rates weren't higher than average in the Scottish hepatitis patients.

The pandemic could, however, indirectly explain the rise of pediatric hepatitis in the United Kingdom. Relaxed COVID-19 restrictions meant children may have been exposed to a "cocktail of viruses" all at once versus gradually, according to Emma Thomson, an infectious diseases specialist at the MRC-University of Glasgow Centre for Virus Research and a leader of the Scottish study.

Both studies also found that all but two of 14 sick children tested carried a specific version of a type of gene called *HLA* that helps shape the body's response to pathogens. The variant is particularly common in northern Europeans—16% of Scottish people carry it, and it is known to be linked to some autoimmune disorders, Thomson notes.

Although the researchers found genetic material from AAV2 in patient's liver cells, they did not detect viral proteins or actual copies of the virus. That suggests instead of directly damaging liver cells, AAV2 may provoke an immune response that harms the organ. That theory is supported by the link with *HLA* type and that some kids had gastrointestinal illnesses many weeks before they developed hepatitis, said a leader of the London team, virologist Judy Breuer of Great Ormond Street Hospital and the University College London Great Ormond Street Institute of Child Health, at a press briefing Monday.

A pathogenic role for AAV2 "goes against everything we know" about the virus, says virologist Eric Kremer of the Institute of Molecular Genetics of Montpellier. Looking at the type of antibodies to AAV2 in the children, he notes, could support its guilt by distinguishing between a long-ago infection, or a more recent one timed with the onset of hepatitis. Those studies are planned, Thomson says.

The good news for U.K. parents in all this: Pediatric hepatitis cases have dropped in recent weeks to "almost ... background," said Meera Chand of the UK Health Security Agency, which expects to release its own study of adenoviruses in these cases this week.

At the same time, the studies raise questions about delivering therapeutic genes with AAVs, as many groups are trying to, Kremer notes. Although the viruses are further modified so they can't replicate even if a helper virus is around, they have sometimes caused liver inflammation—which in rare cases may have contributed to deaths. Stanford University gene therapy researcher Mark Kay says the field may want to explore whether *HLA* type can predict whether an AAV gene therapy patient will experience liver toxicity. ■

DATA: C. CHEN *ET AL.*, OSF PREPRINTS (2022) DOI:10.31219/OSF.IO/XB57U

SCIENTIFIC COMMUNITY

# NSF grant decisions reflect systemic racism, study argues

## Success rates for white scientists far exceed the NSF average, whereas Black and Asian researchers do worse

*By* **Jeffrey Mervis**

White scientists are more likely to win a grant from the National Science Foundation than researchers from other racial and ethnic groups, according to an independent analysis of more than 2 decades of NSF data on its merit review process.

The analysis supports earlier studies finding similar racial disparities in the funding of scientists by other federal agencies, notably the National Institutes of Health (NIH). And its authors—a team led by geochemist Christine Yifeng Chen, a postdoc at Lawrence Livermore National Laboratory—attribute the gap in NSF funding rates, with white scientists at the top and Asian researchers at the bottom, to "systemic racism."

The NSF funding disparities "have cascading impacts that perpetuate a cumulative advantage to White [principal investigators] across all of science, technology, engineering, and mathematics," they write in their study, posted earlier this month on the Center for Open Science preprint site.

The team gave a copy of its analysis to NSF leadership, which is not challenging its conclusions. NSF Director Sethuraman Panchanathan "shares these concerns [about] systemic racial disparities in funding at NSF and other federal agencies," an agency spokesperson says.

The researchers delved into detailed annual NSF reports that contain data on 1 million proposals submitted to the agency between 1996 and 2019. The reports mention racial disparities only in passing, but Chen and her team focused on them after hearing complaints from senior nonwhite colleagues about what they felt was an uneven playing field in winning NSF grants.

"I think it's significant that this project was initiated by early-career scientists," Chen says. "It speaks to the prevailing culture in academia that allows the status quo to be perpetuated. We felt that if we didn't do the analysis, nobody else would."

Every scientist submitting a proposal to NSF faces stiff competition; overall success rates fluctuated between 22% and 34% over the study period. But white scientists consistently did better, Chen and colleagues found. (Scientists are asked to voluntarily provide their race and ethnicity when applying for a grant.)

In 2019, for example, NSF funded 31.3% of proposals from white scientists, versus an overall rate of 27.4%. In contrast, the success rate was 22.4% for Asian scientists and 26.5% for Black scientists. Proposals from Latino scientists were funded 29% of the time, a rate slightly above average but below the rate for white scientists.

Chen and colleagues translate the higher success rates into what they call "surplus awards." In 2019, when NSF received about 42,000 proposals, the team calculated that white scientists received 798 surplus grants. The cumulative surplus over 20 years was 12,820 awards (see table, left).

In contrast, Asian scientists received 460 fewer awards in 2019 than they would have had their success rate been comparable, with a cumulative "unfunded" total of 9701 awards. (Asian scientists submit the second most proposals of the various groups every year, roughly half the number sent in by white scientists.) The relative advantage for white scientists has steadily grown, the analysis shows, from 3 percentage points above the agency's average success rate in 1999 to 14 percentage points above in 2019.

For Black scientists, the funding gap over that period was smaller, but still significant.

### Funding issue

A study of racial disparities in National Science Foundation funding concludes that white researchers reaped a large cumulative "surplus" of awards between 1999 and 2019, whereas Asian applicants experienced significant "underfunding," with other groups falling in between.

| RACE/ETHNICITY | AWARDS |
|---|---|
| White | +12,820 |
| American Indian/ Native Alaskan | +80 |
| Native Hawaiian/ Pacific Islander | –17 |
| Hispanic/Latino | –175 |
| Black/African American | –417 |
| Asian | –9701 |

(Black researchers submit one proposal for every 20 proposals NSF receives from white scientists.) The average funding rate for Black scientists was 8 percentage points below that of white scientists, according to the preprint's authors. Pacific Islander and Native Hawaiian scientists, an even smaller cohort of applicants, had success rates 11 percentage points below that of white scientists. In contrast, Latino scientists—who submit about 50% more proposals to NSF than do Black scientists—have done slightly better than the norm but were 2 percentage points below the success rate for white scientists in 2019.

About 75% of the proposals NSF receives each year are classified as research proposals. The remaining requests are to support education and training, equipment and facilities, conferences, and other activities. White scientists enjoy an even larger advantage over most other groups in winning research awards, the study found. For nonresearch awards, most nonwhite groups did better than the NSF-wide average.

In 2011, a team led by University of Kansas, Lawrence, economist Donna Ginther found similar racial disparities among NIH grant recipients, including a gap of up to 13 percentage points in success rates between white and Black scientists. That gap shrunk—but did not disappear—in follow-up studies that accounted for such factors as an applicant's publication history, prior funding, age, academic rank, and how much research takes place at their institution.

Even so, former NIH Director Francis Collins last year apologized to "individuals in the biomedical research enterprise who have endured disadvantages due to structural racism." NIH has tried to reduce disparities with programs designed to increase the success of Black applicants.

Unlike NIH with Ginther, NSF did not give Chen's team access to applicant data that would have allowed it to do such a multivariate analysis. "That information would have been extremely valuable for looking at issues of intersectionality," says co-author Aradhna Tripati, a geoscientist at the University of California, Los Angeles. "We also could have looked at the impact of NSF's existing programs to foster equity and broader participation in science."

Even without that extra level of analysis, the study's findings appear sound, says Susan White, director of the statistical research center at the American Institute of Physics. "It may not be exactly the number [the authors] present, but I don't doubt that the disparity is real, and serious," she says.

An NSF spokesperson says although the agency is proud of its array of programs designed to address equity and inclusion, "there is still much [work] to do." ■

HUMAN EVOLUTION

# Ancient Europeans farmed dairy—but couldn't digest milk

## Giant study of ancient pottery and DNA challenges common evolutionary explanation for lactase persistence

*By* **Cathleen O'Grady**

Over the past 10,000 years, populations living far apart in Europe, Africa, South Asia, and the Middle East separately acquired a key genetic change: the ability to digest the milk sugar lactose as adults. Researchers thought people who had that ability and lived in dairy farming cultures got a nutritional boost and had more children, thus spreading the genetic changes.

But in recent years, unexpected findings—such as data from Mongolia, where people devour milk products but 95% of adults are genetically lactose intolerant—have challenged that story. Now, a study combines large archaeological data sets on dairy farming with ancient DNA and finds that across Europe, people consumed dairy for millennia before lactase persistence into adulthood was widespread. The researchers suggest illness and famine may have turned lactose intolerance from uncomfortable to deadly, driving periods of intense selection for the digestive trait.

A farmer in Mongolia, where most people are lactose intolerant, milks a cow.

PHOTO: TAYLOR WEIDMAN/BLOOMBERG/GETTY IMAGES

The study "changes our long-term understanding of the relationship between milk use and lactase persistence," says Jessica Hendy, an archaeologist at the University of York who was not involved in the work.

In the new study, archaeologists compiled evidence of milk from nearly 7000 pieces of ancient pottery, taken from 554 European sites representing the past 9000 years. They tracked the rise and fall of dairy farming across Europe by analyzing the fats preserved in the pottery. With ancient DNA specialists, they then compared this with signs of lactase persistence in 1293 published human genomes from the same regions and period.

Fluctuating dairy use over time didn't match up with changes in lactase persistence. Instead, the researchers found that what they considered signals of famine and sickness best matched the jumps in lactase persistence in ancient DNA, they report in *Nature* this week. (They used archaeological records to identify periods of shrinking populations—perhaps famines—as well as times of greater population density—possibly times of faster disease spread.)

Lactose intolerance in dairying cultures might be dangerous for people who were sick or starving, suggests co-author Mark Thomas, a human evolutionary geneticist at University College London. A lactose intolerant person consuming milk normally suffers flatulence and diarrhea, with no more severe effects than embarrassment and discomfort, Thomas says: "But if you get diarrhea when you're severely malnourished, then you have serious problems. One of the biggest causes of death in the world is fluid loss in severely malnourished people."

The findings support the idea that dairy farming alone wasn't the key force behind the spread of lactase persistence, the researchers say: The selection pressure likely only grew strong when combined with sickness and starvation.

It's an "exciting avenue" for ongoing research, Hendy says. But she cautions it's difficult to estimate ancient population fluctuations and understand what led to them.

The research complements previous results, such as the puzzlingly late arrival of widespread lactase persistence in Central Europe, says Christina Warinner, a molecular archaeologist at Harvard University. But she says the new study brings the heft of several large data sets to the question. The story of dairy farming has been "full of surprises," Warinner says. "It's helping us to really appreciate better the complexities of the past." ■