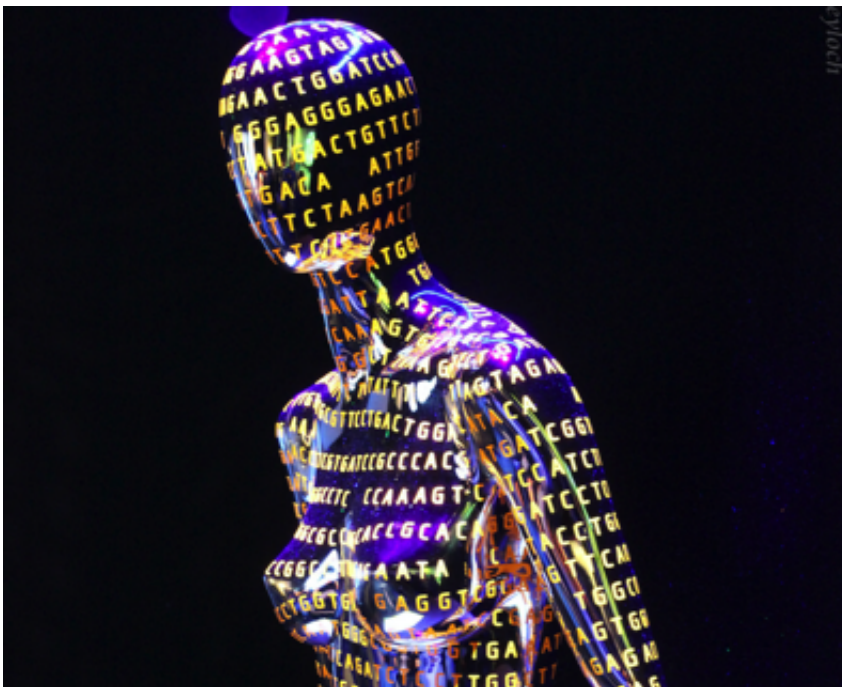


Creating human genomes and synthetic people, destroying entire species with gene drives

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Credit: PLOS Blogs

Researchers have a plan to link together chunks of synthetic DNA, making a researcher-created human genome that can control a cell in a lab dish. This, [the 25 researchers advocating it](#) in an open-access Science paper say, will be called Human Genome Project-Write. That's in contrast with the first HGP, completed in stages earlier in this century,

which they call Human Genome Project-Read. Find [a list of the "stepping stone" projects](#) the researchers are proposing at GEN.

The paper is in a way an outcome of the "secret" meeting about synthesizing whole genomes held at Harvard a few weeks ago. The meeting got unsecret quickly, [making a splash in the MSM](#). At The Conversation, Harvard grad student Jeff Bessen tried to explain why the meeting was secret. [Essentially Science's fault, he implied](#). According to the very high-profile George Church, a host of the meeting and an author of the paper, the editors had asked for a revision that took account of the "ethical, social, and legal components of synthesizing genomes." That made it impossible for the paper to appear at the time of the meeting, and secrecy was required because of the journal's embargo policy.

The published paper spends exactly one sentence on ethical, social, and legal issues.

As the not-quite-secret meeting was taking place, Stanford synthetic biologist Drew Endy and Northwestern bioethicist Laura Zoloth blasted it in a post at COSMOS, saying, "When the first people at the table mostly have significant and direct material interests in proceeding, everyone, not just those in the room, risk [out-of-control competition between public and private interests](#), ethical conflicts of interest, and temptations to manipulate human subject consent."

THE ORIGINS OF HGP-WRITE

HGP-write had its genesis last summer, according to Kelly Servick at Science, when futurist Andrew Hessel made what one scientist called "'this impassioned speech' for a new [human genome project](#) that would capture the public's imagination and inspire the field around a single goal." Hessel is a researcher at the San Francisco software company

Autodesk, which has committed \$250,000 to HGP-write.

According to TechReview's Antonio Regalado, Zoloth is concerned that such a monumental proposal is being led by Autodesk, which Regalado calls "a mid-cap software company with [rinky-dink biomedical credentials](#)."

Drew Endy is also a persistent critic of HGP-write. He has aired his objections, among other places, at a [World Science Festival panel early this month](#), reported by Andrew Joseph at STAT. The panel also featured George Church, key figure in HGP-write—and cofounder with Endy of a synthetic biology company.

"I love the specific projects that George and colleagues are proposing, but I also take at face value that this is going to go beyond that," Endy said. He foresees efforts by other, less ethical, researchers to create synthetic humans.

Making synthetic people is not such a far-fetched fear. Regalado points out that Church has proposed exactly that project in his 2012 book *Regenesis: How Synthetic Biology Will Reinvent Nature and Ourselves*. Church wants to recode the [human genome](#) to make it impossible for viruses to enter. HIV and the common cold, gone.

According to Regalado, Church's lab has already replaced 7 out of 64 codons in *E. coli*, probably making the bug impervious to phage, the viruses that infect bacteria. "In an e-mail, Church agreed that the proposals described in his book could follow if genome-writing technology were developed, even if they aren't the aim of HGP-write. 'Our project is paying attention to these longer-term implications,' he said."



Aedes Egypti mosquito, malaria carrier. Credit: US Department of Agriculture

THE HGP-WRITE TRAIN HAS LEFT THE STATION

Endy wants HP-write halted in its present form. But that's not going to happen. ["The train has left the station,"](#) Sharon Begley and Ike Swetlitz observe at STAT.

Steven Novella summarized some objections to HGP-write at Neurologica: "Critics, however, charge that this work is already being done in many labs, and so one large centralized project is redundant. Others argue that [the ethics need to be discussed first](#), and therefore the project is premature. Still others fear that private companies will have

too much control of the project, and therefore call to have everything be open to the public"

Novella is most concerned about the cost. It's been estimated at no more than the \$3 billion spent on the first Human Genome Project, but that's just a wild guess. With improvements in technology of the sort that have characterized genetics in the past few years, I suppose it might even be cheaper. Fact is, no one knows. The researchers want to begin this year and are hoping to raise \$100 million as a start-up fund.

Novella isn't worried about ethical issues because "proponents state that the synthetic cells will be unable to reproduce. They will remain[sic] cells, and cannot create a synthetic person." He's actually kinda entranced by the idea of synthetic people. "Done carefully and thoughtfully there can be many benefits to synthesizing humans resistant to certain diseases, for example. Perhaps we will need to engineer humans to thrive in space."

ALSO, GENE DRIVES GET A YELLOW LIGHT

Gene drives could drive mosquitoes to extinction, in the process wiping out malaria and the Zika virus. Yay, and I wouldn't mind bite-free summers either. But here, in one sentence, is the issue with gene drives. "The emergence of gene-drive systems—which spread engineered mutations quickly through populations—means that a single released organism could eventually alter most of its local population, and [quite possibly all populations of the species throughout the world.](#)"

That from Kevin Esvelt, in a post at Nature. In a profile at TechReview, Antonio Regalado calls Esvelt ["the moralist policing gene drives, a technology that messes with evolution."](#) Esvelt worked with the ever-present George Church on the gene-editing system known as CRISPR for genome engineering. Regalado credits Esvelt with bringing the gene

drive safety issue to public attention two years ago.

One result of that attention is the 200+-page report issued this week by the National Academy of Sciences, Engineering, and Medicine. The report recommended proceeding cautiously with gene-drive research, advocating limiting it to controlled field trials and warning against releasing engineered organisms into the wild at this point. For [an explainer on how gene drives work](#), see Brad Plumer's post at Vox.

Esvelt told Rob Stein at Shots that he was disappointed that [the report didn't urge scientists to disclose their gene drive plans publicly](#) before trying to engineer an organism. From his new post at the MIT Media Lab, Esvelt says in the Nature post that he and others are launching "the Responsive Science Project to enable gene-drive scientists to share their plans and research with one another and with interested communities. We hope that it will become a central repository of ideas and information relevant to gene-drive research that will permit open assessment and critique before experiments begin."

Hard to imagine that such an open science project will be embraced by researchers. Also, [gene drives](#) may be another case of the train having already left the station. Regalado says gene-drive projects aimed at wiping out malaria by wiping out the mosquitoes that carry it are already in the works. The Bill and Melinda Gates Foundation has given more than \$40 million to a project planning to spread sterile mosquitoes in Africa by 2029.

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