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India and Pakistan, would agree to do so; in fact, those two nations are rapidly expanding their nuclear arsenals as of this writing. Nor is it clear that following the Hoover prescription will in any way deter rogue states such as Iran from going nuclear.

Like it or not, the best option for the US is to continue to maintain a large number of nuclear weapons, with the clear policy message that the perpetrator of any nuclear attack will suffer instant and massive retaliation. The same fate should befall any state that has supplied a nuclear weapon to a terrorist group. Identifying the supplier is a non-trivial task, but rapid progress is being made on nuclear forensics and, at least at present, there are only a small number of potential culprits.

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Drell replies: I agree that the steps in my article "cannot be carried out unilaterally or bilaterally" with Russia. I emphasized the need to make the goal of a world without nuclear weapons into an international diplomatic initiative at the highest level.

However, I disagree with Lewis Glenn's claim that our best option is to maintain a large number of nuclear weapons capable of massive retaliation in response to a nuclear attack. Our gravest danger today, due to the global spread of nuclear technology, is that dangerous hands, including suicidal terrorists, will acquire these horrific weapons. Reliance on thousands of them for deterrence based on massive destruction is becoming decreasingly effective and increasingly hazardous. A better path is for nuclear powers, led by the US and Russia, who own most of the nuclear weapons, to work internationally to prevent nuclear proliferation and initiate practical steps listed in my article toward an ultimate goal of zero weapons for all. Difficult yes, but far superior to the alternatives.

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Encouraging young PhDs to jump boundaries

Lisa Randall's Quick Study piece in the July 2007 issue of PHYSICS TODAY (page 80) makes very good reading. It reminded me of a private discussion I had

a couple of years ago with a postdoc specializing in string theory, who had already published 10 papers on the subject. He started by explaining the idea of branes and the strings that connect them, and he made a drawing like the one in Randall's article. I was immediately reminded of dislocations in solid-state physics, about which my colleague had no idea. Shower curtains might be a helpful model, at least for the geometric description. But dislocations offer a situation in the full context of crystal physics. The "gravitybrane" and the "weakbrane" are compared with two surfaces of the crystal, and the "bulk energy," which is contained in the lattice between the two surfaces, depends on the lattice's symmetry and elastic properties. The dislocation is a one-dimensional defect that connects the two surfaces and is essential for crystal growth as well as for plastic deformation, depending on its Burgers vector.

Nowadays young physicists don't have a chance to learn things in unrelated areas. After getting a PhD in quantum field theory, I got a job at the geophysical laboratory of Shell Oil Co, where I worked from 1953 to 1960. My first task there was to learn something about dislocation theory, because the laboratory also did high-pressure experiments on plastic flow for minerals like calcite and dolomite. Such jumps between the specialties of physics do not happen anymore, and the blame belongs equally to university professors and industry leaders. It is up to the young PhDs to ask for such changes in their experience. All three groups might find those jumps helpful in the application of mathematics to physics.

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