

Essay competition

successful in restoring the hearing of mice and guinea pigs: a breakthrough! These advances have led to the development of more therapies, and one such therapy is now being tested for the first time in humans. The REGAIN clinical trial (REgeneration of inner ear hair cells with GAMma-secretase INhibitors), an international collaboration led by researchers at University College London, is testing a molecule called γ -secretase inhibitor that could potentially restore hearing by encouraging supporting cells to transform into new hair cells themselves.

If it works, such a scientific advance could transform hearing health care as we know it. My own research investigates the impact hearing loss has on people's mental well-being. Many people share Beethoven's despair when they realize that their hearing can't be restored. Hope is an essential element for good mental health.

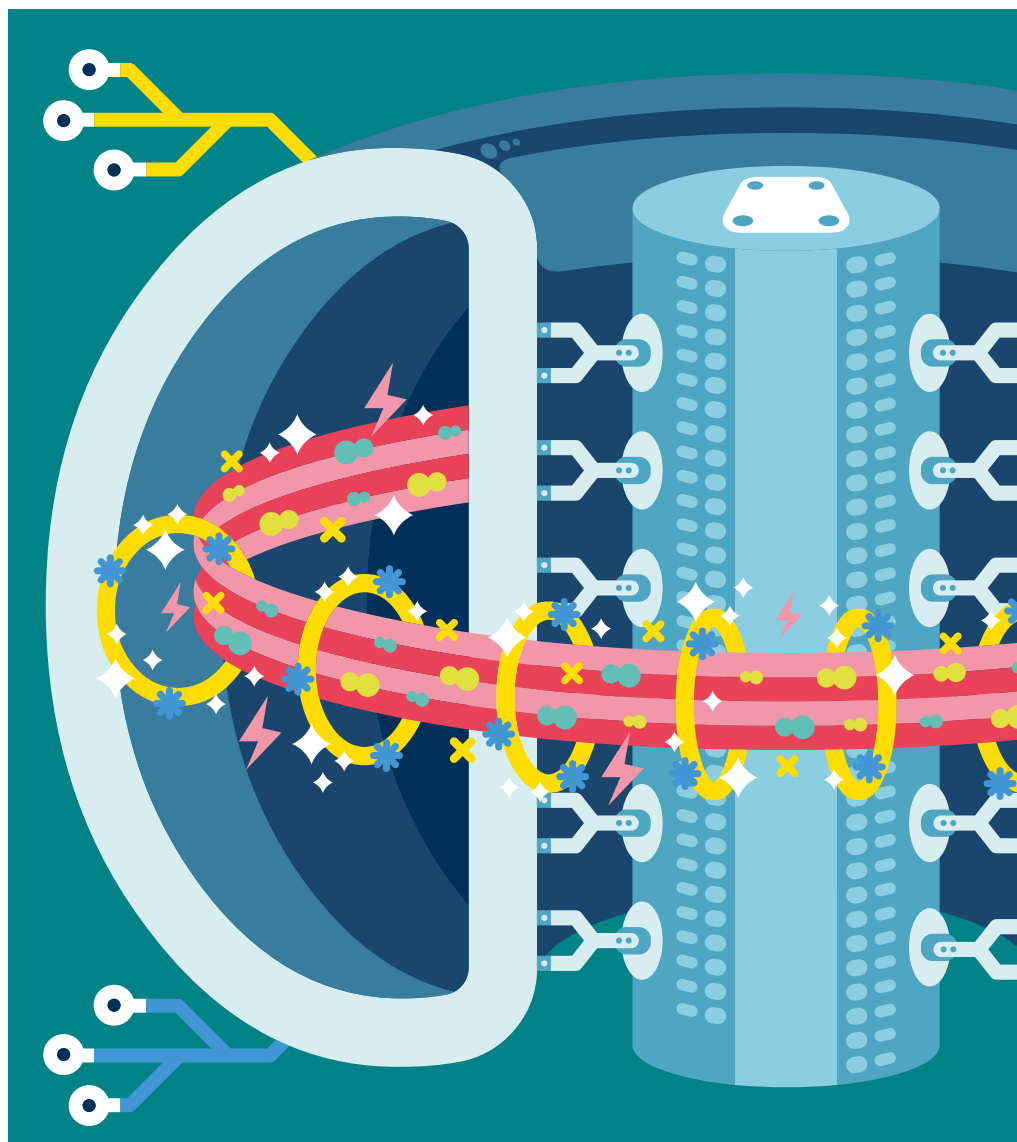
Other members of the deaf community see themselves as a cultural minority, rather than as a disabled group to be 'cured'. My and other scientists' research aims to help those who feel disadvantaged by deafness and want to be able to hear.

Islam and I come from interracial parents, so we look very different. I have white, freckled skin, and his is olive (he gets perfect suntans, and I turn into a tomato). I have blue eyes, and his are hazelnut. I have normal hearing, whilst he has severe hearing loss. He and I have shared the many chapters of our lives, and when things became difficult as his hearing declined, what helped us cope was being able to make sense of it all together. Communication, self-expression, hearing and being heard (even through sign language) are basic human needs. I hope that when I voice support to my brother in the future, that he'll be able to hear it, receive it and not feel alone.

When Beethoven lost his hearing, he secluded himself from society – but one thing that gave him strength was the hope that his hearing could be regained one day. But each medical remedy he attempted failed. In 1802, he wrote: "But, think that for six years now I have been hopelessly afflicted, made worse by senseless physicians, from year to year deceived with hopes of improvement, finally compelled to face the prospect of a lasting malady (whose cure will take years or perhaps be impossible)."

Beethoven's dream of regaining his hearing did not come true for him, but through the scientific advance of regeneration of hair cells, it could become a reality 217 years after his June walk. On his deathbed, it is said that Beethoven's last words were "I shall hear in heaven!" Luckily for us, those facing hearing difficulties could soon be able to hear on Earth.

Yasmin Ali is a PhD student studying mental health and hearing loss at the University of Nottingham, UK.



Power play

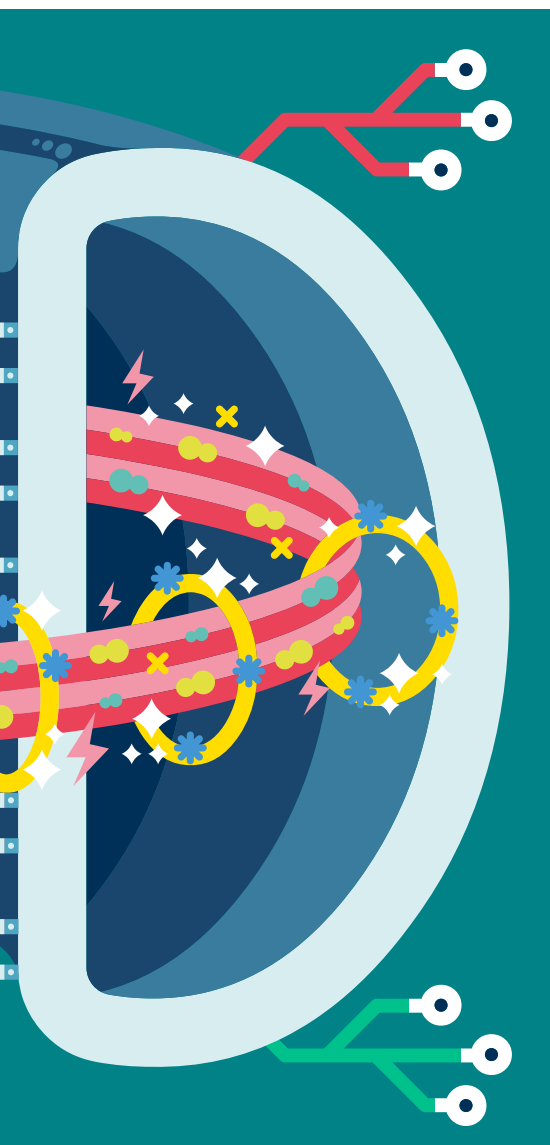
Nuclear-fusion power plants could be part of a solution to the climate crisis. **By Robert Schittko**

If primary sources can be believed, I conducted my first experiment with a high-power energy source at the tender age of one.

It was New Year's Eve 1995, and I had somehow gained possession of two silver objects I now know were screws, when my wandering gaze was captured by a snake-like item emerging from a wall. At its end, which I was about to learn was the head of an extension cord, there were two tiny openings, whose black interiors stood out daringly against the white backdrop of a piece of plastic. Utterly unaware of the cautionary tale I was about to write, I abandoned all hesitation. I took one last

breath, homed in on my target, and shoved the two silver objects into the two little holes, thus producing the first – but, fortunately, not the last – negative result of my newfound career.

Twenty-four years later, my parents and I have fully recovered from our respective shocks, I am still playing around with hazardous equipment – currently as a physicist at Harvard University in Cambridge, Massachusetts – and the mishandling of energy sources on a far larger scale is now threatening not just my existence but that of tens of thousands of species worldwide. Unlike toddler-me, today, we cannot plead ignorance. Even if global warming is kept to 1.5 °C above



Nuclear fusion is a process by which pairs of light atomic nuclei unite while releasing enormous amounts of energy. It is the mechanism that powers the Sun and other stars, and a principle that researchers have long hoped to harness to build nuclear-fusion power plants. In theory, such plants could be fuelled with sustainably sourced hydrogen isotopes for thousands of years, while being safer than nuclear-fission plants and producing zero long-lived nuclear waste. Unfortunately, they also come with a catch: building them is incredibly hard.

This is because nuclear fusion on Earth requires temperatures in the order of tens of millions of degrees Celsius, at which the fusion fuel behaves as a riotous plasma. The difficulty in governing the behaviour of this plasma is the key reason why nuclear-fusion power plants do not exist today, despite over sixty years of extensive research. Nevertheless, those years have resulted in many valuable insights, and a clean-energy future thanks to nuclear fusion seems more realistic today than ever before.

The most ambitious nuclear-fusion project to date, ITER, is currently being constructed in southern France with the explicit goal of pushing past break-even, a so-far elusive point of operation at which the output power of the fusion process exceeds the power invested to maintain the plasma. Helped by dozens of other labs around the world, ITER, which is scheduled to start full operation in 2035, will also test several auxiliary technologies that a working fusion plant would ultimately require, all while separate research into competing types of fusion reactors continues elsewhere and breakthroughs such as deep learning advance the field (J. Kates-Harbeck *et al. Nature* 568, 526–531; 2019). With all this in mind, I'm hopeful that working

nuclear-fusion plants will be built well before the end of the century, and that fusion energy will help substantially in limiting the impact of the climate crisis.

Irrespective of that crisis, there are plenty of other reasons to be excited about nuclear fusion. As a physicist, I am humbled by the idea of taming a plasma that is several times hotter than the Sun's core. As a researcher, I am amazed by the complexity that a nuclear-fusion power plant would require in every aspect of its ultimate design. And as a writer, I marvel at the prospect of mimicking the stars, instead of merely looking up to them.

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But it is as a human, thinking of other humans, that I feel a breakthrough in controlled fusion could rise above all else. After all, the human cost of climate change, of rising seas and rising temperatures, of more frequent droughts and extreme weather events, will ultimately have to be paid. And it will be paid first and foremost by those who have the least; by the poor and the less privileged, who can be faulted for the crisis they will be caught up in no more than a one-year-old boy can be faulted for electrocuting himself.

Nuclear-fusion power plants, more so than any other technology, could prove a uniquely powerful tool to diminish that cost.

That's why I hope to see them in my lifetime.

Robert Schittko is an experimental physicist at Harvard University, Cambridge, Massachusetts.

pre-industrial levels, the Intergovernmental Panel on Climate Change (IPCC) has warned, “climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth” will increase. Warming beyond that point to just 2.0 °C will further harm hundreds of millions of people in vulnerable areas worldwide, the IPCC estimates. Yet the emission levels countries have volunteered to aim for following the Paris agreement will warm Earth by approximately 3.0 °C over the next 80 years alone, and it seems that even these goals will not be met.

This failure of the global political establishment to adequately address climate change has prompted a hunger for some sort of transformative breakthrough, either of the political or of the technological kind.

Our best hope for the former – already expressed in a global wave of climate activism – might be an unprecedented political movement which dramatically ups the pressure to act more determinedly in the face of a crisis.

Our best hope for the latter is called nuclear fusion.

Reproduction, rethought

Same-sex partners should one day be able to raise a biological descendant together. **By Matthew Zajac**

One afternoon as a second-year undergraduate, I called my parents from my dormitory. To them it was a routine call home, but to me it was a conversation long overdue. I'd rehearsed with my closest friends exactly how to start; my words needed to strike with confidence but should mitigate shock. Like protecting them from a grenade I'd thrown at them.

“So ... I actually do have some romance in my life. With a boy.”

I practised answers to typical questions parents ask after their child comes out as gay: “Are you sure?”, “Why haven't you told us?”, “Didn't you like a girl once?” But those questions never came, and I wasn't prepared for the one my mom did ask: “What about kids?” Whether out of sympathy for my aspirations to raise children or because of her plans of pampering grandchildren, my mother quickly recognized that my ability to start a family could be jeopardized by