

Nature Debate Examples

Gay by nature: Part one

What causes homosexuality? Can sexual orientation be changed? And are the brains of gay people different from those of straight people?

While almost all scientists accept homosexuality has purely natural causes, the debate has been mired in confusion. There have been conflicting reports about the existence of 'gay' genes and their significance. Religious propagandists have tried to promote the myths that sexuality is changeable. And the mainstream media, more interested in causing controversy than holding rational debate, has done little to raise public understanding about the issue. For Dr Rahman, who heads QMUL's Biological and Experimental Psychology Group, it is quite clear: you're born gay, and that's that.

I begin by asking him what aspects of biology are responsible for sexual orientation.

"The whole nature-nurture debate is entirely pointless," he says. "Sexual orientation is not a choice because humans come in two types: one with a vagina, the other with a penis, so sexual orientation is entirely biological.

"We all end up at the same point: heterosexuality or homosexuality. There is little variation in between but this is not to exclude bisexual behaviour. People do not end up sexually attracted to bananas or animals for example. This is not a flippant comment. What I am saying is that we see the same characteristic traits and behaviours, resulting from a relatively small number of factors.

"We think the causes for different sexual orientations cluster around two areas. We know that just under half the variation in sexual orientation is down to genes. Then the rest of the variation is down to 'non-shared' factors, and those, like hormones, are primarily biological."

At this point a little background is needed.

Dr Rahman explained that the gene story originated in 1993, when geneticist Dean Hamer published a study that claimed homosexuality was genetically influenced, and pinpointed the stretch of the X chromosome (inherited from the mother). He studied 76 pairs of gay brothers and found they shared a stretch of DNA. However, since then no research has been able to repeat the test.

Despite the shortcomings of Hamer's research, scientists agree the environmental factors do not cause homosexuality. It is increasingly clear that no single gene is responsible for sexual orientation. Furthermore, William Reiner at the University of Oklahoma surveyed the sexuality of a group who had been surgically reassigned from boys to girls at birth, due to genital deformities. Though they were brought up as women, and knew nothing about their surgery, they were all attracted to women later in life.

Michael Bailey of Northwestern University found that an identical twin of a gay man had a 50 per cent chance of also being gay. Among fraternal, yet non-identical twins, that probability was reduced to 20 per cent. This latter statistic does not in fact downplay the role of genetics, because not all the genes we inherit

are active. We receive two alternative genes of every gene – one from each parent. Our bodies, therefore, contain two sets of building plans. A process called methylation turns off certain genes, and determines whether the gene we inherit from the mother or the father gets turned on. Although this process is inherited, it has none of DNA's proof-reading mechanisms, and thus varies greatly from one generation to the next. The causes and effects of methylation are under investigation by Sven Bocklandt at UCLA.

But if homosexuality were inherited, wouldn't the genes for it disappear because of natural selection?

Dr Rahman said: "That is a common misunderstanding, and that is said by people with no understanding of evolutionary biology. Sexuality is a complex human trait, just like IQ or personality. It is determined not by a single gene, but how several genes work together. A whole range of features with reproductive disadvantages can be maintained in the gene pool down the generations, if only a portion of the genes responsible are advantageous to heterosexual carriers."

He continued: "One of the ideas is that heterosexual men that may carry some 'gay' alleles that result in more empathic and nurturing traits, which are thus more attractive to females, who might mate with them and then carry those genes on further. So long as passing on some versions of those genes is reproductively advantageous, the fact that at some point down the generations you end up with a completely homosexual male – with all gay genes activated – is inconsequential. Evolution will happily tolerate that as long as the general reproductive advantage for individuals is maintained.

"However," he added, "there is much work to do. We don't yet know how this works. A couple of papers published last year suggested females, rather than males, benefited. Genes responsible for homosexuality have to do something, but they do not literally write the word 'gay' in the brain.

"Maybe they are involved in producing certain types of proteins or hormones which confer attraction to males, useful for women, but maybe having some of these alleles make them more attractive to men, or maybe these genes make them look more beautiful, effeminising them in some way.

"Either way, these help females find a mate more easily and give them more offspring, while almost sterilising the male line. A male who is gay won't compete with your own reproductive outcomes. At the genomic level, females should be more interested in producing 'like' i.e., more females."

The second influence on sexuality is hormones.

Dr Rahman continued: "The level of exposure to sex hormones, such as testosterone, during life in the womb, seems to influence the direction of sexual preference. Everyone would be born female if it were not for testosterone. At stages during pregnancy, the hormone is introduced into the womb. The level of testosterone to which the foetus is exposed determines the level of masculinity. Some bodily markers provide an insight into exposure. One example is the relative length of index finger to ring finger.

"There are a whole range of measures like startle responses, a particular sound emission that comes from the inner ear and cognitive profiles, which show how people perform on different problem solving tasks."

So, gay brains are wired differently?

"In males the big brother effect is also important. Gay men tend to be born younger in relation to their brothers. The maternal immune system recognises successive male foetuses and may form an immune response to particular types of protein that form on the surface of the brain in the developing foetus. This might affect sexual differentiation or it might produce some hormonal mechanism that produces that variation, too. The big brother effect only appears to be important when gay men are right handed. Left handed gay men owe their sexual orientation to other causes we are unaware of.

"Relatively recently, there has been lots of research into neurobiology – what goes on in the brain. Our lab has been working a lot on mental problem solving skills like spatial ability, finding your way around, finding important objects in a spatial environment, emotional skills and verbal recognition.

"And we know these are different between the sexes, but we find gay men tend to have a female type of spatial ability. Spatial ability is controlled partly by two regions of the brain. So if we know that gay men perform differently in these kinds of tests, that suggests that part of the brain either is structurally different or functions in a different way. That gives us an insight into brain development.

"Thanks to MRI scans, we also have the technology to look at the brain directly rather than just carry out problem solving tests on people. The studies in the last two years strongly suggest that in the adult gay brain, and lesbian brain, it is wired very differently to the straight brain.

"In 2008, Swedish scientists at the Karolinska Institute compared the brain hemispheres of healthy gays and lesbians with heterosexual male and female adults.

"The results showed that heterosexual men and lesbians show a rightward asymmetry in their brain – it appears to be larger in volume than the left. However, the brain hemispheres of gay men and heterosexual women were more symmetrical.

"It might explain why heterosexual men tend to be better at spatial skills; there is some evidence that lesbians are better at some visual motor skills as well. Tests show gay men and hetero women tend to be better at language, verbal fluency, skills and emotion processing.

"The Swedish group also found differences in the amygdala, the part of the brain responsible for orientating the rest of the brain in response to an emotional stimulus, such as a startle (fight or flight) response, or the presence of a potential mate.

"Heterosexual men and gay women have more nerve connections in the right side of the amygdala, while gay men and heterosexual women have more on the left.

"So, the brain network which determines what sexual orientation actually 'orients' towards is similar between gay men and straight women, and between gay women and straight men."

Now some may ask 'but how can you be sure that having gay sexual experiences or straight sexual experiences is not responsible for these differences and surely experience can change brain structure?'

Dr Rahman says this is a good question: "We don't know the answer but studies with animals suggest these differences appear before any sexual experiences calibrate the biology. But only work in humans can truly answer this, and this remains to be done."

So does the data justify stereotypes? Does it suggest footballers and athletes are less likely to be gay? And could research uncover why some people are homophobic?

Gay by nature: Part two

Part 1 discussed the impact of genes and hormones on homosexuality. Here, we have addresses the issue of gay stereotypes and refutes psychoanalytic theories of why some people are gay. We also suggests that research into gay brains may help combat homophobia.

On the subject of gay stereotypes, Dr Rahman said: "[These] might originate from the observation that as children, gay men tend to be gender non-conforming; they are more feminine on average, and that is seen across cultures. These preferences may have their basis in neurobiology during early development (gender roles are partly organised by prenatal sex hormones and develop even before children can label the sexes and ascribe gender roles to them)."

He added: "But don't get too carried away with unrealistic stereotypes, as there is a great deal of variation within that range of gay men. Plenty of gay men are interested in competitive sport and other spheres traditionally thought of as 'male' domains. And scientists need to explain that variation too. This is an area where we need more research."

How does this explain bisexuality, and reports of people changing sexuality?

"We know very little about bisexuality but early work suggests that while bisexual behaviour exists, a bisexual orientation (sexual responsivity to both sexes) is rare in males. In females, there appears to be clearer evidence of bisexual responsivity. This suggests that researchers need to measure sexuality differently in women than in men."

So, your studies can be useful beyond saying how someone turns out gay?

"We know there are big sex differences in certain mental health problems. Women have three times higher anxiety rates than men, while males suffer more from autism, reading problems, an earlier onset of schizophrenia. Early evidence suggests gay men show similar levels of anxiety and eating disorders as women do, incidences of drug addiction and personality problems in lesbians are similar to those reported in men.

"If there is any truth in these brain differences, we can attempt to understand why certain conditions arise, and then offer tailored, instead of generic treatment. This would be major progress in mental health, because people respond very differently according to their biological make-up. This does not exclude the important role of social factors (like stigma) in the development of mental health problems in sexual minorities (just like it impacts other minorities).

"Also, if we learn how people detect sexual orientation in others, we can explore whether someone detects it from a person's speech or movement. We know from previous experiments, that people can detect sexual orientation within a couple of seconds. We can investigate whether homophobic people have a heightened sensitivity to others on the basis of their sexuality. If we know that we can go some way to develop psychosocial interventions to deal with sexuality-related prejudice."

He added: "We welcome input from the gay and lesbian community, to find out what the important priorities are. "

Some say that such research could lead to attempts to remove homosexuals from the gene pool. Isn't there a danger of this?

Dr Rahman said: "Gays and lesbians can find this fascinating or scary and some can be downright against it. But humans have a fascination about their underlying human natures. Sexuality is a core part of who we are as human beings, and for this reason it should be cherished.

"This research has many benefits. It may provide us with clues about tackling homophobia effectively. It may help us understand mental illness better, or teach us more about the biological and psychological development of older gay and lesbian adults. On this latter topic, we currently know very little.

"In the UK, mine is the only group doing research in this area, but in the states, they have healthier funding, there are more groups. They have more money, but even in the USA there have been problems getting funds."

There is a fringe group of psychoanalysts, such as NARTH, who claim that homosexuality is caused by dominant mothers. Dr Raham emphasizes that there is no evidence for these claims.

He said: "Homosexuality is not due an overbearing mother and a distant father as some psychoanalytic nonsense has suggested. The crux of the theory predicts that gay men should come from homes where the father is absent – no demographic evidence supports this claim. Secondly, the notion that homosexuality is due to unresolved Oedipal complex (a core tenet of psychoanalytic theory) makes the prediction in the wrong way – it should explain heterosexuality and not homosexuality. If gay men are so fixated on their mothers as the theory claims then why do they end up fancying men? Psychoanalytic theory is best left in the land of warlock magic and elfin trickery. "

Can exposure to information about homosexuality (for example through sex education classes) or childhood sexual experimentation make people more likely to turn out gay?

"All the biological and developmental evidence shows that homosexuality cannot be learned so teaching about same-sex relationships in schools cannot result in increases in homosexuality. You cannot learn homosexuality like you can learn math! A certain amount of same-sex horseplay is common in adolescence but there is no evidence that is disproportionately results in adult homosexuality."

Although there are frequent reports of kids who are abused, growing up to become gay, Dr Rahman dismisses this as anecdotal.

I ask about the religious right, who seem to be very good at their PR, with reparative therapists getting major news coverage when they visit the UK. Does the media seem to give their crackpot ideas far more attention than they deserve?

Dr Rahman replied: "Yes, and the media are to blame, for creating controversies where none exist. It's vital to have heavyweights armed with the facts to demolish arguments of people who can claim, for example, to 'cure' homosexuals. But having the experts on doesn't make 'sexy' enough TV for the media. Instead, they think, 'let's get a gay clergy member', which may be controversial but it doesn't do justice to truth, or deal with the arguments sufficiently."

He also commented on media representations of homosexual activity in the natural world: "There is a strong absence of any evidence of animals having homosexual behaviour in their programmes in the natural history documentaries. I don't believe for an instant that they don't see the behaviour. It seems just fine to put heterosexual activity in our faces left right and centre, but when it comes to homosexuality, it seems it's a subject they are just not happy to touch. That is ironic because Britain is leaps and bounds ahead of most

countries in terms of representation of gays and lesbians in the media now, before the watershed, but animal sexuality is somewhat inhibited. Maybe it is too animalistic I don't know."

As Dr Rahman shows, there remains much to learn about how sexual orientation is determined. But after nearly two decades of research, the evidence that nature has determined our sexuality is growing ever stronger.

To some, it may sound like we gays and lesbians are a genetic 'mistake'. Not at all. Human civilisation owes its greatness to the ability to pass on ideas and override the genes. We should be thankful we have broken the savage rules of natural selection. Take inspiration from Richard Dawkins, who reminds us of our astronomically good fortune to be here at all, in 'Unweaving the Rainbow':

"We are going to die, and that makes us the lucky ones. Most people are never going to die because they are never going to be born. The potential people who could have been here in my place but who will in fact never see the light of day outnumber the sand grains of Sahara. Certainly those unborn ghosts include greater poets than Keats, scientists greater than Newton. We know this because the set of possible people allowed by our DNA so massively outnumbers the set of actual people. In the teeth of these stupefying odds it is you and I, in our ordinariness, that are here."

And if that doesn't send a shiver down your spine, nothing will.