

### 1. Pro: may prevent disease

Since many diseases are caused by a single genetic mutation, those in favour ask why we shouldn't edit the DNA of an embryo or the sperm and egg to remove the mutation entirely. "In effect this would remove a fault from humanity forever," said Science editor Tom Whipple in *The Times*. John Harris, a bioethicist at the University of Manchester told the *MIT Technology Review*: "The human genome is not perfect. It's ethically imperative to positively support this technology."

### 2. Con: open to misuse

There is the possibility that people will use gene-editing technology for "enhancements", rather than fighting disease, American TV host John Oliver said on his show *Last Week Tonight*, in 2018. "The more control people have over the ability to design their children, the bigger the moral questions that raises - up to and including, who decides what constitutes a genetic problem that needs to be 'fixed'?"

### 3. Pro: encourages regulation

Those in favour argue that these scientific advances can be regulated to avert potential doomsday scenarios. "I still think you can try to regulate the technology," Arthur Caplan, founding head of the Division of Bioethics at New York University, told *USA Today*. "It would be nice if we had an international group; set out some rules. It would be great if the scientific community - with religious and ethics and legal leaders - would set up some rules for how to operate. It would be nice if journal editors would say, 'We're not publishing anything unless these rules are followed.'"

In the aftermath of Jiankui's gene-editing experiment, much has changed, said Professor Robin Lovell-Badge,. "We will be discussing what has happened to the three children whose physiology he may have altered by genome editing," Lovell-Badge told *The Guardian*. "We will also have presentations about the changes that have occurred in China in terms of the law and the ethics governing gene editing. There have clearly been quite substantial changes – for the good."

#### 4. Con: many unknowns

Doctors say that just because we can change a gene does not mean we know what that change will do. “Most diseases are not caused by a single gene but many. Changing lots of genes could have lots of effects elsewhere,” reports The Times.

While most scientists and medical ethicists believe gene editing may one day be able to improve the lives of someone with a life-altering disease, they “recoil in horror at the concept of editing the genome of a human embryo” as changes to genes can be passed down through generations of human beings, said Phys.org.

“We do not know enough about human biology to make genetic engineering changes on behalf of the unborn,” said Dr John Leonard, president and CEO of Intellia Therapeutics, who said that almost all conditions which could benefit from gene editing could also be treated or prevented in another way. He also raised issues of consent, noting that the unborn cannot “agree to have these procedures done to them.”

#### 5. Pro: babies could help humanity

In the US, a poll found that 83% of people thought genetic modification to make a baby more intelligent would be “taking medical advances too far”, according to MIT Technology Review, published by the Massachusetts Institute of Technology. However, proponents of genetic engineering argue that a higher IQ is exactly what we should be considering. Nick Bostrom, an Oxford philosopher best known for his work on the risks of artificial intelligence, wrote in a 2013 paper that even a small number of “super-enhanced” individuals could “change the world through their creativity and discoveries, and through innovations that everyone else would use”.

#### 6. Con: only for the rich

Any ethical debate “will also naturally run against practicalities like funding”, says The Independent. Many patients are subject already to a postcode lottery in accessing fertility treatment based on their local NHS funding, and “gene editing could initially be out of reach for all but the richest”, adds the newspaper.

Acknowledging this problem, panel chair Professor Yeung said that if funding inequalities “were to exacerbate social injustice, in our view that would not be an ethical approach”.