

# World view



By Victoria  
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## Before making a mammoth, ask the public

**The best ethics adviser for a de-extinction company is the public at large.**

**E**very few years for the past 20 or so, the story resurfaces, frozen in time like a permafrost carcass. At some future point, typically within the decade, scientists hope to ‘bring back the mammoth’. There have been a few tantalizing results – stirrings in mammoth nuclei transplanted into mouse eggs (K. Yamagata *et al. Sci. Rep.* **9**, 4050; 2019) – but that’s it. Hence raised eyebrows at last month’s announcement by de-extinction champion and geneticist George Church, co-founder (with entrepreneur Ben Lamm) of biotechnology start-up Colossal: yet again, the world has about five years until a wobbly, woolly calf takes its first steps into the Anthropocene.

What Colossal actually aims to produce is less a mammoth than a new synthetic species, a chimaera of Asian elephant DNA and mitochondria, mammoth genetic code and, from the probable surrogate dam, African elephant epigenetics. The resulting cold-adapted elephants – Colossal hopes – will trample and graze northern Siberia to create something akin to the Ice Age grasslands of the woolly mammoth’s heyday. Compacted, cooler soils and paler, more reflective foliage, will – the company says – help to avert climate disaster. De-extinction this is not. This is synthetic biology meets geoengineering.

Although I question the timeline, it was ethics, not feasibility, that was my main concern back in July, when Lamm asked if I, an outspoken critic of mammoth de-extinction, would join the advisory board.

I said no. Not because I doubt Colossal’s motives. Its founders are driven by a real desire to help the world, and have recruited expert advisers, including at least two excellent bioethicists. They are thoughtful and serious, and I wish them well. But reshaping the planet shouldn’t be left to a chosen few, with insider advice from hand-picked experts. Instead, Colossal, and all companies like it, should do something as radical for business as its plans are for the planet: actively involve the public in its research decisions.

Colossal’s plans push into ethically and politically fraught territory, operating on time scales that legislation can’t keep pace with: gene editing; reproductive technology; animal welfare; conservation; and land management, to name a few. Both geoengineering and synthetic biology have a poor track record when it comes to people taking matters into their own hands. In 2012, the Haida Salmon Restoration Corporation, based in Vancouver, Canada, tipped 120 tonnes of iron sulfate and iron oxide into international waters off the coast of British Columbia as part of an ocean fertilization project, without the knowledge of national authorities. And

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there is Chinese researcher He Jiankui, sentenced to prison last year for his role in using CRISPR technology in at least two human embryos, resulting in the birth of gene-edited babies. These incidents have had a chilling effect on public trust and on research, and have destroyed the careers of at least three scientists. Open, public participation can rebuild that trust, and improve research outcomes.

Openness and public participation are core components of the Oxford Principles for geoengineering governance, which have underpinned international ethical and legal discourse on geoengineering since their endorsement by the UK government in 2010. These values are also central to the development of regulatory frameworks for genome engineering in humans, and to the potential requirement for free and informed consent from Indigenous and local communities before the implementation of engineered gene drives, in which altered genes propagate through an animal population. And they sit at the heart of the United Nations Research Roadmap for the COVID-19 Recovery.

But they coexist uncomfortably with the business needs of confidentiality and the control of intellectual property. And consulting the public costs money. Colossal has committed to “radical” transparency, inclusion and community engagement, but has the chance to set the bar even higher, by empowering the public as part of its de-extinction journey.

There are tested ways to bring the public into research decisions. Groups such as Expert & Citizen Assessment of Science and Technology (ECAST) in the United States and Involve in the United Kingdom have pioneered public participatory research. For example, NASA’s Double Asteroid Redirection Test Mission, launching on 24 November, can be traced, in part, to public consultation run by ECAST in 2014, when planetary defence was flagged as a key public concern, shaping NASA’s long-term strategic focus.

True, this approach can act as a brake on research plans. In 2020, the solar geoengineering project SCoPEX, run by researchers at Harvard University in Cambridge, Massachusetts, suspended field experiments in Sweden in response to feedback gathered by its independent advisory committee. But for a business such as Colossal, as for NASA, this extra input could equally be a catalyst for innovation, and a way to remove the risk of derailment by protest and controversy. The gene-drive project Mice Against Ticks, for example, benefited when local involvement identified potential unanticipated ecological consequences (J. Buchthal *et al. Phil. Trans. R. Soc. B* **374**, 20180105; 2019).

The ethical road to de-extinction has to include informed citizen voices, alongside experts and activists. This might mean that the process takes longer than five years, but private enterprises working for the common good shouldn’t shy away from the views of those they seek to serve. Let the people decide the future world they want to build.

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