

Restart science stronger after COVID-19

As the scientific enterprise and its supporting institutions rebuild from the disruptions caused by the coronavirus disease 2019 (COVID-19) pandemic, we must support the graduate students and young investigators whose developing careers have been interrupted or irretrievably damaged. Even before the pandemic, the next generation of the scientific workforce faced problems such as limited job opportunities and narrow career training, inadequate mentoring, and a less diverse and inclusive scientific establishment (1, 2). Studies of these challenges have yielded recommendations for at least partial solutions, but few changes have been implemented (1, 2). The pandemic has now increased the urgency of these issues, which must be addressed if science is to thrive in the future.

More than 60% of new Ph.D.s will not pursue careers in academic research. Graduate curricula must therefore be at least partially redesigned to accommodate their broader career interests (3). Mentorship quality can be improved with appropriate faculty training (4). The lack of diversity, equity, and inclusion in science must be taken seriously and ameliorated. Resources may have to be redistributed to ensure that younger scientists have independent careers earlier than has become common. Let us not waste the opportunity presented by this crisis to address longstanding problems. As we rebuild, we should look hard at our own enterprise, make some changes, and restart science stronger.

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Uphold the nuclear weapons test moratorium

The Trump administration is considering renewing nuclear weapons testing (1), a

move that could increase the risk of another nuclear arms race as well as an inadvertent or intentional nuclear war. Following in the long tradition of scientists opposing nuclear weapons due to their harmful effects on both humanity and the planet (2), we ask the U.S. government to desist from plans to conduct nuclear tests.

During the Cold War, the United States conducted 1030 nuclear weapons tests, more than all other nuclear-armed nations combined (3). In 1996, the United States signed the Comprehensive Nuclear Test Ban Treaty (CTBT), agreeing not to conduct a nuclear weapons test of any yield (4). The United States has not yet ratified the CTBT but did spearhead the 2016 adoption of UN Security Council Resolution 2310, which calls upon all countries to uphold the object and purpose of the CTBT by not conducting nuclear tests (5).

Eight of the nine nuclear-armed states, including the five permanent members of the UN Security Council, have observed a moratorium on nuclear testing since 1998 (3, 4). The ninth, North Korea, responding to international pressure, stopped testing warhead detonations (as opposed to missile flights) in 2017 (6). If the United States ratified the CTBT, joining the 168 countries who have already done so (4), there is a good chance that the other holdout countries would ratify the treaty as well (7).

In contrast, restarting U.S. nuclear weapons tests of any size, underground or aboveground, would give license to other countries, such as North Korea, India, and Pakistan, to resume testing. If the tests are underground, radioactive materials could leak into the local environment, including water supplies (8); if in the atmosphere, which is currently prohibited by the 1963 Limited Nuclear Test Ban Treaty (9), such tests would spread radioactivity, sometimes very widely (8). Once the United States breaches the treaty, there will be no way to prevent other nations from carrying out tests of larger warheads or to control leaks into the environment and atmosphere. Even a “limited” nuclear exchange between nuclear-armed nations can cause untold local death and destruction, as well as global climate and agricultural catastrophes stemming from the climate impacts of smoke from fires ignited by nuclear weapons (10).

The current U.S. arsenal includes thousands of warheads, together capable of obliterating every major city in any country on Earth. Yet the United States has embarked on a \$1.7 trillion nuclear weapons enhancement program (11), of which the proposed testing would be one small—but dangerous—component. All nations, including the United States,

should continue to reduce the number of nuclear warheads in the world’s arsenals, not increase their efficacy or develop more lethal versions. Senator Edward Markey and Senate colleagues recently announced the Preserving Leadership Against Nuclear Explosives Testing (PLANET) Act, which would deny funding for and thereby prevent the renewal of testing (12). We urge the Senate to pass this bill and to ratify the CTBT immediately.

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COMPETING INTERESTS

D.H., R.S., and S. Solomon are members (in an unpaid advisory capacity) of the Science and Security Board of the Bulletin of the Atomic Scientists. J.F.T. is affiliated with the Center for Arms Control and Non-Proliferation.

SUPPLEMENTARY MATERIALS

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