COVID-19

Vaccines that use human fetal cells draw fire

Abortion opponents urge United States and Canada to avoid "ethically-tainted" cell lines

By **Meredith Wadman**

Senior Catholic leaders in the United States and Canada, along with other antiabortion groups, are raising ethical objections to promising COVID-19 vaccine candidates that are manufactured using cells derived from human fetuses electively aborted decades ago. They have not sought to block government funding for the vaccines, which include two candidate vaccines that the Trump administration plans to support with an investment of up to $1.7 billion, as well as a third candidate made by a Chinese company in collaboration with Canada's National Research Council (NRC). But they are urging funders and policymakers to ensure that companies develop other vaccines that do not rely on human fetal cell lines and, in the United States, asking the government to "incentivize" firms to make only vaccines that don't rely on fetal cells.

"It is critically important that Americans have access to a vaccine that is produced ethically: no American should be forced to choose between being vaccinated against this potentially deadly virus and violating his or her conscience," the U.S. Conference of Catholic Bishops (USCCB) and 20 other religious, medical, and political organizations wrote to Stephen Hahn, commissioner of the U.S. Food and Drug Administration (FDA), in April. "Thankfully, other [COVID-19] vaccines … utilize cell lines not connected to unethical procedures and methods."

"We urge your government to fund the development of vaccines that do not create an ethical dilemma for many Canadians," wrote Richard Gagnon, archbishop of Winnipeg and president of the Canadian Conference of Catholic Bishops, and 17 other antiabortion religious, medical, and political groups and individuals in a 21 May letter to Prime Minister Justin Trudeau. "The … manufacture of vaccines using such ethically-tainted human cell lines demonstrates profound disrespect for the dignity of the human person."

FDA replied to USCCB on 11 May, writing that, "An inability to use these cells … would deprive the United States of lifesaving vaccines, and … adversely impact" public health. In Canada, the health ministry has promised to respond to the letter to Trudeau, says Moira McQueen, executive director of the Canadian Catholic Bioethics Institute and lead signatory on the letter.

In response to lobbying by antiabortion groups, the Trump administration last year barred U.S. government scientists from using human fetal cell lines from new elective abortions in their work. But the administration has not banned the use of fetal cell lines derived from abortions decades ago. Such cell lines have been used since the 1960s to manufacture vaccines, including current vaccines against rubella, chickenpox, hepatitis A, and shingles.

Now, research groups around the world are working to develop more than 130 candidate vaccines against COVID-19, according to the World Health Organization. At least six of those candidates use one of two human fetal cell lines: HEK-293, a kidney cell line widely used in research and industry that comes from a fetus aborted in about 1972; and PER.C6, a proprietary cell line owned by Janssen, a subsidiary of Johnson & Johnson, developed from retinal cells from an 18-week-old fetus aborted in 1985. Both cell lines were developed in the lab of molecular biologist Alex van der Eb at Leiden University.

Two of the six vaccines have entered human trials (see table, below). Five are made by using human fetal cells as "factories" to make adenoviruses that carry genes from SARS-CoV-2, the virus that causes COVID-19. The adenoviruses, which are disabled so they can't replicate, are given as a vaccine; recipients' cells then produce proteins from the coronavirus, hopefully triggering a protective immune response.

The sixth vaccine, which could enter human trials this summer, is a protein subunit vaccine. Researchers use HEK-293 cells to make pieces of the spike protein that studs the coronavirus' surface. To trigger an immune response, the vaccine is delivered through a skin patch with 400 tiny needles.

Human fetal cells are key to producing both types of vaccines. For the protein subunit vaccine, "Cultured [nonhuman] animal cells can produce the same proteins, but they would be decorated with different sugar molecules, which … runs the risk of failing to evoke a robust and specific immune response," says Andrea Gambotto, a vaccine scientist at the University of Pittsburgh School of Medicine and lead developer of the vaccine. (Of the developers of the six vaccines, only Gambotto responded to a request for comment.)

David Prentice, vice president and research director at the Charlotte Lozier Institute, which opposes abortion, notes researchers making adenovirus vaccines have modified HEK-293 cells to be adept at packaging new genes—such as those that direct cells to assemble the coronavirus spike protein—into adenoviruses. But he adds that other technologies are available, including using fetal cells captured from amniocentesis.

"The use of cells from electively aborted fetuses … makes these … COVID-19 vaccine programs unethical, because they exploit the innocent human beings who were aborted,"

In contention

At least six COVID-19 vaccine candidates use cells from fetuses aborted decades ago.

DEVELOPER	VACCINE TYPE	FETAL CELLS USED	HUMAN TRIALS	POTENTIAL U.S. FUNDING	WARP SPEED PICK
CanSino Biologics, Inc./Beijing Institute of Biotechnology	Replication-deficient adenovirus	HEK-293	Yes (phase II)	No	No
University of Oxford/ AstraZeneca	Replication-deficient adenovirus	HEK-293	Yes (phase II/III)	$1.2 billion	Yes (short list)
Janssen Research & Development USA	Replication-deficient adenovirus	PER.C6	No	$456 million	Yes (short list)
University of Pittsburgh	Protein subunit	HEK-293	No	No	No
ImmunityBio/ NantKwest	Replication-deficient adenovirus	HEK-293 or derivative E.C7	No	No	Yes (long list)
altimmune	Replication-deficient adenovirus	PER.C6	Expected this month	No	No

Prentice and a co-author—molecular biologist James Sherley, a Lozier Institute associate scholar and director of the adult stem cell company Asymmetrex—wrote last month.

But Arthur Caplan, a bioethicist at the New York University School of Medicine, counters: "There are better ways to win the abortion wars than telling people not to use a vaccine. These are long-over abortions. These cells are decades old, and even major religious leaders like the pope have acknowledged that for the greater good it's not worth the symbolism to put the community at risk."

The Vatican's Pontifical Academy for Life declared in 2005 and reaffirmed in 2017 that, in the absence of alternatives, Catholics could in good conscience receive vaccines made using historical human fetal cell lines.

One of the six vaccines, made by the Chinese company CanSino Biologics, was the first COVID-19 vaccine to enter phase II human trials. It uses HEK-293 cells that the company licensed from Canada's NRC, which developed the cells. (The firm has previously used HEK-293 cells from NRC to develop an approved Ebola vaccine.) NRC is now collaborating with CanSino Biologics, preparing to run trials of the vaccine in Canada and scale up production facilities.

Two vaccines that have drawn criticism from antiabortion groups are on a short list of candidates to get financial and logistical support from the U.S. government under the White House's Operation Warp Speed, which aims to deliver at least one approved COVID-19 vaccine by January 2021, according to a 3 June report in *The New York Times*. One, made by Janssen Research & Development, uses PER.C6 cells. The second, from University of Oxford researchers and AstraZeneca, uses HEK-293 cells. Both have received U.S. government commitments of, respectively, $456 million and $1.2 billion, if they meet milestones, through the Biomedical Advanced Research Development Authority.

Another vaccine that relies on HEK-293 cells made a Warp Speed long list of 14 candidates, according to a press release from NantKwest, one of two companies owned by billionaire scientist Patrick Soon-Shiong that are developing the vaccine.

Prentice believes the government should think twice about supporting such vaccines. "As they are choosing … what vaccines to move ahead, they should at least recognize that there is some portion of the population who would like an alternative vaccine they can take in good conscience," he says.

Caplan disagrees. "If you are going to say the government shouldn't fund things that a minority of people object to, you will have a very long list of things that won't get funded by the government, from research on weapons of war to contraceptive research." ■

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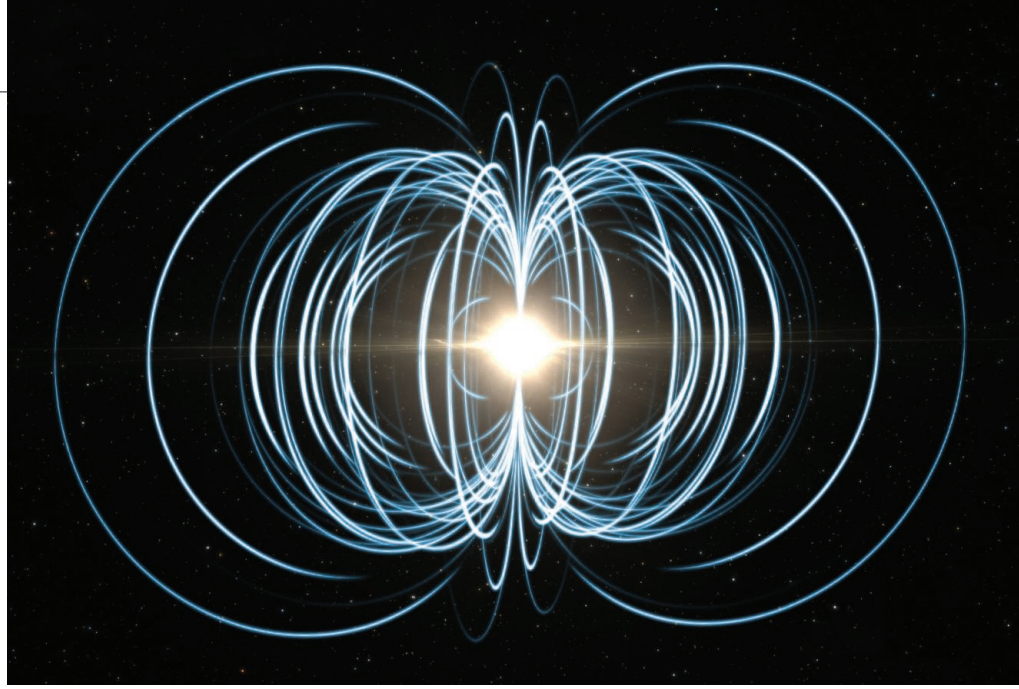

Magnetars are collapsed stars with fields 100 million times stronger than that of any magnet on Earth.

ASTRONOMY

Galactic flash points to source of enigmatic fast radio bursts

CHIME telescope catches burst generated by a highly magnetized neutron star in the Milky Way

By **Daniel Clery**

On 28 April, as Earth's rotation swept a Canadian radio telescope across the sky, it watched for mysterious millisecond flashes called fast radio bursts (FRBs). At 7:34 a.m. local time an enormous one appeared, but awkwardly, in the peripheral vision of the scope. "It was way off the edge of the telescope," says Paul Scholz, an astronomer at the University of Toronto and a member of the Canadian Hydrogen Intensity Mapping Experiment (CHIME). Because of its brightness, the team knew its source was nearby. All other FRBs seen so far have erupted in distant galaxies—too far and too fast to figure out what produced them.

The team had a hunch about this one. In previous days, orbiting telescopes had witnessed a Milky Way magnetar—a neutron star with a powerful magnetic field—flinging out bursts of x-rays and gamma rays. The turmoil suggested it might be pulsing with radio waves, too. After some extra data processing, the team determined the FRB was "definitely colocated" with the magnetar, Scholz says. "We were really excited."

The find, announced in a paper posted to the arXiv preprint server on 20 May, could be the missing link in a problem that has puzzled astronomers for more than a decade. It's only a single event and many questions remain, including why this burst was 30 times less energetic than the weakest FRB traced to another galaxy. Yet astronomers are increasingly confident that some, if not all, of these laserlike radio flashes originate from magnetars, collapsed stars with magnetic fields 100 million times stronger than any magnet made on Earth. A magnetar origin would rule out more exotic sources such as supermassive black holes and merging neutron stars. "The game of alternative theories is becoming more and more difficult," says theorist Maxim Lyutikov of Purdue University. "For the majority it's a decided question: It's magnetars."

The first FRB was detected in 2007, and astronomers have tallied a little over 100 since then. Their brevity makes them hard to study or trace to a particular celestial object. But several FRBs have been found to repeat, giving astronomers a chance to identify their host galaxy. And in the past year or two, wide-field telescopes such as CHIME, designed to survey large swaths of the sky, have begun to boost the number of detections substantially (*Science*, 15 March 2019, p. 1138).

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