a facilitator. Written summaries from each group will be made available electronically during the meeting, and groups will have the opportunity to receive feedback from other participants during the meeting. The Summit will conclude with a wrap-up session involving all participants. The Plenary Sessions, wrap up session, and any discussions involving all participants will be webcast.

Summit Topics:

Curriculum: What content, competencies, and skills are needed to prepare undergraduate students for graduate school and/or for future careers in the geosciences? What should the next-generation undergraduate geoscience curricula include? Given the change in scope of the geosciences, how can we balance more traditional geoscience courses and topics (e.g. mineralogy, paleontology, etc.) with newer ones (e.g. climate, hydrogeology, etc.)? What level of math, other basics sciences, and computational competencies for dealing with large datasets, geospatial data, and modeling is needed? How can we integrate field experiences into the curricula at diverse institutions? How do we ensure students develop critical-thinking and problem solving skills and the ability to be life-long learners? How do we successfully teach students to work well in a team environment? What other skills and types of courses will be critical to students' success in the workforce of the future? How do we make sure that students graduate with the communication skills and understanding of social science that will make them effective in their chosen careers? How do we infuse curricula with an appreciation for ethics and personal responsibility?

Pedagogy: What should next-generation undergraduate geoscience pedagogies look like? What have we learned from educational and design-based education research (DBER) about student learning? What are effective ways of using the results of this research in different size classes, educational settings, and diverse institutions? What are the best practices for providing student-centered, interactive instruction? How do we get geoscience faculty to move from traditional, lecture-style instruction to more effective methods of student learning? What factors keep faculty from adopting new pedagogies and how can these be overcome? How do we get the wider geoscience educational community to assess and adopt evidence-based practices? How do we successfully implement sustainable changes in pedagogy? What further educational research is

needed for the geosciences? How have technological advances changed pedagogy for the geosciences? How do we ensure that courses are taught in ways that contribute to success for all students, including low-income, first-generation, and underrepresented minorities?

Technology: What are the implications of rapidly advancing technology for undergraduate education, both in terms of how and what students are taught? How should geoscience departments and faculty respond positively to the challenges and opportunities inherent in potentially disruptive technologies? How can new modes of teaching, such as hybrid or blended learning (traditional face-to-face classroom instruction combined with online learning), flipped classrooms, MOOCs, and the availability large open-source datasets, crowd-sourced and other distributed open education resources, be used effectively? How can we develop more shared resources and courses that allow institutions with limited faculty and resources to customize external instruction to meet their needs? How can virtual experiences be used to effectively augment, or in some cases replace, field and other "real" experiences? What should geoscience departments and faculty do to prepare undergraduates for rapidly advancing technologies that they will need to use in the future? What place does computational modeling and simulation, analysis of large datasets, and new visualization and geospatial tools and programs (e.g. Google Earth, Arc GIS) have in undergraduate education?

Broadening participation and retention: What are challenges to developing a robust and diverse future geoscience workforce? What are proven best practices for engaging and retaining traditionally unrepresented and first generation college students in the geosciences? What roles can 2-year colleges, minority serving institutions, employers and professional societies play? What pathways would improve the transition from 2-year associates degrees in geoscience or science to 4-year bachelor's degree geoscience programs?

Preparing K-12 geoscience teachers of the future: What are effective models for attracting and developing middle and high school geoscience teachers? What geoscience content should be included in a curriculum for future geoscience teachers and for all K-12 teachers? How can we effectively integrate the Geoscience Literacy documents into introductory and lower level geoscience courses? How will the Next Generation Science Standards effect what future geoscience and science teachers should learn and how they teach? How do teacher certification rules impact geoscience teaching at K-12 levels? In introductory and lower level geoscience courses, what are effective ways to demonstrate the use of all sciences and math to solve geoscience problems, thereby providing future science teachers geoscience examples to use in their science and math classes?