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Same-sex attraction seems to be at least partly controlled by genetics.

GENETIC PATTERNS OFFER CLUES TO EVOLUTION OF HOMOSEXUALITY

Massive study finds that genetic markers associated with same-sex encounters might aid reproduction.

By Sara Reardon

To evolutionary biologists, the genetics of homosexuality seems like a paradox. In theory, humans and other animals who are exclusively attracted to others of the same sex should be unlikely to produce many biological children, so any genes that predispose people to this would rarely be passed on to future generations. Yet same-sex attraction is widespread in humans, and research suggests that it is partly genetic.

In a study of data from hundreds of thousands of people, researchers have now identified genetic patterns that could be associated with homosexual behaviour, and showed how these might also help people to find different-sex mates, and reproduce. The authors say their findings could help to explain why genes that predispose people to homosexuality continue to be passed down (B. P. Zietsch *et al. Nature Hum. Behav.* https://doi.org/gsp5; 2021). But other scientists question whether these data can provide definitive conclusions.

Evolutionary geneticist Brendan Zietsch at the University of Queensland in Brisbane, Australia, and his colleagues used data from the UK Biobank, the US National Longitudinal Study of Adolescent to Adult Health and the company 23andMe, based in Sunnyvale, California, all of which sequence genomes and use questionnaires to collect information from participants. The team analysed the genomes of 477,522 people who said they had had sex at least once with someone of the same sex, then compared these genomes with those of 358,426 people who said they'd only had heterosexual sex. The study looked only at biological sex, not gender, and excluded participants whose gender and sex did not match.

In earlier research, the researchers had found that people who'd had at least one same-sex partner tended to share patterns of small genetic differences scattered throughout the genome (A. Ganna *et al. Science* **365**, eaat7693; 2019). None of these variations seemed to greatly affect sexual behaviour on its own, backing up previous research that has found no sign of a 'gay gene'. But the collection of variants seemed to have a small effect overall, explaining between 8% and 25% of heritability.

Next, the researchers used an algorithm to simulate human evolution over 60 generations. They found that the array of genetic variations associated with same-sex behaviour would have eventually disappeared unless it helped people to survive or reproduce.

Zietsch and his team decided to test whether these genetic patterns might provide an evolutionary edge by increasing a person's number of sexual partners. They sorted the participants who had only had heterosexual sex by the number of partners they said they had had, and found that those with numerous partners tended to share some of the markers found in people who had had a same-sex partner.

The researchers also found that people who'd had same-sex encounters shared genetic markers with people who described themselves as risk-taking and open to new experiences. And there was a small overlap between heterosexual people who had genes linked to same-sex behaviour and those whom interviewers rated as physically attractive. Zietsch suggests that traits such as charisma and sex drive could also share genes that overlap with same-sex behaviour, but he says that those traits were not included in the data, so "we're just guessing".

The authors acknowledge many limitations of the study. All of the participants lived in the United Kingdom or United States, and were of European descent. And the databases' questionnaires asked about sexual behaviour, not sexual attraction. Most of the participants were born during a time when homosexuality was either illegal or culturally taboo in their countries, so many people who were attracted to others of the same sex might never have actually acted on their attraction, and could therefore have ended up in the wrong group in the study.

Julia Monk, an ecologist and evolutionary biologist at Yale University in New Haven, Connecticut, thinks that these caveats are so important that the paper can't draw any real conclusions about genetics and sexual orientation. Sexual behaviour and reproduction, she says, occupy a different place in modern societies than they did for human ancestors, so it's difficult to infer their role in our evolution. For instance, people might engage with more sexual partners now that sexually transmitted diseases can be cured. And the existence of birth control and fertility treatments negates many of the reproductive advantages that genes might provide. "People's behaviour when it comes to sex and reproduction is highly culturally informed, and maybe digging into genetics is next to impossible," Monk says.

Weak linkages

Qazi Rahman, a psychologist at King's College London, thinks that the study was conducted well, but is sceptical of some of the conclusions. He says the data sets are too biased towards people who were willing to reveal their sexual behaviour to researchers, which could itself be considered a risky behaviour. He adds that once the data are broken down into men and women, and into those who had only had same-sex partners versus those who had had encounters across sexes, the number

of people in each group becomes so small that the genetic linkages are very weak.

Dean Hamer, a retired geneticist in Haleiwa, Hawaii, who published some of the first studies on the genetics of sexual orientation, is disappointed with the study. Defining sexual orientation on the basis of a single same-sex encounter is not a useful way of categorizing people, he says, because many people who identify as heterosexual have experimented with a same-sex partner. Instead, he thinks the researchers have found genetic markers associated with openness to new experiences, which could explain the overlap between people who have had a homosexual partner and heterosexual people who have had many partners.

Zietsch says that risk-taking can explain only part of the statistical link between markers associated with same-sex encounters and those associated with number of partners. And he admits that using a single homosexual experience as an indication of sexual orientation isn't ideal, but says that the UK Biobank didn't provide data on sexual attraction. Zietsch's previous research on data from 23andMe showed a strong genetic overlap between people who reported same-sex sexual experiences and those who reported same-sex attraction.

Hamer acknowledges that linking a complex behaviour to genetics is extremely difficult, but says he is glad the team is researching sexual orientation. "It's vastly understudied considering it's a driving force for the human race," he says. "It's a good question, they just didn't find an answer."

HOME SEISMOMETERS PROVIDE CRUCIAL DATA ON HAITI'S QUAKE

A volunteer network helps to monitor aftershocks and illuminate the country's earthquake hazards.

By Alexandra Witze

A network of inexpensive seismometers, installed in living rooms, gardens and workplaces across Haiti, is helping scientists to unravel the inner workings of the magnitude-7.2 earthquake that devastated the southwestern part of the Caribbean nation last month. Researchers launched the community-science effort after the country's previous major earthquake — a magnitude-7 tremor in 2010 that killed more than 100,000 people — and it has since helped to reveal details about Haiti's seismic activity.

The country's official seismic monitoring stations are sometimes offline because of limited resources, so the community seismology project provides much-needed data. Its seismometers feed data into a system that displays the locations and magnitudes of Haitian earthquakes on a web-based portal in real time (see go.nature.com/3zxpxwg).

"It's not professional equipment, and there are a lot of limitations," says Dominique Boisson, a geologist at the State University of Haiti in Port-au-Prince who helps to run the network. But "some results are very nice".

REGINALD LOUISSAINT JR/AFP VIA GETTY

Haiti's earthquake last month destroyed many buildings, including this church.

Difficult work

The network underscores just how far seismology in Haiti has come in 11 years. When the 2010 earthquake struck near Port-au-Prince, the country had no seismologists and just one official seismic monitoring station, says Boisson. Now, there are several professional seismologists, as well as 7 stations in the official national network, which is operated by Haiti's Bureau of Mines and Energy, and 15 in the community-science network.

Within days of the big quake hitting on 14 August, teams of scientists and technicians were driving towards its epicentre, carrying seismometers and other instruments to measure how the ground was moving. Monitoring the ground with scientific instruments immediately after a quake allows researchers to better understand why the earthquake occurred and the future seismic risk. In 2010, it took weeks after the quake for foreign researchers to fly to Haiti and deploy instruments.

This year, many of those foreign teams are forbidden to travel to Haiti because of COVID-19 restrictions and political instability following the assassination in July of Haiti's president, Jovenel Moïse. Instead, the work is being led by Haitian seismologists, such as Steeve Symithe, also at the State University, who, before he went into the field, was streaming Facebook Live presentations about the science of the quake to the Haitian public.

Both the 2010 and the 2021 quakes happened in the Enriquillo–Plantain Garden fault zone, a tangle of fractures in Earth's crust where the North American and Caribbean tectonic plates slide past one another. It runs from west to east along Haiti's southern peninsula. The 2010 quake occurred on a previously unknown fault in that zone. The epicentre of the 2021 quake lies about 100 kilometres to the west, in the province of Nippes (see 'Tracking Haitian tremors').

At least 2,100 people died in the 14 August quake, although the total count has yet to be tallied. The US Geological Survey estimates that there might have been more than 10,000 deaths. Many survivors endured heavy winds and rain from a tropical storm as they tried to shelter outside. The scientists who travelled to the area spent a night in their cars as rain pelted down, softening the ground and