

Edited by Jennifer Sills

## Eugenics lurk in the shadow of CRISPR

IN CALLING THEIR Perspective “A prudent path forward for genomic engineering and germline gene modification” (3 April, p. 36; published online 19 March), D. Baltimore *et al.* show at once the size of the problem and the modesty of their response to it. CRISPR-Cas9, invented by the ninth author, Jennifer Doudna, allows the alteration of specific DNA in the mammalian genome. The authors say that “CRISPR-Cas9 technology, as well as other genome engineering methods, can be used to change the DNA in the nuclei of reproductive cells that transmit information from one generation to the next (an organism’s ‘germ line’).” This is a big deal. It means that we can imagine a day when human chromosomes may be modified in the sperm and egg to assure that one or another aspect of a child’s inheritance is designed to order.

This is a huge departure from current understanding, but the authors are remarkably circumspect. They call for the convening of a “globally representative group of developers and users of genome engineering technology and experts in genetics, law, and bioethics, as well as members of the scientific community, the public, and relevant government agencies and interest groups, to further consider these important issues, and where appropriate, recommend policies.”

That simply will not do. This opening to germline modification is, simply put, the opening of a return to the agenda of eugenics: the positive selection of “good” versions of the human genome and the weeding out of “bad” versions, not just for the health of an individual, but for the future of the species. I do not think their call is sufficient. Even in its inadequacy, I doubt it will be heeded by the six private corporations that are listed in the paper as supporting their research, nor by the universities listed as holding their patents on continuing CRISPR-Cas9 research.

Rational eugenics is still eugenics. The best in the world will not remove the pain from those born into a world of germ-line modification but who had not been given a costly investment in their gametes. They will emerge with the complexity of a genome different from what this technology will be able to define as “normal.” I do not think anything short of a complete and total ban



Eugenics on the horizon?

on human germline modification will do, to prevent this powerful force for rational medicine—one patient at a time—from becoming the beginning of the end of the simplest notion of each of us being “endowed by our Creator with certain inalienable rights.”

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## Carnivore coexistence: Wilderness not required

OUR REPORT “RECOVERY of large carnivores in Europe’s modern human-dominated landscapes” (19 December 2014, p. 1517) generated a series of Letters, published in the 23 January issue, concerning the importance of wilderness for large carnivore conservation (“Carnivore coexistence: Value the wilderness,” J. J. Gilroy *et al.*, p. 382; “Carnivore coexistence: America’s recovery,” M. E. Gompper *et al.*, p. 382; “Carnivore coexistence: Trophic cascades,” T. M. Newsome and W. J. Ripple, p. 383).

Gilroy *et al.* claim that the recovery of large carnivores in Europe is contingent on wilderness and protected areas. However, barely 13% of the European Natura 2000 network contains relatively undisturbed natural habitat (1), and the majority of protected areas in Europe are too small and isolated to house even single individuals, let alone sustain viable large carnivore populations (2). We by no means argue for a rollback on protected area designation or on the importance of conserving remaining wilderness. We simply argue that European

carnivores are not among the species whose conservation depends on either of these conservation strategies.

In contrast to the claim made by Gilroy *et al.*, Swedish bears do not live in wilderness but in some of the most intensively harvested commercial forests in the world (3, 4). Decades of bear hunting in Sweden have not precluded their recovery. Central European lynx populations are not generally linked to protected areas. The Bavaria-Bohemian lynx population is a rare exception (5). At their lowest demographic extent, wolves in Mediterranean countries persisted in human-dominated landscapes, and they have made a remarkable comeback to such landscapes in Germany (6). The high black bear densities in New Jersey cited in Gompper *et al.*’s Letter are another illustration of large carnivores’ ability to coexist with people if they are allowed.

We agree that the apparent dichotomy between Europe’s land sharing versus North America’s land sparing may be primarily a legacy of the size difference in protected areas available between continents, and may even reflect a difference in rhetoric rather than practice. Where they exist, wilderness areas tend to play an important role as refuges and potential recovery nuclei for large carnivores, but claiming that such areas are a requirement for large carnivore recovery is not supported by the data.

We agree with Newsome and Ripple that preserving the ecological processes driven by large carnivores in human-dominated landscapes is challenging and requires further research on the functionality of the many different levels of completeness in which the ecological processes can be



## OUTSIDE THE TOWER

## Honing the climate change message

Five years ago, I scheduled my first meeting with a local official to discuss carbon emission reduction in China. I had planned a polished and persuasive argument. First, I presented the main findings from the IPCC Fourth Assessment Report: Climate Change 2007. I then illustrated the various scenarios and the possible turning points we may see under the Kyoto Protocol and beyond. I concluded that we should spring into action to develop a lower-carbon-emission strategy to address global climate change within the regional developmental policy system immediately.



Bing Xue

The official's reaction surprised me. I learned that those in government didn't feel that climate change was a priority. Rather, they were focused on sustaining local economic growth and maintaining socioeconomic stability. This was true despite sustainable development being a national strategy since 1994 (1) and the publication of China's first comprehensive policy initiative, China's National Climate Change Programme, in 2007 (2).

Based on this meeting, and the others that followed, I honed my message. Instead of emphasizing the local responsibilities in addressing global issues such as climate change, I now tell politicians that local efforts on reducing carbon emissions could lead to substantial cobenefits, such as reduction of local air pollutants (3), better economic performance (4), new economic growth areas, and job opportunities. I remind them that tax sources would be created by building low-carbon-oriented facilities.

There has always been a language gap between scientists and local officials, particularly in the field of sustainable development. To address climate change effectively, we must bridge that gap. I found that advocating for science was possible if I could articulate our shared goals.

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declined (7). There is also no doubt that these processes will be very different in landscapes that are human-dominated. Allowing "nature its way" in an area undisturbed by humans is both important to conserve some elements of biodiversity

and scientifically fascinating, but so is the ability of large carnivores to cope with human-dominated landscapes, which, like it or not, is a prerequisite for their survival in large parts of the modern world.

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### TECHNICAL COMMENT ABSTRACTS

#### Comment on "Agriculture facilitated permanent human occupation of the Tibetan Plateau after 3600 B.P."

*Jade d'Alpoim Guedes, R. Kyle Bocinsky, Ethan E. Butler*

Chen *et al.* (Reports, 16 January 2015, p. 248) argued that early Tibetan agriculturalists pushed the limits of farming up to 4000 meters above sea level. We contend that this argument is incompatible with the growing requirements of barley. It is necessary to clearly define past crop niches to create better models for the complex history of the occupation of the plateau.

Full text at <http://dx.doi.org/10.1126/science.aaa4819>

#### Response to Comment on "Agriculture facilitated permanent human occupation of the Tibetan Plateau after 3600 B.P."

*Guanghui Dong, Dongju Zhang, Xinyi Liu, Fengwen Liu, Fahu Chen, Martin Jones*

Guedes *et al.* have drawn attention to a mismatch between the predictions of their "thermal niche model" and the records we have published of early barley finds in the northeastern Tibetan Plateau. Here, we consider how that mismatch usefully draws our attention to the additional variables that may account for it—namely, variations in genetic expression and agricultural practice.

Full text at <http://dx.doi.org/10.1126/science.aaa7573>

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