Edward Bullard and Patrick Blackett. Both went to the Cavendish Laboratory, but that is about all they have in common.

Harold Jeffreys and Maurice Ewing, two equally prominent geophysicists who were contemporaries of Bullard and Blackett and are also mentioned in Good's article, were not Cavendish people. The major problem they faced was how to reconstruct the structure and inner processes of Earth from surface data only. They may have recognized that the problem was ill-posed and that it could only be solved numerically. But their approaches were different: Bullard and Ewing used controlled explosive sources to constrain the solution, while Jeffreys used Bayesian statistics. Their views had much to do with their approaches. Jeffreys, in the fifth edition of his treatise *The Earth: Its Origin, History, and Physical Constitution* (Cambridge University Press, 1970), adopted my viscoelastic Earth model and thus unwittingly opened the door to plate tectonics.

Incidentally, Good claims that Jeffreys was "a fellow of Trinity College." He was not. He became a fellow of St. John's in 1914 and held successive fellowships thereafter under different titles, always at St. John's. I was his guest at St. John's College in the late 1950s.

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Good replies: David Stevenson's letter raises an interesting issue that has more to do with the nature of history than with Earth's internal heat. As Stevenson notes, from our current vantage point we know that ignorance of radioactivity was not the main problem with Lord Kelvin's calculation of Earth's age. And the belief of Kelvin's peers that this invalidated his calculations "undoubtedly influenced the development of geophysics," as Stevenson says. What counts in history is what people thought at the time. Although "could haves" interest me, too, we historians usually struggle sufficiently just establishing what did happen.

I hope I did not suggest that Teddy Bullard was the first to think Earth's magnetic field might be due to electrical currents deep within. In fact, wonderful letters in which Bullard, Patrick Blackett, and Walter Elsasser debate details of such currents still exist in the Bullard archive. And even before Joseph Larmor's 1919 paper on stellar interiors, Arthur Schuster had also considered those currents in several papers. Michael Rochester's comments are much appreciated, since he knew and worked with Bullard.

As Nick Rogers points out, Bullard came from a wealthy family and experienced opportunities less available to his working-class peers. Social background is always relevant to biography. I thank Cinna Lomnitz for the welcome correction of my error regarding Harold Jeffreys. I did know that Jeffreys was a fellow of St. John's College; I spent several enjoyable weeks in the school's archives reading his manuscripts.

Bullard and Blackett actually had more in common than their interest in geophysics. Both were government advisers and department directors, both involved themselves in operational research and the governance of science. Their personalities, of course, could not have been more divergent.

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Roots and risks of total nuclear disarmament

Notably absent from Sid Drell's otherwise comprehensive review of nuclear reductions (PHYSICS TODAY, July 2010, page 30) is one of the most efficacious and irreversible nuclear-disarmament measures—demilitarization of fissile materials.[1]

Demilitarizing weapons-grade uranium and plutonium is an established industrial practice: These fissile weapons materials are blended with industrial-grade low-enriched uranium oxide, resulting in the mixed oxide that fuels commercial reactors.

In fact, most fuel rods in civilian US power reactors contain at least some weapons-origin fissile material. Civilian nuclear reactors can profitably consume weapons-source materials while rendering them militarily useless.

Fissile conversion and demilitarization is a valuable disarmament method because it is cost-effective and irreversible in the long term; the fuel supply is reliable; and industry personnel have decades of experience in the process.

Demilitarization, which applies to both fission and thermonuclear weapons, would preclude reconstruction of proven weapons and reduce fears of treaty violations among both nuclear- and non-nuclear-weapons states.

Coupled with a ban on production of weapons-grade materials, demilitarization would most durably and tangibly impede nuclear rearmament and would be attractive to a wide array of nations.

Reference

1. A. DeVolpi, *Ann. Rev. Nucl. Part. Sci.* **36**, 83 (1986); *Nuclear Insights: The Cold War Legacy*, 3 vols., DeVolpi, Oceanside, CA (2009).

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I disagree with my friend Sid Drell about the implications of a world ostensibly without nuclear weapons. In such a world, the only countries with nuclear weapons would be Iran, North Korea, and the like. A treaty renouncing nuclear weapons would be a modern-day repeat of the folly of the 1928 Kellogg–Briand pact, the General Treaty for the Renunciation of War.

Such symbolic gestures are not harmless. The signatories of Kellogg–Briand included all the aggressors of the 1930s. Democracies are slow to recognize aggressor nations because their motives are incomprehensible to us. Our enemies arm before we realize their intent, and our defensive measures follow only after long delay. We listen to our Winston Churchills very late. As a wise Roman said: "If you wish for peace, prepare for war."

Disarmed, we would face the threat of even a single nuclear weapon without the ability to deter it. In the age of the intercontinental ballistic missile, not even the oceans offer strategic depth.

An American renunciation of nuclear weapons would be followed by a rush to proliferation as a dozen or more regional powers, no longer protected by an implicit or explicit American guarantee, build their own nuclear forces. Such a world, in which a multitude of rivalries and enmities become nuclear confrontations, would certainly be more dangerous than the present one.

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Drell replies: In my article I emphasized the need for "a mechanism for international control of the entire [nuclear] fuel cycle at all stages." Establishing such a mechanism will be critical to making substantial progress toward a