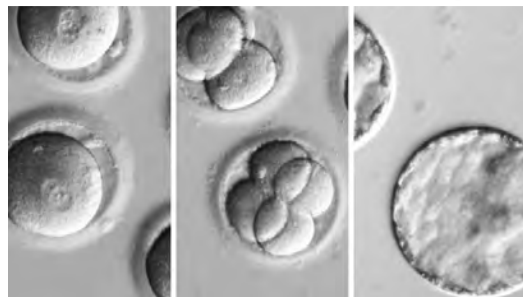


## HEALTH

### Human embryos edited to stop disease



Scientists have, for the first time, successfully freed embryos of a piece of faulty DNA that causes deadly heart disease to run in families. It potentially opens the door to preventing 10,000 disorders that are passed down the generations. The US and South Korean team allowed the embryos to develop for five days before stopping the experiment. The study hints at the future of medicine, but also provokes deep questions about what is morally right. Science is going through a golden age in editing DNA thanks

to a new technology called Crispr, named breakthrough of the year in just 2015. Its applications in medicine are vast and include the idea of wiping out genetic faults that cause diseases from cystic fibrosis to breast cancer. **Heart stopper** US teams at Oregon Health and Science University and the Salk Institute along with the Institute for Basic Science in South Korea focused on hypertrophic cardiomyopathy. The disorder is common, affecting one in every 500 people, and can lead to the heart suddenly stopping beating. It is caused by an error in a single gene (an instruction in the DNA), and anyone carrying it has a 50-50 chance of passing it on to their children. In the study, described in the journal *Nature*, the genetic repair happened during conception. Sperm from a man with hypertrophic cardiomyopathy was injected into healthy donated eggs alongside Crispr technology to correct the defect. It did not work all the time, but 72% of embryos were free from disease-causing mutations. **Eternal benefit** Dr Shoukhrat Mitalipov, a key figure in the research team, said: "Every generation on would carry this repair because we've removed the disease-causing gene variant from that family's lineage. "By using this technique, it's possible to reduce the burden of this heritable disease on the family and eventually the human population." There have been multiple attempts before, including, in 2015, teams in China using Crispr-technology to correct defects that lead to blood disorders. But they could not correct every cell, so the embryo was a "mosaic" of healthy and diseased cells. Their approach also led to other parts of the genetic code becoming mutated. Those technical obstacles have been overcome in the latest research. However, this is not about to become routine practice. The biggest question is one of safety, and that can be answered only by far more extensive research. There are also questions about when it would be worth doing - embryos can already be screened for disease through pre-implantation genetic diagnosis. However, there are about 10,000 genetic disorders that are caused by a single mutation and could, in theory, be repaired with the same technology. Prof Robin Lovell-Badge, from the Francis Crick Institute, told the BBC: "A method of being able to avoid having affected children passing on the affected gene could be really very important for those families. "In terms of when, definitely not yet. It's going to be quite a while before we know that it's going to be safe." Nicole Mowbray lives with hypertrophic cardiomyopathy and has a defibrillator implanted in her chest in case her heart stops. But she is unsure whether she would ever consider gene editing: "I wouldn't want to pass on something that caused my child to have a limited or painful life. "That does come to the front of my mind when I think about having children. "But I wouldn't want to create the 'perfect' child, I feel like my condition makes me, me." **Ethical?** Darren Griffin, a professor of genetics at the University of Kent, said: "Perhaps the biggest question, and probably the one that will be debated the most, is whether we should be physically altering the genes of an IVF embryo at all. "This is not a straightforward question... equally, the debate on how morally acceptable it is not to act when we have the technology to prevent these life-threatening diseases must also come into play." The study has already been condemned by Dr David King, from the campaign group Human Genetics Alert, which described the research as "irresponsible" and a "race for first genetically modified baby". Dr Yalda Jamshidi, a reader in genomic medicine at St George's University of London, said: "The study is the first to show successful and efficient correction of a disease-causing mutation in early stage human embryos with gene editing. "Whilst we are just beginning to understand the complexity of genetic disease, gene-editing will likely become acceptable when its potential benefits, both to individuals and to the broader society, exceeds its risks." The method does not currently fuel concerns about the extreme end of "designer babies" engineered to have new advantageous traits. The way Crispr is designed should lead to a new piece of engineered DNA being inserted into the genetic code. However, in a complete surprise to the researchers, this did not happen. Instead, Crispr damaged the mutated gene in the father's sperm, leading to a healthy version being copied over from the mother's egg. This means the technology, for now, works only when there is a healthy version from one of the parents. Prof Lovell-Badge added: "The possibility of producing designer babies, which is unjustified in any case, is now even further away." *BBC*

### From the "TRIVIA BOOK"

Dutch engineers have developed a computerized machine that allows a cow to milk itself. Each cow in the herd has a computer chip in its collar. If the computer senses that the cow has not been milked in a given period of time, the milk-laden animal is allowed to enter the stall. The robot sensors locate the teats, apply the vacuum devices, and the cow is milked. The machine costs a mere \$250,000 and is said to boost milk production by 15 percent.

## TIDES

Sep 1 Fr	2 Sa	3 Su	4 Mo	5 Tu	6 We	7 Th
0155 1.3 0809 1.7 1554 0.8 2239 1.5	0337 1.3 0926 1.8 1654 0.8 2330 1.6	0449 1.2 1033 1.8 1739 0.7 1815 0.6	0007 1.7 0535 1.1 1128 1.9 1815 0.6	0039 1.9 0611 1.0 1214 2.1 1847 0.5	0109 2.0 0644 0.9 1255 2.2 1917 0.8	0138 2.1 0718 0.7 1335 2.3 1946 0.4
Sep 8 Fr	9 Sa	10 Su	11 Mo	12 Tu	13 We	14 Th
0208 2.2 0754 0.6 1414 2.3 2017 0.5	0240 2.3 0834 0.5 1454 2.3 2051 0.5	0312 2.4 0920 0.5 1537 2.2 2126 0.6	0347 2.4 1014 0.5 1623 2.0 2205 0.8	0424 2.3 1120 0.5 1720 1.8 2250 0.9	0508 2.3 1232 0.5 1837 1.7 2348 1.1	0604 2.1 1340 0.6 2009 1.0
Sep 15 Fr	16 Sa	17 Su	18 Mo	19 Tu	20 We	21 Th
0107 1.2 0721 2.0 1450 0.6 2141 1.6	0237 1.2 0849 2.0 1602 0.6 2257 1.8	0405 1.1 1018 2.0 1703 0.5 2349 1.9	0512 1.0 1131 2.1 1748 0.5	0030 2.0 0601 0.8 1226 2.1 1825 0.5	0105 2.2 0643 0.7 1312 2.2 1859 0.5	0137 2.2 0721 0.6 1353 2.1 1931 0.5
Sep 22 Fr	23 Sa	24 Su	25 Mo	26 Tu	27 We	28 Th
0296 2.3 0759 0.5 1430 2.1 2002 0.6	0232 2.3 0837 0.5 1504 2.0 2033 0.7	0257 2.2 0914 0.5 1538 1.9 2104 0.9	0321 2.2 0957 0.6 1613 1.8 2134 1.0	0345 2.1 1045 0.7 1653 1.7 2206 1.1	0410 2.0 1141 0.7 1753 1.6 2242 1.2	0442 1.9 1242 0.8 1921 1.5 2335 1.3
Sep 29 Fr	30 Sa	Oct 1 Su	2 Mo	3 Tu	4 We	5 Th
0528 1.8 1344 0.8 2035 1.5	0124 1.3 0706 1.7 1453 0.9 2143 1.6	0305 1.3 0849 1.7 1603 0.8 2240 1.7	0423 1.2 1005 1.8 1658 0.7 2324 1.8	0515 1.0 1107 1.9 1740 0.7	0001 1.9 0554 0.9 1158 2.0 1814 0.6	0034 2.1 0629 0.7 1243 2.1 1845 0.6

## 'Please Explain'

### CD Rot

The oldest known musical instruments are a set of tuned bones, about 20 000 years old, made from the shoulder blades, hips, jaws, tusks and skullbones of mammoths. A team of criminologists, forensic scientists and musicologists deduced that these bones were primitive percussion instruments such as drums and cymbals. In fact, they still maintain their tone to the present day. Some people make a similar claim about the strength and durability of compact discs - but like the song in the Gershwin opera, *Porgy and Bess*, 'It ain't necessarily so'. For most of its history, music was as temporary and ethereal as the wind. If you wanted to hear live music, you needed the services of live musicians. This began to change around 1877, when Thomas Edison invented the 'phonograph', which recorded music as tiny dents in a sheet of tinfoil wrapped into a cylinder. The technology improved with Emil Berliner's invention of 1887 - which now recorded the sound quality improved slowly as these gramophone records improved - with different sizes of discs, thinner grooves to squeeze in more music, and different rates of spinning the records. The next big jump in sound quality came in 1958, with the introduction of stereophonic sound. There were now two channels, each with a different sound, feeding two separate speakers. This record technology became almost obsolete in the 1980s, with the introduction of the compact disc. The belief was that they were as tough as nails, and would probably outlast the Pyramids. Popular TV science shows had presenters rubbing CDs in the dirt, and even drilling small holes in them - and afterwards, they still played perfectly. We were all assured that here was a truly archival medium - one in which our stored memories would live forever. But once again, we were deceived.

Forget CD-ROM and think CD-ROT.

Sony and Philips designed the original audio CD, which carry 4 minutes of music. This duration was chosen because Norio Ohga of Sony (who had studied opera in Berlin) decreed that a single CD should be able to carry all of Beethoven's Ninth Symphony (which plays for 70 minutes). And the reason for their particular size is that they are just a little too large to fit into a shirt pocket, making them just that much harder to steal.

It didn't take a long to squash the idea of compact discs being indestructible.

In the early days of CDs, there were problems with sulphur from cheap cardboard sleeves, and from some of the links used to print the label information. The chemicals ate through the lacquer, destroying the thin aluminium layer. The se teething problem were quickly recognised and fixed. Today's CDs can be ruined by severe bending, or by rolling a sharp point (such as a ballpoint pen or a pencil) over the surface. (A handy hint: never buy a CD with a fingerprint on it - always ask for a clean one. The oils on fingerprint can sometimes eat into plastics.)

Under archival storage conditions (low temperature and humidity) Kodak says that CDs will last for between 70 and 200 years. But who has archival conditions, with constant low temperature, low humidity and low light? In the average office, one of these expensive archival CDs will last only 100 years. Indeed, the heart of a car cabin in summer can decrease their life to as little as five years.

And yet the original Domesday Book, compiled in 1086 by William the Conqueror for accounting purposes, is still in mint condition in the Public Record Office in Chancery Lane, London. Does this mean that taxes will outlast music? As we've seen, it took a mammoth effort for music to outlast taxes.

### Microscopic CD

A compact disc is a 1.2mm-thick disc of transparent polycarbonate (as used in bulletproof glass), with a diameter of about 12cm. It stores the information in a five-kilometre-long spiral of raised rectangular bumps on the surface. These bumps are about 0.5 microns wide (about 100 times smaller than the thickness of a human hair) and one-eighth of a micron high. This makes the CD one of the smallest easily available, mechanically manufactured objects ever made by human beings. Because it is virtually impossible to see tiny transparent bumps on a transparent disc a thin layer of metal (usually aluminium, although gold and silver have been used) is laid on top of the polycarbonate. This shiny metal reflects the laser beam, so that it can read the little bumps. Unfortunately, this metal layer is very fragile, and is easily damaged. For this reason the metal layer is then covered with a thin layer of lacquer to protect it from the air, as well as dirt and chemical attack. The title of the CD is usually screen-printed onto this lacquer.



## ENTERTAINMENT

### Robert Hardy: Harry Potter and All Creatures Great and Small

#### star dies

The actor Robert Hardy, star of TV series *All Creatures Great and Small*, has died aged 91, his family has said. Hardy, they said, had a "tremendous life" and "a giant career in theatre, television and film spanning more than 70 years". He was also known for numerous portrayals of Winston Churchill. In more recent years, he appeared as Cornelius Fudge, the Minister for Magic, in four of the Harry Potter films. His family said: "Gruff, elegant, twinkly, and always dignified, he is celebrated by all who knew him and loved him, and everyone who enjoyed his work." His children Emma, Justine and Paul said in the statement: "Dad is also remembered as a meticulous linguist, a fine artist, a lover of music and a champion of literature, as well as a highly respected historian, and a leading specialist on the longbow. "He was an essential part of the team that raised the great Tudor warship *The Mary Rose*." Obituary - Robert Hardy With his instantly recognisable voice and British bulldog manner, Robert Hardy enjoyed a distinguished acting career which spanned seven decades. By the time he endeared himself to television audiences in the BBC's *All Creatures Great and Small*, he had already carved out a reputation as one of Britain's most versatile actors. While his earlier career gave him a firm grounding in the theatre his best known roles were in front of the camera - particularly in television, a medium he obviously enjoyed. The British Film Institute also posted a message in response to the "sad" news, while Magdalen College, where Hardy attended university, also paid tribute to him on Twitter. One of Hardy's earliest TV roles was portraying Cassio in *Othello* in 1955. He went on to become a household name in the BBC's *All Creatures Great and Small*, which ran for 12 years, in which he played senior vet Siegfried Farnon. Co-star Christopher Timothy remembered him on Thursday as a "fascinating" actor who had been "a joy to work with". "He didn't suffer fools so he was sometimes quite tricky," he told Radio 4's PM programme. "But I was most grateful for his experience, confidence, wit and style." Timothy said he had last seen Hardy 18 months ago and found him "frail, yet still sparkly and twinkly." "He was a very clever fellow," he went on. "I remember once on set he was talking about manure, and his description of the smell was poetry." Nick Betts, director of scripted production at BBC Studios, said Hardy was an "iconic British actor of stage and screen". "We are very sorry to hear of his passing today and our thoughts go out to his family and friends." Other TV roles included Arthur Brooke in *Middlemarch* in 1994 and *Tite Barnacle* in *Little Dorrit* in 2008. On the big screen he was seen in *Mary Shelley's Frankenstein* and 1995's *Sense and Sensibility*. *BBC*

