Mentoring students with diverse backgrounds/learning styles outside the classroom

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Minorities & Scientific Research

- Alice A. Ball, an African-American woman whose research was instrumental in developing a drug to treat Hansen's disease.
- Mario José Molina Henríquez, a chemist and native of Mexico and won the 1995 Nobel Prize in chemistry for his work in linking chlorofluorocarbons (CFCs) to the destruction of the earth's ozone layer.
- Percy Julian was the first African-American inducted into the National Academy of Sciences.

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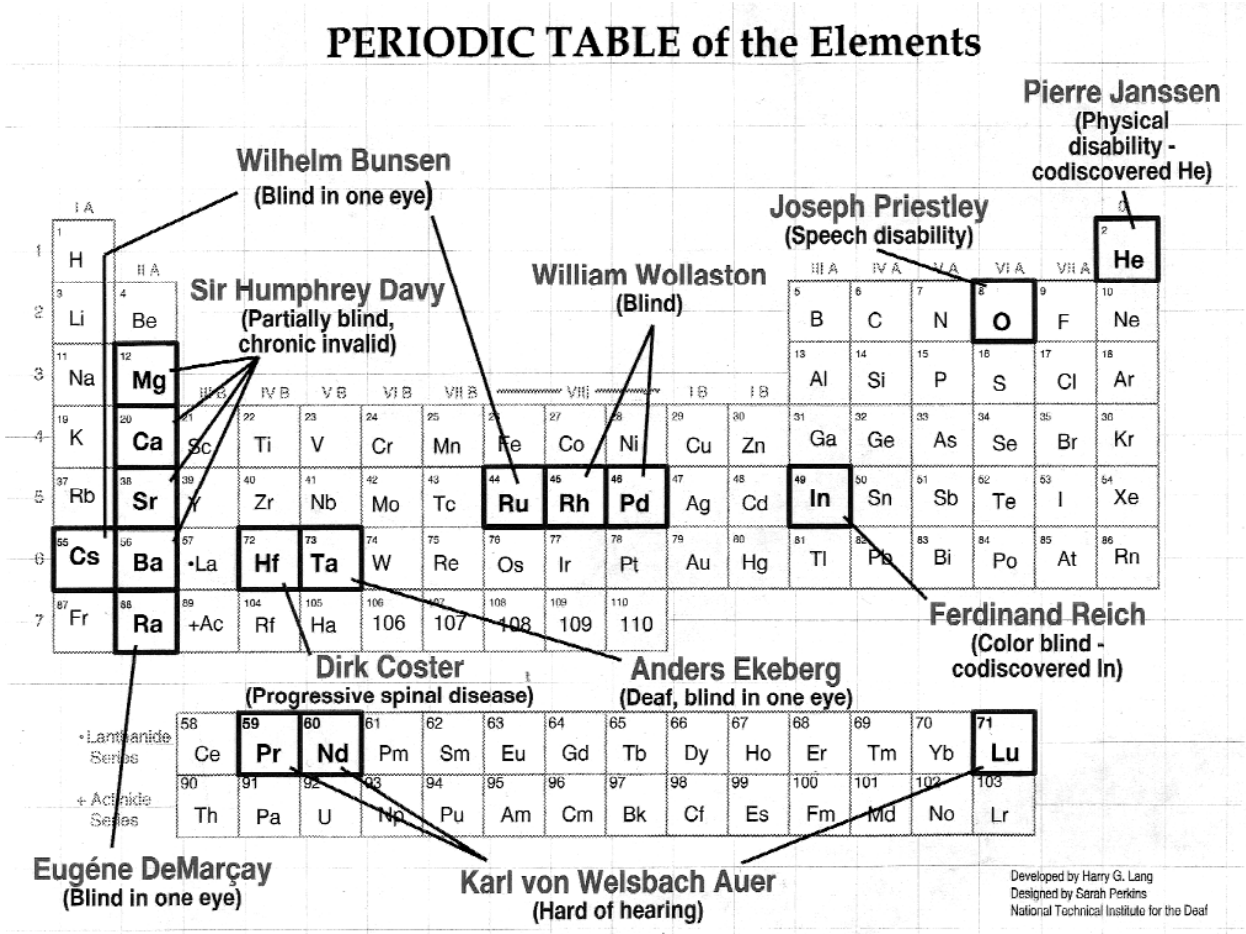

in Miner (2001)

Importance of Diversity in Research

Representation . . . means having qualified individuals from various backgrounds, perspectives, and influences to strengthen our ability to solve complex scientific problems. Therefore diversity is not just a feel good issue or simply the right thing to do – it benefits all through improved outcomes.

Drew 2009

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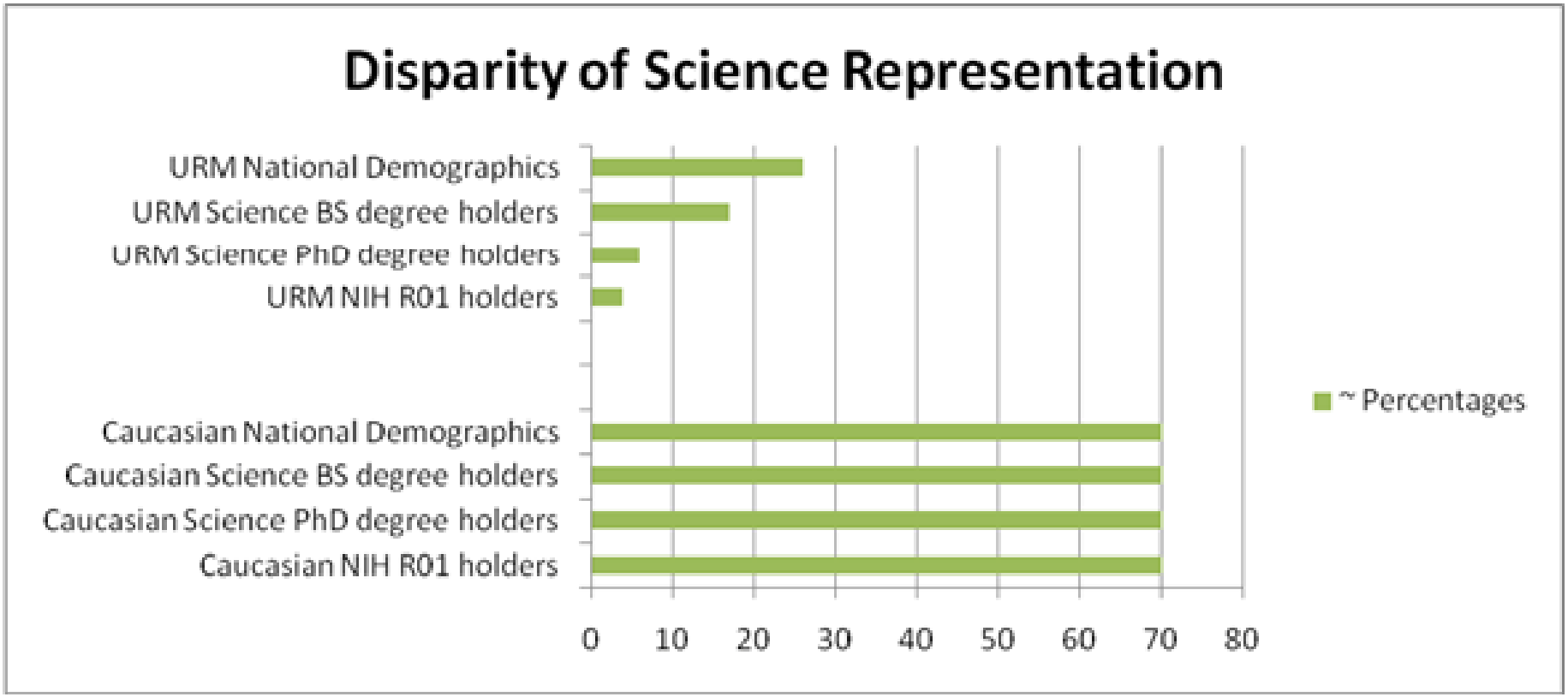
Underrepresentation in Science



NSF Webcasper, in Drew 2009

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Student Perceptions of Science Classrooms

Case studies of "second-tier" students revealed perceptions of science that it is:

- competitive and isolated
- hierarchal
- concerned with facts and direct problem solving (no room for uncertainty or questioning)
- unidirectional (no perceived discussion among the members of the community)

Tobias 1990

“Switchers”

The rejection of SME careers or lifestyles is partly a rejection of the role models which SME faculty and graduate students present to undergraduates.

Seymour & Hewitt 1997

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Expectations about Learning

- With respect to effort, understanding concepts, use of mathematics, relevancy and usefulness of science in a wide variety of contexts, and development of essential professional skills, a gap in the level of expectations exists between students in early courses in the major and faculty.
- The gap begins to disappear between junior level students in the major and faculty.

Grove & Lowery-Bretz 2006; Redish, et. al. 1998

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Undergraduate Education

Student researchers appear to learn little about the actual research practices in their discipline via the traditional classroom venue and associated media, specifically, lectures, journal articles, and textbooks. Rather, the critical learning appears to take place informally in spontaneous discussions at conferences, in coffee shops, bars, cars, and so forth.

Mabrouk 2009; Bowen & Wolff-Michael 2002

Recognizing Student Needs

"The more students agreed that faculty use pedagogical strategies consistent with cognitively based principles of learning, the more they felt that faculty were interested in teaching and in students."

Kardash and Wallace 2001

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Inclusive Instructional Practices

If students operate in a learning environment where their egos are protected from undue stress, their naïve ideas listened to and gently critiqued with new directions provided, students, like all human beings, will have a better chance to grow in their understanding

Novak and Gowin, 1984

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Engaging Students

An overwhelming number of early undergraduate students can be ego-oriented.

"When placed in stimulating environments, with enthusiastic people, some people who think they don't want to learn, change their minds."

Ward and Bodner 1993

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Graduate Students

"The training of graduate student scientists does not follow some well-defined, dispassionate, rational, and hierarchical system. The process appears to be a messy inherently social negotiation between advisor and graduate student. Similar to scientific research itself the process involves a significant quantity of time, trial, and error."

Mabrouk 2009

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Benefits of Undergraduate Research

Undergraduates shared that when involved in research they:

- made personal/professional gains,
- thought and worked like a scientist,
- developed various skills,
- made clarification/confirmation of career plans (including graduate school),
- enhanced career/graduate school preparation, and
- perceived that they were beginning to learn and work as a researcher.

Seymour, et. al 2004

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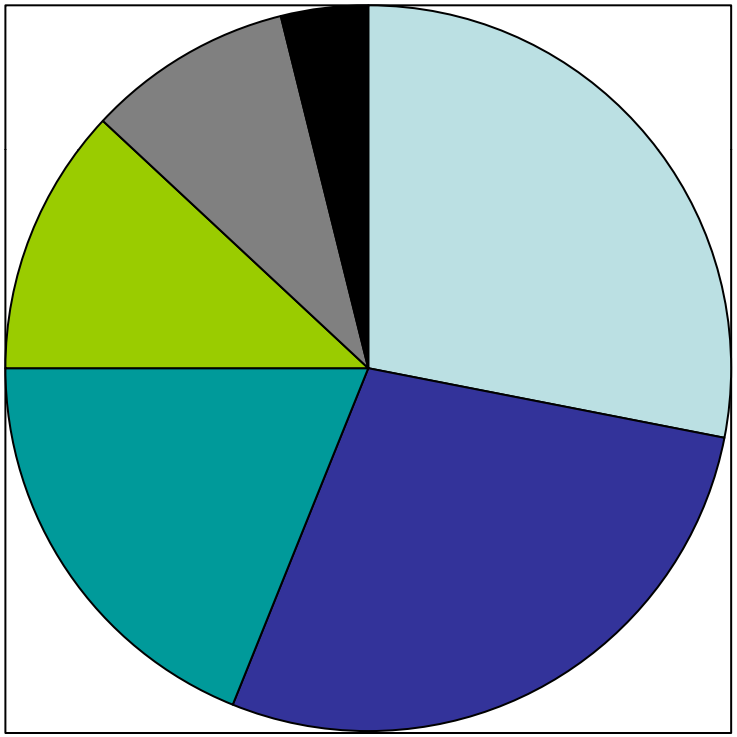
Benefits of Undergraduate Research

Percentage of Survey Responses



Professional Conferences

- Fifty-eight percent of the respondents [to an online survey] felt that attendance at the meeting had influenced their decision to pursue advanced study in the field of chemistry (21% strongly).
- Eighty-three percent of the African-American respondents indicated that they went to the ACS meeting to see what it is like to be a scientist, to develop their self-confidence, and to meet prospective graduate advisors. Two-thirds of the African-American student respondents indicated that they went to network for employment purposes.

Marbouk 2009

Tips for Mentoring

- Listen to and converse with students.
- Create environments that align to and support how people learn and tends to the influences on learning (e.g. self-efficacy, attitudes, expectations for learning)
- Find ways to connect to their interests and address their needs.
- Develop research participation early and foster true learning communities.
- Encourage conference participation, especially for presenting on research projects.

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