Bruce Alberts: Education, education, education

Bruce Alberts has an unwavering commitment to improving science education both at home and globally.

Bruce Alberts needs no introduction to our readers, each one of whom is sure to have a thoroughly dog-eared copy of "Molecular Biology of the Cell" (1). Alberts, a coauthor of this bible of biology, has not only been shaping the scientific landscape through his research (2, 3), but also influencing the way science is done (4), and the way science is taught (5, 6). Not bad for a man who failed his PhD exam on the first attempt.

"If we're going to produce scientifically empowered citizens, we have to teach them what science truly is."

Alberts was elected to the National Academy of Sciences in 1987, and served as its President from 1993 to 2005. He is a member of the American Society for Cell Biology and served as its President in 2007. Since 2000, he has been the Co-Chair of the InterAcademy Council (the association of Science Academies from around the world). And this March he was appointed as Editor-in-Chief of *Science* magazine. On top of all this, he still manages to hold down a day job: he is a Professor in the Department of Biochemistry and Biophysics at the University of California, San Francisco.

Despite having a schedule busier than an international airport, Alberts made time to talk with us and share his dreams for a scientifically empowered global populace.

DISCOVERING REAL SCIENCE

How did you get started in science?

My first introduction to science was in high school. I took chemistry and became very attached to the teacher; his name was Carl Clader. I was entranced by chemistry, but I didn't know you could make a career out of it. I didn't know anybody who was a scientist.

No scientists in your family?

No. I didn't meet a scientist until I got to Harvard, where I took premedical classes with the intention of going to medical school.

How did you go from pre-med to becoming a scientist?

I remained a pre-med student until my junior year at Harvard, when, by chance, I got into a research laboratory. Until then, laboratory classes had seemed like cookery classes. They were for three hours an afternoon, three days a week. I didn't enjoy them. When I took a terrible physical chemistry laboratory in my junior year, I finally got enough courage to say, "I want to drop this lab. What can I do to get out of it?"

I discovered that it was possible to do independent research—an option that had not been advertised. So, after taking two and a half years of science courses at Harvard, I finally found out what science was really about. I met people who were trying to be professional scientists.

By "cookery classes" you mean you followed a recipe, but didn't really know why you were doing it…

That's right. It's corrupting because you're all doing the same thing, and you're supposed to get a certain result. If we spilled some reagents, we would check our answers with the other students, and then fudge the results. It's the opposite of what you're supposed to do!

It certainly doesn't instill good scientific habits!

No, and it's not even interesting. I've talked to many scientists who took such courses; they all feel the same way. Why do we have them? Science is about having your own idea and testing it, and there was no chance for that in any of the laboratories I had.

There is now a major movement to get inquiry into these early laboratories, but this idea has been slow to get off the ground. I'm very much an advocate of getting first-year college students into research laboratories wherever possible.

TOM KOCHEL

Bruce Alberts

AN AGENT FOR CHANGE

Why do you think it's so hard to change these courses?

For one thing, the current professors will be people who were very successful in such courses, and so perhaps do not recognize that other people have other ways of learning. As a result, we're missing a lot of talented people because we're not reaching them.

Small colleges actually tend to be more invested in their education mission than bigger colleges. And studies show that you're much more likely to go on to become a scientist if you're from those schools than from big ones. The bigger ones are so focused on research that their faculty is not spending enough time thinking about what they're teaching. It takes a lot of work to make the changes. But it's critical that they're made. Organizations like the Howard Hughes Medical Institute deserve a lot of credit for providing resources and stimulating universities to improve their introductory science classes.

Such changes are not just important for those that go on to be scientists, but also for those that don't. If we're going to produce scientifically empowered citizens, we have to teach them what science truly is. By improving the teaching of science, we will ensure that a much wider range of the pop-

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UCSF PUBLIC AFFAIRS

Bruce, busy scientifically empowering the younger populace.

ulation understands why scientists' judgments are important and therefore pays attention to what scientists say about global warming and many other critical issues.

At what point in your career did you become more interested in policy?

I've always been the sort of person who tries to improve local conditions. As a young professor at Princeton, I was writing notes to the university president saying, "Why don't we do this, why don't we do that?" That's how I got to be department chair. But the major turning point came in 1987, about six years after I had been elected to the National Academy. The Academy asked me to chair a committee to decide whether or not there should be a project to map and sequence the human genome. I was astounded because I hadn't gone to any of the meetings on the subject or even done much thinking about it. They said, "That's exactly why we want you."

The committee contained a wonderful group of people with a wide range of opinions, and the study proved to be a great learning experience for all of us. We eventually came to the conclusion that sequencing should focus on the genomes of small model organisms—in particular, bacteria, yeast, flies, and worms—until the technology had become much cheaper. It cost about $4 per base pair back then. So it would have cost about 12 billion dollars to complete the human genome; we said that the focus should be on technology development until the cost per base pair dropped about 10-fold.

The committee's report, published in 1988, was a big success, and four years later I was asked to be President of the Academy. I was very reluctant at first, as it's a full time job, but then I realized it would put me in a good position to make changes in education policies. We produced nearly 150 reports on education during my 12 years at the Academy.

GOING GLOBAL

In addition to education, you've become involved in international science policy. How did that come about?

When I first got to the National Academy, my predecessor had set up the first ever meeting of all the academies of the world. It was in New Delhi in September '93 and it was wonderful. There were about 50 academies in attendance. I felt like I was in my first week in college. I didn't know what was going on. Anyway, on the last day of that meeting, somebody called a special half-day session to explore whether we should establish a permanent organization of academies. The result was the formation of the Inter-Academy Panel (IAP) in Trieste, which now has 100 academies as members, followed in 2000 by the IAP's formation of the Inter-Academy Council (IAC) in Amsterdam.

What sort of topics does the Council cover?

At the beginning, we held a special meeting of the 15 Academy presidents who form the IAC Board to determine the most important issue we wanted to work on. We were unanimous in deciding that building capacity for science and technology in every country, no matter how rich or poor, is essential. That led to our first report, called *Inventing a better future: A strategy for building worldwide capacities in science and technology.*

The second IAC report was the result of a direct request from Kofi Annan, who was then the Secretary General of the United Nations. He asked if the Council would produce a document on the scientific and technological aspects of agriculture in Africa. The best thing to me about that report was that it was the first time that African scientists had a major voice in guiding African agricultural policy.

How do you gauge the success of these reports?

You see whether they have an impact, and whether people are doing better things because of them. For example, the World Bank and the Gates Foundation have now picked up the central message of the first Council Report, which is that every nation needs its own science and technology capacity. You can't just pour in money to fix AIDS in Africa. There are infrastructure problems that you need to work on. The only way to get long-term progress is to improve the scientific capacity in a nation and then give the scientists a rational and powerful voice in their own countries.

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And a big part of building infrastructure is improving education…

That's right. And you also need to prevent the brain-drain that's happening in many of these countries. You have to build institutions locally for science and technology to give these educated people reason to stay. And you need to bring research on agriculture, health, environment, and economics into the universities to enable students to engage with the real problems of their nation. JCB

1. Alberts, B., et al. 2007. 5th ed. Molecular Biology of the Cell. Garland Science Publishing, London.
2. Alberts, B. 1998. *Cell.* 92:291–294.
3. Alberts, B. 2003. *Nature.* 421:431–435.
4. Alberts, B. 1985. *Cell.* 41:337–338.
5. Alberts, B. 2000. In: Inquiring into Inquiry Learning and Teaching in Science. AAAS, Washington, DC. 3–13.
6. Alberts, B. 2005. *Cell.* 123:739–741.

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