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The Scientist Who Made a 'Total Turnaround'

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Bill McKibben

Energy for Future Presidents: The Science Behind the Headlines

by Richard A. Muller

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Subhankar Banerjee

A mother polar bear and two cubs playing near their den, Brownlow Point, Canning River Delta, Arctic National Wildlife Refuge, Alaska, along the coast of the Beaufort Sea, March 2002

In the long intellectual struggle over global warming—by now stretching out to something like the duration of the cold war—one of the more amusing sideshows came earlier this summer, courtesy of Berkeley physicist Richard Muller.

An engaging soul (he's won teaching awards at Cal; no wonder, since his Wikipedia page shows him wearing a long blond wig as he touches the Van de Graaff generator to demonstrate static electricity), Muller is clearly one of those scholars who relishes

attention. A particle physicist by training, he has published widely on controversial topics—theorizing, for instance, that our sun has an undetected companion star that periodically sends swarms of comets in our direction (the so-called Nemesis hypothesis) and estimating in a column for MIT's *Technology Review* that polygraph machines are 80–95 percent accurate. From a distance, he seems a type familiar to anyone who spends time on college campuses—the brilliant curmudgeon who trespasses across disciplinary boundaries, often equal parts endearing and tiring.

Sometime in the last decade Muller got a bee in his bonnet about climate change, or at least the measurements used to show that the earth was warming. He worried that thermometers used to take readings around the world had been placed too near pavements; that raw data had been incorrectly “adjusted” by scientists; that cities had warmed because of the so-called “urban heat island effect” and that this affected calculations; and that there had been bias in the selection of which temperature records to use.

Other scientists had already tackled each of those possible sources of error repeatedly, and reached a strong consensus that indeed the planet was warming. But Muller decided he should reach his own conclusions, and raised money from a variety of sources, including Charles Koch, one of the two Koch brothers who made their fortune in fossil fuel and have generously funded the climate denial movement. Expectation therefore ran high among these skeptics that Muller's Berkeley Earth Surface Temperature (BEST) project would confirm their view. Anthony Watts, for instance, proprietor of the most widely read skeptic blog, said, “I'm prepared to accept whatever result they produce, even if it proves my premises wrong.”

In the event, the project's reworking of the data found precisely what one might expect: the previous teams of talented scientists had gotten it exactly right. When you plotted the BEST line against earlier work from places like Jim Hansen's NASA lab, they matched up almost exactly—in fact, Muller's data showed the planet had warmed a bit more than other reckonings. “Our biggest surprise was that the new results agreed so closely with the warming values published previously by other teams in the US and the UK,” said Muller, when preliminary results were announced last fall. “This confirms that these studies were done carefully and that potential biases identified by climate change skeptics did not seriously affect their conclusions.” Earlier this summer, Muller and his colleagues released a new (not as yet peer-reviewed) paper going a step further, declaring that humans, thanks to our carbon emissions, are “almost entirely the cause” of the increase.

The news that a team of scientists had discovered exactly the same thing as all the other scientists before them would normally not create much furor. And indeed among scientists in the field the BEST paper was largely a nonevent. Technicians were interested in the new “data-set agglomeration” techniques used by Muller’s colleague Robert Rohde, who is admired as a topnotch statistician, but otherwise it held little technical interest for scientists. For lay observers, though, the fact that Muller was a former skeptic, and that he’d taken money from a Koch brother, seemed to endow his findings with special significance, an idea Muller was happy to foster. “Call me a converted skeptic” was how he opened the *New York Times* Op-Ed where he released his findings. He had made “a total turnaround, in such a short time.” And since the press loves to write about converted skeptics, he became the subject of thousands of comments and press accounts. “Koch-Funded Climate Change Skeptic Reverses Course” was the altogether typical headline on the *Los Angeles Times* story.

The climate denier community was the first to complain about Muller’s change of heart. Needless to say, his findings did not in fact cause them to recant. Their scientific counterattacks were as usual paltry, but they had a reasonable point to make about Muller himself—namely, that he hadn’t ever been much of a skeptic, and hence his conversion was really not that big a deal. Indeed, a great deal of his supposed change of heart did appear to be PR—it didn’t take long to find essays from almost a decade ago where he said things like

my own reading of the literature and study of paleoclimate suggests strongly that carbon dioxide from burning of fossil fuels will prove to be the greatest pollutant of human history. It is likely to have severe and detrimental effects on global climate.

In the long run, however, advocates for action on climate change—who enthusiastically embraced Muller’s supposed defection on the matter of the temperature record—may have more to fear from his sudden celebrity. His daughter Elizabeth, who was his collaborator on the BEST project, announced plans for a “new section” of the BEST project to “look at policy.” (He’s also the president of a consulting company, Muller & Associates, whose website describes its work for a “large industrial conglomerate,” “a major energy company,” “a major private equity firm,” and governments from oil-rich Nigeria to oil-rich Abu Dhabi, not to mention “analysis of the bioterrorism threat” for the US government. His daughter is CEO.)

Muller’s new book, *Energy for Future Presidents*, released alongside his own statements

to the press about the new findings, in fact centers on policy suggestions, and it is one of the strangest mixes of wool-gathering, Op-Ed punditry, and general mixed-up-ness I've ever read. It's actually the second in a series of books he's written purporting to advise potential occupants of the White House, the first titled *Physics for Future Presidents*, based on a course of that name that he taught for many years at Berkeley. (Apparently, Cal is rich with people considering commander in chief as a career.) This volume repeats many of the first book's themes and examples; it's clear that Muller has a few hobbyhorses that he is willing to ride into the ground.

It's also clear he's got a penchant for straw men, and this book begins with one. Determined to rehabilitate nuclear power after the Fukushima accident, he begins with a potted history of the 2011 Japanese tsunami (in three sentences the size of the wave goes from thirty feet to fifty feet) that "severely damaged" the reactor. The world was on tenterhooks: "Might the uranium inside explode like an atomic bomb?" Except...no scientists, and very few journalists, that I came across were worried about a nuclear explosion. I know he's writing for future presidents, and the quality of this year's primary field does give one some pause; still, all the media coverage focused on the possibility not of an atomic explosion, but of a large-scale radiation leak. So the two pages spent explaining why a nuclear plant is not a nuclear bomb (and the four pages spent on precisely the same topic toward the end of the book) are so much hand-waving.

One suspects that Muller has given the lecture about why basic physics prevents an atomic reactor from exploding in a mushroom cloud several times over the course of his career, and rather enjoys it. Once he's finished delivering it here, he goes on to downplay the danger of the radiation that did leak, calculating that it will only cause one hundred additional cases of cancer—which may not come as comfort to the thousands of people evacuated for the foreseeable future from the region surrounding the plant where they had previously made their homes and livings. At any rate, Muller's technique is clear: take the worst possible (or in this case impossible) danger and dismiss it, at which point any other effects will seem small.

Applied to global warming a little later in the book, the sleight of hand goes like this: it's unlikely that we'll heat the planet enough to set off a runaway greenhouse effect that will turn Earth into Venus. Also, some people thought climate change "caused" Hurricane Katrina, not to mention outbreaks of tornadoes and other severe weather, but we don't have statistical proof that hurricanes or tornadoes are on the increase, so it's okay to conclude that we should be "concerned" about global warming but we should

certainly not panic. In fact, he opines that “maybe global warming is good,” adding that his home in “chilly Berkeley” might “be nicer with a few degrees of warming.”

In truth, this is a veritable march of straw men. Almost no one has seriously worried that we’ll heat the earth to the point where, say, our oceans boil away. And let’s give Muller the benefit of the doubt on hurricanes and tornadoes—they’re rare and episodic, and hence amid the random noise of nature it is hard to pin down how their incidence is changing (though it would have been correct to note that scientists who study severe weather are clear that increased temperature, by loading the atmosphere with extra moisture, can contribute to stronger storms).

In any event, all this spinning allows Muller to avoid grappling with the basic, fundamental, readily apparent, and already highly dangerous effects of climate change. Muller posits a spectrum of positions that run from “alarmist” and “exaggerator” through “warmist” and “lukewarmist” to “skeptic” and “denier,” and attempts to claim for himself the responsible middle ground while shunting scientists and activists more worried about global warming off into the extremes. This is a political strategy—a bid for the ear of pundits as well as presidents, with the time-honored strategy of representing the reasonable middle.

The trouble is, climate change has already produced empirically verifiable results, precisely as people like Hansen have predicted from the start. Forty percent of summer ice in the Arctic is gone (and this year’s melt season set a new record in late August); the ocean is 30 percent more acidic; and the atmosphere is 5 percent wetter than it used to be, loading the dice for more severe floods, even as hotter summers give us more prolonged and pronounced droughts. Data released this past summer demonstrates huge increases in “extreme precipitation” from rainstorms. In the northeast United States, for instance, such gullywashers grew 85 percent more common. Results like this are why the world’s largest insurance company, Munich Re, said in 2010 that “a marked increase in the number of weather-related events” simply “cannot be explained without global warming.” As Hansen demonstrated earlier this summer, in a paper (this one, as opposed to Muller’s, peer-reviewed) published in the *Proceedings of the National Academy of Sciences*, the one-degree increase in temperature that has already occurred has been enough to give us “a high degree of confidence” that extreme heat events like those we’ve seen this summer across the US are “a consequence of global warming because their likelihood in the absence of global warming was exceedingly small.”

Muller, in TV appearances, has downplayed such a link—but of course he thought

Hansen was wrong about temperature trends too, until he actually did the work to find out. The people who do carry out such studies grow ever more alarmed; just to give a single example from the morning that I'm writing this piece, a new study in *Nature* finds that the chances of droughts like the one the Midwest is currently enduring are soaring, and we can expect many more such events over the next several decades.

Even given his nonchalance about global warming, Muller's prescriptions for policy are underwhelming, and in some cases odd. He loves shale gas, for instance—the new fracking technologies have provided a “windfall,” “the most important new fact for future US energy security,” and a big step toward solving global warming since burning gas produces half as much carbon as coal. I've already discussed fracking in these pages,¹ and was not surprised to find Muller gliding past the central questions about natural gas and global warming. He notes rightly that opposition to fracking comes from “environmentalists who worry about natural gas leaking into the atmosphere” unburned, since those methane molecules are twenty-three times better at trapping heat than CO₂. But he offers no reason to think that this problem (which by some estimates would make fracked gas worse for global warming even than coal) is being solved; instead, having raised it he simply drops the whole subject.

He also seems unaware of recent work by economists demonstrating that cheap shale gas undercuts the transition to no-carbon wind and solar power; even the staid International Energy Agency, when it made a study of a fast and thorough switch to a gas-powered world, concluded, in the words of the UK journalist Fiona Harvey:

Reliance on gas would lead the world to a 3.5C temperature rise. At such a level, global warming could run out of control, deserts would take over in southern Africa, Australia and the western US, and sea level rises could engulf small island states.²

Muller likes a few other technologies too—he exults about new shale oil finds in the Dakotas, theorizing that we may be about to become the next Saudi Arabia. But given his confidence about that, he also inexplicably recommends that we build synthetic fuel



Robert McCabe

Adélie penguins at the Cape Royds rookery; photograph by Robert McCabe from his book DeepFreeze! A Photographer's -Antarctic Odyssey in the Year 1959, published recently by International Photography Publishers

plants to turn coal and natural gas into liquid fuel, as the Nazis and the South Africans once did. (This process of course produces extra greenhouse gases, and so would exacerbate global warming.) He likes nuclear power, especially small nuclear plants buried underground and dug up once every thirty years for maintenance.

A principal problem with his analysis is that it ignores economics. Even the head of GE, which has a substantial nuclear component, said earlier this summer that the technology had become so expensive that it was “really hard” to justify. Muller devotes twenty pages to explaining the intricacies of different types of fusion (cold, muon, beam, tokamak) but amid the pointless detail he offers no convincing evidence that any of it will amount to anything reasonably soon. No president actually needs to know, say, that in the Tri Alpha proprietary design “hydrogen and boron are accelerated into smoke-ring shaped beams” confined by electric fields, especially if the best summation you can offer is: “Will this work? I don’t know.”

As far as I can tell, Muller doesn’t even mention the one obvious solution discussed by almost everyone who’s considered this question in the last twenty-five years: pricing carbon emissions to reflect the damage they do in the atmosphere. I suppose you could excuse this as being outside the field of physics, except that he’s eager to touch on all kinds of other political controversies. For instance, he spends a number of pages pointing out that nothing the US president can do will have enormous effect on the atmosphere if China keeps burning ever more coal and pouring ever more carbon into the atmosphere. “Most future CO₂ will come from the emerging economies, with China contributing 44%,” he writes. “As far as global warming is concerned, the developed world is becoming irrelevant.”

But everyone who’s written about energy for the last fifteen years has reached the same conclusion; and it’s been a constant concern of, among others, State Department negotiators for the last three presidents. And set aside the fact that Muller gets easy numbers wrong (he claims Chinese GDP per capita is 2 percent that of the US, when in fact it’s more than 10 percent in nominal terms).

His real weakness as a presidential adviser in this case is that he has not even rudimentary diplomatic counsel to offer his putative commander in chief. Given that historically the US has been the biggest source of carbon emissions, it might be easier for the Chinese to move politically if America made real gestures, including for example a carbon tax; persuading Congress to make those gestures would be the most useful thing a president could accomplish. (And persuading those huge political donors the

Koch brothers to let Congress let the president propose such a tax would be a great start, and given Muller's connection with the Kochs at least within his power to suggest).

In the event, our failure to act has not in fact completely inhibited the Chinese, who are beginning to introduce regional carbon pricing, and who are by most accounts now leading the world in the installation of renewable energy. In fact, by far the biggest use of solar power in the world is by the Chinese for producing domestic hot water—as much as a quarter of the country gets its hot water from the roof, and there are cities where virtually every apartment building has such a system. The percentage for the US is under one percent. Before one lectures the Chinese too much, it might be best to visit Himin Solar, the biggest solar-thermal company in the world, where they have on display one of the solar hot water panels that Jimmy Carter installed on the White House in 1979, and Ronald Reagan took down in 1985.

Muller manages to get a couple of things exactly right. His description of the role that conservation and efficiency could play in reducing energy use is solid if anodyne—he quotes the obvious people, like efficiency guru Amory Lovins, and the report prepared by the consulting firm McKinsey and Company demonstrating the savings to be made from relatively simple measure such as replacing inefficient household appliances and switching to hybrid cars. This money would, according to Muller, be almost enough to pay for costly projects—for example, expanding wind and solar energy production and capturing carbon from coal and gas power plants.

And then there is a chapter toward the end, titled “What Is Energy?,” that he prefaces by saying, “This is a part of the book that you really don't need to read.” But in fact it's by far the best stretch in the whole book, a meditation by a wise physicist on what energy means. Suddenly you sense the reason that he's a much-loved lecturer; he has that feel for the subject that comes across even to an audience that's not following the math. The connection between energy and time, he writes, “provides an insight that goes beyond engineering and borders on the spiritual.” I would say that it's the one chapter in the book that really bears reading.

Muller provided a small service by confirming what other scientists had long since shown on global warming. One worries, on the evidence of this book, that he will provide a continuing disservice by haranguing people on subjects he has not yet investigated thoroughly enough to find out that he's once again wrong. (And one suspects that journalists, thrilled by his apostasy, will give him ink at every turn.) It's too bad, really, since he clearly has a powerful mind. But—as Muller says in his

discussion of cold fusion—“self-doubt is the essence of the scientific method.” And there’s very little of that on display here.

1. 1
“[Why Not Frack?](#),” *The New York Review*, March 8, 2012. ↩
2. 2
“Natural Gas Is No Climate Change ‘Panacea,’ Warns IEA,” *The Guardian*, June 6, 2011. ↩

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