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Feature

From the National Academies: A Tribute to the Science Education Legacy of National Academy of Sciences President Bruce Alberts

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This column, "From the National Academies," was Bruce Alberts' idea, one of so many for improving education. As a long-standing member of the American Society for Cell Biology, the namesake for the prize that is awarded annually to cell biologists for excellence in science education,[1] and one of the founding editors of *Cell Biology Education (CBE),* Bruce Alberts established this column as a way for readers of *CBE* to learn more about the activities and resources that are available for improving K–12 and undergraduate science education. I have been fortunate to work with him for several years on improving education and was honored to be asked to assume primary responsibility for producing these quarterly columns for *CBE* and to coauthor one column with him (Alberts and Labov, 2004).

Many articles could (and will) be written about Bruce Alberts' other accomplishments and leadership in international and public policy, and in transforming the National Academies in so many ways during his tenure (e.g., American Association for the Advancement of Science, 2005). I dedicate this column as a tribute to Bruce Alberts so that all readers of *CBE* might better understand and appreciate how critically important his dedication and ceaseless work have been in raising awareness and concern for improvement of science education among college and university faculty and administrators.

PORTRAIT OF AN INSPIRATIONAL EDUCATION LEADER AND MENTOR

> *If we are to be effective in spreading an understanding and appreciation for science throughout our society . . . our scientists and science leaders must reflect the diversity of this great nation. This means that we must develop an education system that does a much better job of preparing all students. . .*
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> Bruce Alberts, Address to the Members of the National Academy of Sciences, May 2000

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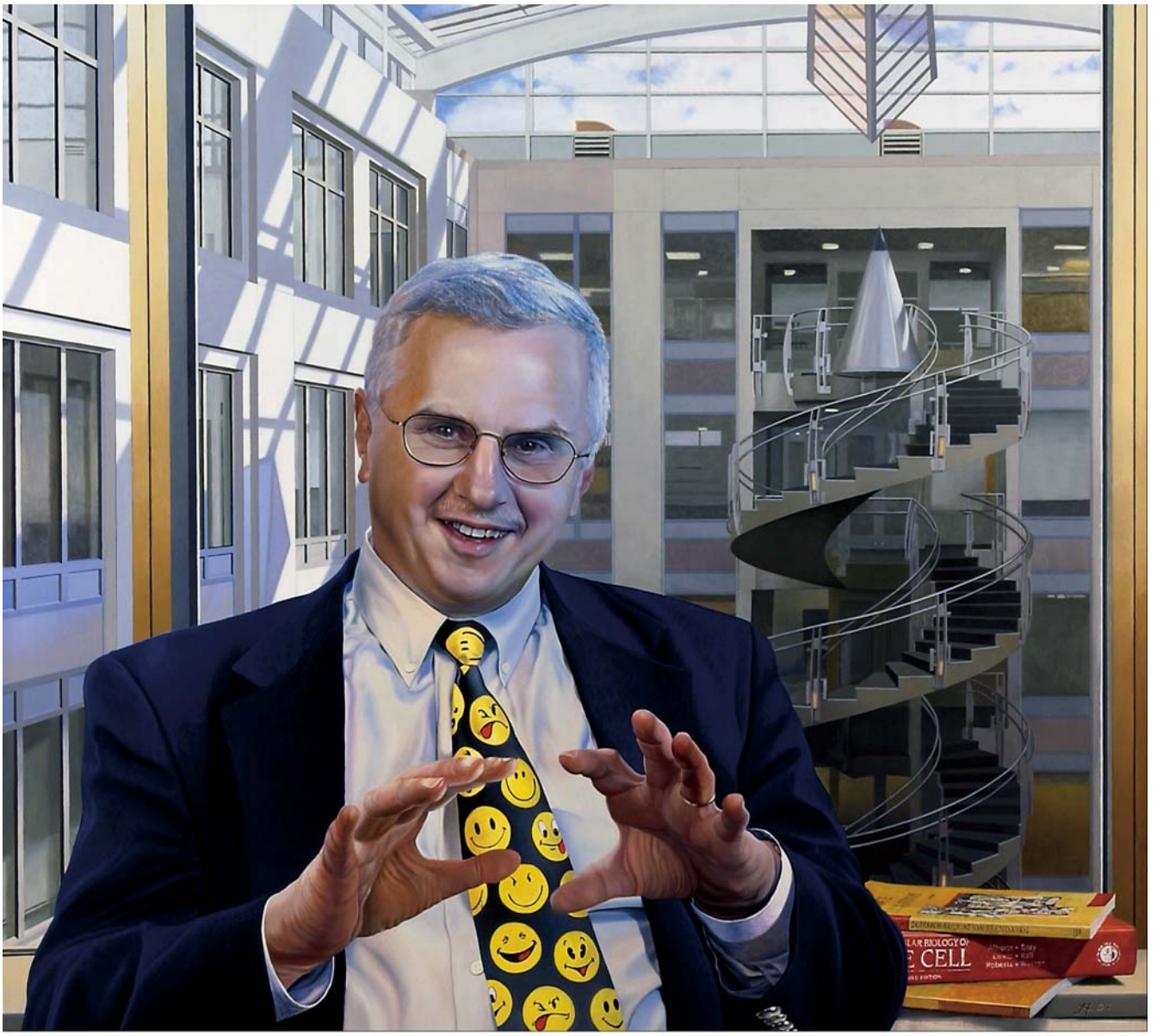
[1]Awardees are ". . .selected by the ASCB Education Committee for innovative and sustained activities in science education with particular emphasis on the local, regional, and /or national impact of the nominee's activities." For additional information, see http://ascb.org/membership/awards.html.

Bruce Alberts began his tenure on July 1, 1993. Academy presidents are allowed to serve a maximum of two 6-year terms; Alberts completed his second term on June 30, 2005. An official portrait was unveiled in May 2005 and will hang in the National Academies' new Keck Center in Washington, DC (Figure 1). The painting vividly captures how Bruce Alberts views himself and his 12 years as the 20th president of the National Academy of Sciences and chair of the National Research Council (NRC).

The symbolism of the portrait reflects well what Alberts has accomplished and what he viewed as important during his leadership of the Academies. The setting of the portrait is the Keck Center, a $140 million building that opened in June 2002. Before its construction, staff from the Academies were housed in five buildings across Washington, DC. Depending on one's job, a significant amount of time could be spent on shuttles between those buildings. A primary motivator for constructing this building was to better realize Alberts' vision of offering opportunities for Academies staff to work more closely together in ways that are typical on college and university campuses. Two prominent features of the building that are in the background of the portrait attest to Alberts' and the Academies' longtime support of the interfaces between science and art. The colored prism that hangs from the glass ceiling of an eight-story-high atrium projects a rainbow of colors throughout the room on sunny days that continually moves with the earth's rotation. When viewed from afar, the railings and risers of the spiral staircase appear to form the double helical structure of DNA.

The three books on the table behind him also are symbolic. In the middle is the latest edition of his best-selling textbook, *Molecular Biology of the Cell* (Alberts *et al.*, 2002). Despite his frenetic schedule and the demands on his time, Alberts has devoted several weeks each year of his tenure as president to preparing revisions for the next edition of this classic text.

Molecular Biology of the Cell is sandwiched between two National Academies reports to which Bruce has referred frequently in his speeches: the *National Science Education Standards* (*NSES*; NRC, 1996) and *Inquiry and the National Science Education Standards* (NRC, 2000). The *NSES* was being written when Bruce became president, and he played critical roles in moving the project forward and in shaping its vision, goals, and descriptions of new ways of teaching and learning science. For most Academies reports, drafts are not made public until an extensive internal report review process is



Bruce Alberts (888) / 2004 / Oil on linen / 43.375 x 48.125 inches
Commissioned by the National Academy of Sciences

Figure 1. A portrait of Bruce Alberts, 20th president of the National Academy of Sciences. Alberts is seated in one of the many collaboration rooms of the Keck Center. Painting of Bruce Alberts © 2005 Jon R. Friedman.

completed. However, the *NSES* was distributed for comment to thousands of individual scientists, K–12 and higher education faculty, and dozens of professional and education organizations for review and comment. As a result, when the standards were finally released, the Academies could truly claim that they represented a national consensus on new ways of teaching and learning about science. Along with the American Association for the Advancement of Science's *Benchmarks for Science Literacy* (1993), this report has influenced the production of science standards in 49 of 50 states and the District of Columbia. To date, more than 250,000 copies have been distributed across the United States. The book can now be freely downloaded as a portable document format (pdf) file. *Inquiry and the National Science Education Standards* (NRC, 2000) was one of several compendium reports released by the Academies to help curriculum developers, assessment experts, teachers, and school officials better understand the vision, scope, and implications of these new standards.

Then there is The Tie! Bruce claims to have purchased it one day while walking down Fifth Avenue in New York. (So much for that city's claim to be one of the fashion centers of the world!) He has worn that necktie to many high-level meetings and functions. In my opinion, that one piece of haberdashery speaks volumes about Bruce Alberts: a leader who has accomplished so much, but one who never becomes too taken

with himself as a result; a man who is a peer with many of the world's leading scientists and policy makers, but who always maintains a sense of perspective and a sense of humor that is often self-deprecating. As the portrait was unveiled, Bruce (wearing The Tie) delivered a lecture to the assembled dignitaries, complete with laser pointer and assistant, about what the various faces on the tie represent in his job. The Tie has become such a hallmark of Bruce's style of leadership that nearly everyone who was invited also donned copies of it that had been photocopied from a scan of the original.

A RICH LEGACY OF ACCOMPLISHMENTS IN EDUCATION

Under Bruce Alberts' leadership, the National Academies accomplished the following:

- In 1995, it established a Center for Science, Mathematics, and Engineering Education (CSMEE) that for the first time in the Academies' history brought together in a single organizational entity a variety of education projects. In 1999, further consolidation of education activities within the NRC took place when CSMEE was merged with the NRC's Board on Testing and Assessment to form a new Center for Education. With broadened perspective from the behavioral and social sciences, this center now emphasizes the "science of education" as much as it does science and mathematics education. Some spectacular talent has been recruited to serve on the center's standing boards and committees. For example, Carl Wieman, Nobel Laureate in Physics, now serves as chair of the center's Board on Science Education (Wieman, 2005). The center now serves as the primary locus for education activities within the Academies. It also helps inform the work of other boards and committees that are involved with discipline-based issues in education.
- It published more than 190 reports that have focused on some aspect of education. This is more than a threefold increase in education reports from the decade preceding Bruce's leadership. Earlier "From the National Academies" columns in *CBE* have highlighted some recent education reports on both K–12 and undergraduate education that should be of interest to readers.
- It established a National Academies Teacher Advisory Council, which now provides invaluable advice and perspective from the "wisdom of practice" to boards, committees, and staff members within the National Academies that are undertaking studies or preparing reports and other products that could be useful to K–12 teachers. The members of the council represent teachers from elementary, middle, and secondary grades from across the nation.[2] The council is now developing a network of associates in every state. It has worked with counterparts in California to establish a Teacher Advisory Council[3] in that state and is currently seeking to assist other states in providing this kind of voice for teachers. This spring, the Governing Board of the NRC authorized making the council a permanent board within the Center for Education. Much of the support for the council has come from National Academies funds.
- It provided leadership on developing the Marian Koshland Science Museum of the National Academy of Sciences. Located in the Keck Center, the museum opened in April 2004 and has attracted some 30,000 visitors during its first year of operation. The museum features state-of-the-art exhibits that present the complexities of science in an engaging and accessible way to the general public, with in-depth explorations of "Putting DNA to Work," "Global Warming Facts and Our Future," and "Wonders of Science" that have been designed for adults and young adults. All exhibits are based in part on reports issued by the Academies. Exhibits offer visitors opportunities to consider the implications and applications of data and to engage in interactive decision making based on their roles as citizens. The museum also maintains an extensive Web site for the general public and for educators.[4]

> It [the debate over teaching evolution] says we've failed as scientists and science educators to convey the nature of science and its values to the American public, despite our world leadership in science and technology.... We've got to pay more attention to the education of young people and completely transform the way we teach introductory science at the college level. We are failing to make people understand what science is, or why they should care about it.
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> Bruce Alberts. Comments in an interview, American Association for the Advancement of Science, 2005, p. 1108.

- Perhaps most importantly for readers of *CBE*, during Alberts' presidency, the National Academies published a series of reports focusing on improving undergraduate education in science, technology, engineering, and mathematics (STEM; reviewed in several of my earlier "From the National Academies" columns). Bruce has been outspoken and unwavering in his support for changing our current system of undergraduate, graduate, and teacher education to allow science to be taught in a way that models what scientists actually *do*.

  Bruce Alberts also has personally taken specific actions to foster this approach to promoting quality science education for undergraduates. For example, the NRC report, *Bio2010* (NRC, 2003; see also Brenner, 2003; Farnbrough, 2003; Morse, 2003; Steitz, 2003), recommended that an institute on teaching and learning, modeled after the Cold Spring Harbor summer courses, be developed to provide an environment in which university faculty could spend focused time learning about and practicing how to improve their teaching and student learning in the life sciences. Bruce Alberts embraced this recommendation, with the collaboration of the Howard Hughes Medical Institute (HHMI), members of the National Academy of Sciences, and other prominent life scientists who were developing the concept of "scientific teaching" (Handelsman *et al.*, 2004). Along with HHMI, the Academies, under Alberts' direction, provided start-up funds for this new venture.

[2]For additional information, see http://www7.nationalacademies.org/tac. Also see Labov, 2003.

[3]For additional information, see http://ccst.us/ccst/projects/caltac/caltacdex.html.

[4]For additional information, see http://www.koshland-science-museum.org.

These funds have enabled planning sessions, a pilot National Academies Summer Institute at the University of Wisconsin–Madison in August 2003, and the first full Institute in August 2004. Some 40 people from 18 research universities (out of 38 institutions that submitted applications) spent 5 days at that first Institute immersed in a culture of undergraduate education.[5] Another 19 teams (out of 37 institutional applicants) were accepted to participate in the August 2005 Summer Institute on the Madison campus, which is now being supported by HHMI.

- Internationally, Alberts played an important role in founding and has been directly involved with the mission and operations of the InterAcademy Panel on International Issues (IAP), a global network of 92 academies of science around the world.[6] Alberts also has been a key figure in the InterAcademy Council, created by the world's science academies to mobilize the best scientists and engineers worldwide to provide high-quality advice to international bodies.[7] Alberts was re-elected as cochair of this body through 2009. A major effort by this international body will be to "mobilize the academies of science of the world to improve science education through the introduction of inquiry-based methodology and the collaboration of scientists, teachers and educational authorities." Regional consortia will plan and implement joint activities to improve science education.[8]

The list of accomplishments summarized here cannot begin to elucidate the ultimate impact that Bruce Alberts has had and will continue to have on science education in this country and around the world. During the time that I have worked with him, he has been tireless and completely focused on delivering this message to STEM faculty and his colleagues in the National Academy of Sciences. He has undertaken seemingly endless travel to any location where those assembled were willing to listen to his thoughts about improving STEM education. These grassroots efforts, combined with his testimony to leaders in Washington, state capitals, and elsewhere have all contributed to what I perceive to be a new openness and willingness of various stakeholders to consider much more seriously what needs to be done to improve STEM education at all levels. His work also has helped various stakeholders better understand how they, as individuals and organizations, can become part of the solution.

In July, Bruce returned home and again began his position at the University of California, San Francisco. One of his goals there is to revamp the courses he will teach to reflect and apply the growing body of research on human learning and cognition. He also plans to resume his work in improving science teaching and learning in the San Francisco Public Schools. His experiences in working with children and teachers there changed both the school system and him profoundly. We are all the richer for it.

Thank you, Bruce, for all that you have given us. You will be sorely missed at the National Academies, but your legacy (and your Tie) are sure to endure!

[5]For more information, see the website of the Summer Institutes: http://academiessummerinstitute.org. For citations and links to a series of articles about the National Academies Summer Institute that have been published, see http://www.academiessummerinstitute.org/articles.shtml.

[6]For additional information, see http://www4.nationalacademies.org/iap/iaphome.nsf.

[7]For additional information, see http://www.interacademycouncil.net/.

[8]For more information, see http://www4.nationalacademies.org/iap/IAPhome.nsf/weblinks/MGLY-4VQVEY?OpenDocument.

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