

# New book tutors future presidents and public on science behind the headlines

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In the event of a standoff between the United States and Iran over uranium enrichment, would Barack Obama, if elected president, know enough about the physics of nuclear weapons to assess the threat? In leading the nation toward reduced greenhouse gas emissions, would John McCain as president understand which technologies would best decrease America's carbon footprint?

If not, University of California, Berkeley, physicist Richard A. Muller has the answer: a new book, "Physics for Future Presidents" (Norton, 2008) that he's written as a primer for anyone aspiring to the Oval Office.

The book provides the scientific literacy would-be leaders need to challenge ill-informed, partisan advice on science-based issues such as terrorist threats, global warming, the value of manned exploration of space and the dangers of nuclear weapons. With book in hand, candidates and presidents will be able to publicly explain and defend their decisions rather than defer to their science advisors.

"It's hard to think of an issue these days that doesn't have a science or high tech angle to it," said Muller, a professor in UC Berkeley's physics department for 30 years and an experimental physicist and astrophysicist at Lawrence Berkeley National Laboratory. "My real goal is to make the dialogue more based in knowledge and fact, because I think that will cool down the rhetoric and help bring opposite sides of the political spectrum together to reach agreement."

A big reason such a book is needed is the current lack of scientists at the highest level of government to advise the president, said Muller, a former MacArthur "genius" Award winner who for 34 years was a member of the JASONs, a group of top-level scientists who advise the U.S. departments of defense and energy as well as NASA on technological issues.

"There used to be a science advisory committee that was in constant contact with the president and was expected to think through technology and make suggestions," Muller said. "There is nothing like that anymore."

The need for such advice was demonstrated in 2003, said Muller, when President George W. Bush touted a future hydrogen economy in his State of the Union address, despite the fact that there are many problems with the use of hydrogen as a transportation fuel.

"There was nobody there to stop him and say, "No, this isn't going to work,"" Muller said. "I doubt that he knew, for example, that hydrogen is currently made from fossil fuels in a process that emits greenhouse gases, or that liquid hydrogen contains only a quarter the energy of gasoline per gallon, severely limiting an auto's range."

A year later in Bush's State of the Union message, there was no mention of the hydrogen economy, said Muller, who suspects that the president learned some physics in the interim.

Muller's book, officially published Aug. 4, is an outgrowth of a popular UC Berkeley class by the same name taught by Muller since 2000 that has achieved fame through freely-available Webcasts. One Iraq war soldier called it a "lifeline" during his deployment in Iraq, saying that the course teaches "the basics needed to be an informed, critical-thinking citizen of our country." In a poll taken last semester by the Daily

Californian, UC Berkeley's student newspaper, Muller's class was voted "Best of Berkeley." Muller has received e-mail from people in 48 states and 84 countries thanking him for the Webcasts.

Despite a class enrollment of 500 students per semester - the maximum the lecture hall can hold - and many online followers, Muller decided he wanted an even larger audience. Hence, a textbook - currently used at 10 other universities - and now a book for the general public that covers the physics behind major issues facing the country today: terrorism, nuclear power and nuclear bombs, energy and global warming, and space.

Muller's book dispels many myths and gathers facts that even many physics professors find surprising.

"A lot of people base their opinions on the equivalent of urban legends: stories that are so powerful that you assume they are incontrovertible, but which may not actually be true," Muller said.

Among these legends is that of the danger of radioactivity at even small doses. Muller said an irrational fear of radioactivity interferes with discussion of nuclear power as an alternative to other, more polluting sources of power, including coal.

"People are afraid of radioactivity because it is invisible and unknown," he said. "But that doesn't mean that we can't detect and work with it. Part of this wariness is that people don't trust the government when it says, 'Don't worry.' Well, they don't have to trust the government - they can actually learn what levels of radioactivity are and what they cause and make their own judgment."

Muller emphasized that the facts he presents in the book are not meant to change people's minds but, rather, provide background for making decisions. "Policy," he said, "is outside the purview of physics - but

policy should be based on facts and understanding.

"When I teach my class, I say, 'I don't care if you are pro- or anti-nuke, you're going to learn about nukes. Maybe your opinion will be strengthened; if so, you will have a way of defending your opinion that is far more powerful than just stating it. Maybe your opinion will change. I don't know, and that is not my role. My role is to give you the facts. Once you understand the facts, your opinion is as good as anyone else's - and maybe better.'"

Muller's "refuge in the facts" runs counter to the attitude of some scientists today, he said. For example, while the Nobel Prize-winning Intergovernmental Panel on Climate Change (IPCC) wrote an objective report on the perils of global warming, "many who describe the report, even members of the panel, when speaking as individuals, put spin on their description that is not in the report."

This includes co-prizewinner Al Gore, who exaggerates many of the panel's findings and implies in his book and movie that his opinions are actually the IPCC consensus, said Muller, who has credentials of his own as author of a respected technical book on climate change in Earth's history. Many climate scientists have remained silent about these misleading statements, hoping that the exaggerations stimulate public interest. Muller acknowledges this benefit, but feels that there is a core of intelligent readers that deserve to know the whole truth. That includes anyone running for office.

Widespread acceptance of the exaggerations has led, for example, to the belief that the United States is the main culprit in global warming. In fact, said Muller, the IPCC climate models attribute only one-fifth of a degree Fahrenheit of global warming to the United States - a quarter of the total 0.8°F warming estimated to have occurred over the past 50 years. While the U.S. contribution is far more than that of any other

country and disproportionate with the rest of the world, if the nation continues at its current rate of emissions, it will be responsible for another 0.2 degrees of warming in the next few decades, whereas the emerging economies of China, India and Russia combined could contribute 4 to 5 degrees of warming, he said. Thus, whatever the United States does to limit carbon emissions could quickly be negated by actions in the developing world. China, in particular, might choose not to slow economic growth - and carbon emissions - until its people reach the same level of wealth as people in the United States.

"In the end, the issues go beyond physics, but we need to recognize that many measures we institute in the United States to deal with global warming can be classified as feel-good measures or setting-the-example measures," he said. "We have to ask ourselves which example the developing world will follow - our example of reducing carbon emissions or our example of generating enormous wealth."

Muller's efforts to present just the facts often earn him attacks from both sides of a debate, with each claiming he is on the other's side. One of his proudest moments came after a semester of discussion of nuclear bombs and terrorism and global warming, when a student asked him what his politics were.

"Just in asking the question, he gave me a great compliment," Muller said, noting that he refused to divulge his voting preferences. "Science should be nonpartisan, and that's how I try teach it."

Muller is unsure whether either presidential candidate has seen his book, but he has already gotten it into the hands of some of the candidates' senior advisors. His goal is not to turn the candidates into physicists, but to give them the knowledge they need to make more informed decisions, and to be better able to defend those decisions to the public.

"The book was really written for two people," he said, "though, ultimately, just for one. I just don't know which one."

Source: University of California - Berkeley

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