

Correspondence

Academies' action on germline editing

We share the concerns raised by Eric Lander and colleagues, who call for a moratorium on clinical uses of heritable human genome editing and emphasize the urgent need for an acceptable international framework (see page 165).

Statements from the organizing committees of both the 2015 and the 2018 international summits on human genome editing made it clear that any clinical use of heritable genome editing would be irresponsible at this time. A 2017 report by the US National Academies of Sciences, Engineering, and Medicine also concluded that clinical use, including clinical trials, of heritable germline editing should not proceed until preclinical research clarifies the potential risks and benefits, and should be considered only for compelling medical reasons, in the absence of reasonable alternatives. And in 2018, the London-based Nuffield Council on Bioethics recommended more research to establish standards for clinical use, along with opportunities for broad societal engagement.

To this end, the US National Academy of Sciences, the US National Academy of Medicine and the UK Royal Society are leading an international commission to detail the scientific and ethical issues that must be considered, and to define specific criteria and standards for evaluating whether proposed clinical trials or applications that involve germline editing should be permitted. Dozens of scientific academies around the world are lending their support to the commission. We also welcome the establishment by the World Health Organization of an expert panel on human genome editing, with which we have agreed to liaise closely.

Our intention is that the commission's work will be an important step forward in reaching international consensus on standards that should apply to

decisions about germline editing. As emphasized previously by our academies and others, we also recognize that — beyond the scientific and medical communities — we must achieve broad societal consensus before making any decisions, given the global implications of heritable genome editing.

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NIH pro germline editing moratorium

We strongly support Eric Lander and colleagues' call for an international moratorium on clinical uses of human germline editing (see page 165). We also welcome the proposed process that nations could consider in the future to determine whether necessary conditions to lift the moratorium have been met.

This is a crucial moment in the history of science: a new technology offers the potential to rewrite the script of human life. We think that human gene editing for reproductive purposes carries very serious consequences — social, ethical, philosophical and theological. Such great consequences deserve deep reflection. A substantive debate about benefits and risks that provides opportunities for multiple segments of the world's diverse population to take part has not yet happened. Societies, after those deeper discussions, might decide this is a line that should not be crossed. It would be unwise and unethical for the scientific community to foreclose that possibility.

There are significant reasons to support a moratorium at the present time. As Lander and colleagues note, the risks currently far outweigh the benefits, given the serious and

unquantifiable safety issues, ethical concerns and lack of sufficiently compelling medical applications. Although some extremely rare medical scenarios could exist in which germline editing might be the best or only option, those arguments must be balanced against the many other considerations.

Gene editing has enormous potential in other applications to advance science and save lives. The US National Institutes of Health is prohibited from supporting the use of germline gene-editing technologies in human embryos, but we consider research on therapeutic uses of gene editing in somatic cells — in diseases such as sickle-cell anaemia and muscular dystrophy — to be among our highest priorities.

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Help curtail new coal mines

Despite many countries' efforts to ramp up renewable-energy use, the demand for affordable energy is rising so rapidly that coal production is set to continue. The Carmichael project, an Indian venture based in Australia, could become the largest coal mine to be developed anywhere since the Paris climate agreement went into force in 2016 (see go.nature.com/2shmiyu). Scientists must step in to help bring international demands for coal under control.

Australia's biggest coal-mining company, Glencore, announced last month that it would cap production because of societal concerns about climate change (see go.nature.com/2seent7). And a court turned down a huge coal-mining project in Hunter Valley on the same grounds. However, action by local judges and chief executives is not enough.

Science can inform courts, companies and politicians on the types and scale of mining

projects that can support growth in developing countries (S. Kartha *et al.* *Nature Clim. Change* **8**, 348–349; 2018), and on which ones would need to be stopped or capped to mitigate climate change (an emissions–development trade-off). Such analysis would take into account cross-national emissions budgets and the difficulties faced by regions of energy poverty.
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'Work on problems you most enjoy'

An exchange I once had with oceanographer Walter Munk offers insight into how he inspired countless scientists and engineers (see page 176).

The inspiration first came to me from his classic paper 'Abyssal recipes' (W. H. Munk *Deep-Sea Res.* **13**, 707–730; 1966), in which he laid out the seemingly unlikely notion that swimming animals contribute to ocean mixing. In 2007, after pursuing that line of research for more than a year without success, I e-mailed Walter for advice.

He replied: "It was partly an attempt at humor when I suggested many years ago that diurnal migration could lead to appreciable mixing. And I was amazed at recent papers authored by those who think this is not a joke." He added: "People thought it was a lunatic idea when Carl Wunsch and I suggested that the Moon (via lunar tides) could have anything to do with mixing. And now that is generally accepted."

His advice? "Work on problems you most enjoy. Strange things can happen." More than a decade later, we are gleaming hints of truth from his original jest (see I. A. Houghton *et al.* *Nature* **556**, 497–500; 2018).

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