HIV mechanism

Scientists have discovered that the human immunodeficiency virus (HIV) hijacks a small molecule from the host cell to protect itself from being destroyed by the host's immune system.

Making oxygen from water may pave way for long-distance space travel

Scientists have converted water into oxygen and hydrogen under microgravity conditions using only a semiconductor and sunlight. The technology could make long-distance space travel possible.

Researchers have previously developed a variety of water-splitting technologies for use on Earth, UPI wrote.

One of the simplest methods is called photocatalysis — the technology uses photons, a semiconductor material and water to create electron-hole pairs, when the material absorbs photons, a free electron is released.

UPI

NASA astronaut Robert Curbeam works on the International Space Station's S1 truss during the space shuttle Discovery's STS-116 mission in December 2006.

The reaction pulls a proton from the water, which can combine with the free electron to form hydrogen.

The hole created by the released electron is replaced by an electron from water, which can combine with protons to form oxygen.

The system can produce hydrogen fuel for a spaceship and oxygen for astronauts to breathe.

To see if the technology can work under microgravity conditions, scientists dropped a photocatalysis system down a drop tower. When an object is in free fall, it experiences conditions similar to microgravity.

Photocatalysis results in bubble production near the catalyst material. On Earth, buoyancy causes the bubbles to float to the surface. But under microgravity conditions the bubbles remain near the catalyst.

Scientists were able to make nanoscale augmentations to the catalyst material's microstructure, creating tiny pyramid-like shapes on the surface. The texture causes bubbles to move to the tip of the pyramid and disengage.

Researchers detailed their design change in the journal Nature Communications.

The technology isn't yet perfect. Though scientists were able to get the bubbles to separate from the catalyst, they still remain in the water. The accumulating foam diminishes the efficiency of the hydrogen-production process.

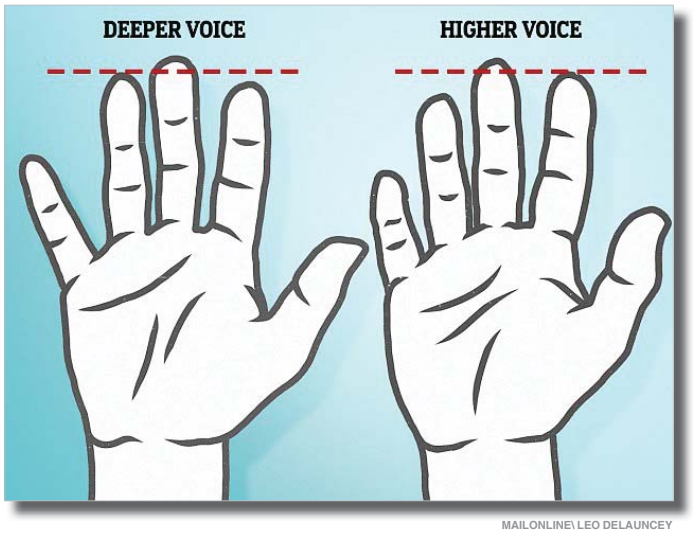
Researchers wrote in The Conversation, "Engineering solutions around this problem will be key to successfully implementing technology in space — with one possibility being using centrifugal forces from rotation of a spacecraft to separate the gases from the solution."

There is also the problem of water supply. Though blasting off with large amounts of water is safer than carrying large amounts of fuel, water is heavy.

Long-term space travel will require external sources. Eventually, scientists hope space-mining operations will be able to harvest water form asteroids.

Scientists said, "Thanks to this new study we are a step closer to long-duration human spaceflight."

Will your child have high-pitched voice as an adult?



MAILONLINE\ LEO DELAUNCEY

A bizarre link between the size of a child's fingers and the pitch of their voice has been uncovered by scientists.

A bizarre link between the size of a child's fingers and the pitch of their voice has been uncovered by scientists.

A baby is more likely to grow to have a squeaky voice if the index finger on their right hands is longer than the ring finger, dailymail.co.uk reported.

Researchers said the connection is probably the result of a lack of the hormone testosterone in the womb.

Testosterone is known to be key to early body growth and plays an important role in how vocal pitch develops during puberty.

The research, conducted by the University of Sussex, measured the voices of babies and infants aged four months and five years.

Fifteen children had their fingers measured and voices recorded on separate occasions to see if the two were linked.

The closer the index finger is in length to the ring finger, or even if it is longer, the child will likely have a higher pitched voice.

Strangely, this relationship — which was true of both young girls and boys — was only true of the fingers on the right hand.

Researchers said they were unsure whether the older children's pitch would last beyond puberty.

They wrote in their paper, "Pitch is a highly salient feature of the human voice that affects listeners' perceptions of femininity and masculinity in babies' cries, children's speech and adult speech.

"Here, we found that the pitch of babies' cries at four months of age was a significant and substantial predictor of the pitch of their speech at five years of age."

The researchers believe the unique relationship exists because finger length and vocal pitch are both affected by the amount of testosterone in the womb.

Previous research has shown that men with high testosterone levels have a longer ring finger, likely because the hormone is involved in growth.

During puberty, testosterone causes the voice to change pitch, though this same link has not been made in younger children.

The researchers of the new paper said voice depth and finger ratio could be used to determine attributes related to gender, masculinity and dominance throughout the lifespan in future.

The researchers are hoping to see if this relationship stands true past puberty and into adulthood in upcoming research.

How to build a real time machine

BBC

Ron Mallett built a device that illustrates principles he believes could be used to build a time machine.

Traveling in time might sound like a flight of fancy, but some physicists think it might really be possible.

BBC Horizon looked at some of the most promising ideas for turning this staple of science fiction into reality.

Prof. Ron Mallett has a dream: He wants to travel in time.

This isn't mere fantasy — Mallett is a respected professor of physics.

He said, "I think of myself as being an ordinary person with a passion, and my passion is the possibility of time travel."

Mallett has wanted to build a time machine for most of his life. His passion, he explained, can be traced to a tragic event early in his life.

Ron's father, a heavy smoker, died of a heart attack at the age of 33 — when Mallett was just 10 years of age. Ron was devastated and withdrew into his books.

The University of Connecticut physicist said, "A year after that when I was 11, I came across the book that changed everything for me. That was The Time Machine, by HG Wells.

"The cover caught my attention, but it was when I read the inside, and it said: Scientific people know very well that time is just a kind of space and that we can move forward and backwards in time, just as we can… in space.

"When I read that I said: This is wonderful!"

Mallett explained, "If I could build a time machine, then I could go back into the past and see my father again and maybe save his life and change everything."

Time travel may sound farfetched, but scientists are already exploring several mysteries of nature that could one day see Ron's dream fulfilled.

Albert Einstein thought the three dimensions of space were linked to time — which serves as a fourth dimension. He called this system space-time, and it's the model of the Universe that we use today.

But Einstein also thought it was possible to warp space-time, creating a 'bridge'.

This phenomenon is called a wormhole, and it can be visualized as a tunnel with two ends, each opening into different points in space-time.

Wormholes might exist naturally in the cosmos; indeed, scientists in Russia are trying to use radio telescopes to detect them. But using wormholes for time travel won't be straightforward.

The nearest ones could be many light-years away. And even if you could get to them and then survive the journey through them, there's no guarantee where you'd end up.

But some physicists have speculated that we might be able to conjure up bespoke wormholes at some point in the future — though we currently have no idea how.

Physics also predicts that wormholes would have a habit of collapsing, crushing whatever's inside them. If a time machine is ever to exploit them, we'd have to find a way to stop this inconvenient feature.

The mysterious phenomenon of dark energy might provide a solution. In the 1990s, astronomers found that the expansion of the Universe was speeding up, rather than slowing down as might have been expected.

Prof. Tamara Davis, a cosmologist at the University of Queensland in Australia, said, "Something out there is having an 'anti-gravity' effect —it's pushing rather than pulling. We don't know what that is, but it makes up most of the Universe. We call it dark energy."

A wormhole will only work for time travel if its 'mouth' can be held open for long enough that it allows something to travel through it.

That requires something called negative energy, which doesn't really exist in the everyday world.

But the dark energy that permeates the cosmos fits the bill — if we can figure out what it is, we might be able to prop open a wormhole long enough to go in one end and out the other.

Davis said, "We don't know whether we are able to make a wormhole, whether that's technically within our capabilities… But who knows what a future human civilization is going to be able to do.

"Technology has advanced so rapidly that maybe space and time themselves are something that can come under our control."

Wormholes exist at the more speculative end of physics, offering one approach to traveling in time. But Mallett has another.

He has drawn up plans for an actual time machine, and his concept was inspired by a book he read at age 12 about Albert Einstein's equations.

Mallett has built a table-top device that illustrates principles he thinks could be used to build a real, working time machine.

First, lasers are used to generate a circulating beam of light. The space inside this 'ring laser' should become twisted, 'like stirring a cup of coffee', the University of Connecticut professor explained.

Because space and time are intimately connected, warping space should also warp time. Mallett's theoretical work has shown that, given enough laser intensity in a small enough space, it should be possible to alter the normally linear timeline we all inhabit.

Mallett, said, "If space is being twisted strongly enough, this linear timeline is going to be twisted into a loop. If time all of a sudden is twisted into a loop that allows us the possibility of travelling into the past."

However, in order to make it work, the concept would require vast amounts of power and a way of shrinking everything to a microscopic scale.

But once we have a time machine, using it successfully will require a detailed understanding of time itself.

The generally accepted view is that the Universe is an unchanging 'block' of space-time; this idea arises directly from Einstein's equations.

Dr. Kristie Miller, director of the Center for Time at the University of Sydney, Australia, said, "What's important about the model is the idea that the past, present and future are all equally real.

"So you can think of everything that ever did exist, does exist or will exist as all somehow being out there in space-time.

"The dinosaurs are all out there somewhere in the past doing dinosaur stuff, we're all here now and all of the future is out there somewhere in space-time too."

One way to visualize the block model is to think of other places in time as being like other places in space.

Miller said, "We are here in Sydney, but there are other people located in Singapore and London. Those places are perfectly real, it's just that we aren't at them.

"This is good news for the budding time traveler, because it suggested there is nothing to stop us from swapping where we are now for some other place and time.

"But, importantly, it also implies that the past, present and the future are already written, so that if we were to travel back in time, we wouldn't be able to alter it."

To take an oft-quoted example, we shouldn't be able to kill someone's grandparent so that their descendant will cease to exist in the future.

The block model treats our everyday concept of time as an illusion, a way that humans rationalize reality.

But Prof. Lee Smolin, from the Perimeter Institute in Waterloo, Canada, disagrees.

He believes that the passage of time is a real and fundamental phenomenon.

He said, "Time travel is probably impossible. If what's real is the present moment and the past is only real in the sense that there are memories and records of it in the present, and the future is still to exist… there's nowhere to go."

His colleague Prof. Neil Turok, director of the Perimeter Institute, thinks the weird world of quantum physics could be crucial to answering this question.

This area of physics emerges at very small scales, where the rules of classical physics we learnt about in our school textbooks break down. For example, in the quantum world, it might be possible for a particle to be in many places at once.

He said, "I think it's clear to me that there is some probability of us going backwards in time.

"In quantum physics, nothing is impossible — particles travel through walls!"

Turok explained that time travel remains a distant hope because no one really has any plausible idea of how to go backwards in time right now.

But he added, "One should never say never, because some clever person will come along and tell you how to break the rule."