



# Notes from the Edge



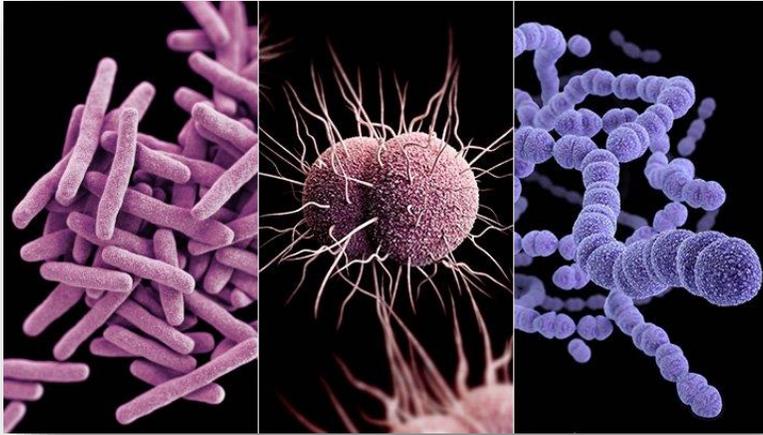
## Insights into an Evolving Future

VOL 7 – ISSUE 3

MARCH 2017

A Product of the Futures Assessment Division

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### MEDICAL SCIENCE

**WHO: These 12 bacteria pose greatest risk to human health.** Twelve types of bacteria were deemed "priorities" in urgent need of new antibiotics, according to a list released by the World Health Organization (WHO). The first list of its kind, it highlights bacteria that global health experts believe pose the greatest threats to human health. The WHO is calling on governments and pharmaceutical companies to prioritize the development of new drugs against them.

Globally, antibiotic resistance has been seen in every country, according to WHO, and drug-resistant bacteria are estimated to cause 700,000 deaths each year. If no action is taken, they are expected to kill 10 million people annually by 2050. [Drug Resistant Mass Killers](#)

**West Australia tests synthetic antibiotic.** Recce Limited, a Perth, Australia-based pharmaceutical research company, is a step closer to developing a new class of synthetic antibiotics to overcome superbugs because it is synthetic and unknown to germs. Rather than look at a natural source, the scientists have synthesized this new type of antibiotic in the laboratory, and it has been proven to kill all bacteria – both natural forms and the mutated or superbug versions.

An independent U.S. laboratory is testing the new antibiotic, known as Recce 327, in mice infected with a drug-resistant strain of the food poisoning bug E. coli. This is one of 10 studies commissioned by Recce as it prepares to seek formal U.S. Food and Drug Administration approval and start clinical trials in humans. Laboratory tests have shown the antibiotic is effective against a range of bacteria, including E. coli and Clostridium difficile which can cause life-threatening infections. [There Is Hope](#)

### **A U.S. panel has endorsed limited genetic modification of humans – Here’s what that means.**

“Heritable germline genome editing” is a game changer; changes and substitutions to the unique genetic blueprint for a person before they are born snipping out code for traits they don’t want and potentially replacing them with something else. These changes would be passed on to their offspring, introducing

manually edited genes into the wild. After evaluating the issue for a year, the National Academy of Sciences and the National Academy of Medicine concluded that clinical trials involving inheritable changes to the genome could be allowed, so long as they treat or prevent rare genetic diseases that we have no other way of dealing with. They leave open the possibility of using genetic editing to remove or replace mutations that make people susceptible to other diseases like certain cancers and Alzheimer's disease. This is unlike making "enhancements", which they say should not be allowed at this time, though they call for public discussion of those possibilities. Once that's done, the first "designed" babies could – or will – be born. If all goes well and these guidelines are followed, they'll be healthier and free of a disease that could or would have been devastating. [Engineering the Death of Disease](#)

## SECURITY

**Could malicious music take control of autonomous cars?** What if someone could take control of an autonomous car simply by playing a piece of music embedded with malicious sound frequencies? Researchers at the University of Michigan have provided compelling evidence highlighting how a variety of technologies including smartphones, fitness wearables, and automobiles can be hacked using specific acoustic tones. The team discovered that by deploying precisely tuned acoustic tones, Microelectromechanical systems (MEMS) and the capacitive MEMS accelerometers could be fooled into registering false movement readings. These false readings could be so precisely calibrated that they enabled the researchers to take control of some of these devices. [Music Hack](#)

## TECHNOLOGY

**Why Google and Apple will rule mixed reality.** The future of mixed reality (*ed: aka "Augmented Reality"*) won't be dominated by Microsoft, Magic Leap, ODG or Meta, but by Google and Apple. Unlike virtual reality, which involves immersion into a fully computer-generated world, mixed reality blends the real with the computer-generated. For the richest mixed-reality experience, you need both 3D mapping and image rendering. As a result, products like HoloLens and Magic Leap require heavy, bulky headsets and cost a lot of money. This class of mixed-reality product is exciting, but these systems aren't for casual use. Only businesses, universities, military operations, and very dedicated gamers will buy them in the near future.

Google's Tango 3D mapping technology is capable of quickly mapping interior spaces, including depths and distances; it's even capable of accurately determining the size of objects in a room. The best Tango products are yet to come. These will appear in the form of new phones, new apps, and new peripherals, such as mixed-reality glasses that work with a smartphone. Google is building a world of smartphone-friendly mixed reality that's mainstream, portable, affordable, and practical.

While Microsoft, Magic Leap, and others are creating powerful, exciting mixed-reality products, they lack the one quality that Google and probably Apple have – the intention to develop mixed reality that's affordable, mobile, and mainstream. [Mixed Reality](#)

**The autonomous future of warfare looks a lot like Pokémon Go.** Yes, the Pentagon Strategic Capabilities Office imagines a world where soldiers on the battlefield will use mixed reality.

[Military in the Mix](#)

## FUTURE OF ARTIFICIAL INTELLIGENCE

**China may soon surpass America on the artificial intelligence battlefield.** The rapidity of recent Chinese advances in artificial intelligence indicates that China is capable of keeping pace with, or perhaps even overtaking, the United States in this critical emerging technology. The successes of major Chinese technology companies, notably Baidu Inc., Alibaba Group, and Tencent Holding Ltd. – and even a number of start-ups – have demonstrated the dynamism of these private-sector efforts in artificial intelligence. China's research is cutting edge – from speech recognition to self-driving cars. There is also relevant research in artificial intelligence occurring in the People's Liberation Army research institutes

and the Chinese defense industry. These developments could have immense strategic implications for the United States. [New AI Leader?](#)

**Why parents might not be ready for AI in the classroom.** From blended learning to AI tutors, algorithms are poised to reshape the way teachers engage with their students. No one can reliably predict the degree of impact AI may have in education, but one thing seems clear – parents should expect to deal with more complexity and greater responsibility in overseeing their children’s education. Many students fall behind as they struggle to grasp concepts that are presented in ways they don’t understand. They may be ill-suited to the standardized school environment, or their cognitive development may take place at a different rate than that of their peers, either faster or slower. Artificial intelligence offers an alternative for these children in the form of personalized learning systems that adjust lessons, reviews, and activities based on individual skill levels and strengths. Given evidence that AI-powered intelligent tutoring systems outperform traditional classrooms, AI could have a democratizing effect on education. What will it mean for parents if their children can learn just as well, if not better, from the comfort of their homes instead of in traditional classrooms?

[AI Changing the Classroom](#)

## RENEWABLE ENERGY

**New materials could turn water into the fuel of the future.** Researchers at Caltech and Lawrence Berkeley National Laboratory (Berkeley Lab) have – in just two years – nearly doubled the number of materials known to have potential for use in solar fuels, putting solar fuels on the fast track to commercial viability. Solar fuels, a dream of clean-energy research, are created using only sunlight, water, and carbon dioxide (CO<sub>2</sub>). Researchers are exploring a range of target fuels, from hydrogen gas to liquid hydrocarbons, but producing any of these fuels involves splitting water. To create practical solar fuels, scientists have been trying to develop low-cost and efficient materials, known as photoanodes, which are capable of splitting water using visible light as an energy source.

Over the past four decades, researchers identified only 16 of these photoanode materials. Now, using a new high-throughput method of identifying new materials, a team of researchers have found 12 promising new photoanodes. What is particularly significant about this study, which combines experiment and theory, is that in addition to identifying several new compounds for solar fuel applications, the team was able to combine the best capabilities enabled by theory and supercomputers with novel high-throughput experiments to generate scientific knowledge at an unprecedented rate.

[Supercomputing Water into Fuel](#)

**New world record set for converting sunlight to electricity.** An Australian team has set a new record for squeezing as much electricity as possible out of direct, unfocused sunlight via a new solar cell configuration. Engineers at the University of New South Wales (UNSW) achieved 34.5 percent sunlight-to-electricity conversion efficiency, a new mark that also comes closer than ever to the theoretical limits of such a system.

UNSW's Dr. Mark Keevers and Professor Martin Green set the record with a 28 centimeter-square (4.3 sq in), four-junction mini-module embedded in a prism. This new configuration allows the sun's rays to be split into four bands so that a higher amount of energy can be extracted from each beam. This new record is the highest level achieved without the use of concentrators. "What's remarkable is that this level of efficiency had not been expected for many years," said Green, citing a German study that set a goal of 35 percent efficiency to be reached by 2050. [Sooner and Better Solar](#)

## FORESIGHT

**What does the future hold? Most people don't want to know.** The American Psychological Association drew data from two nationally representative studies involving 2,000 adults in Germany and Spain, and found that 85 to 90 percent of people would not want to know about negative events in the future, and 40 to 70 percent felt the same about future positive events. In fact, only 1 percent of survey

recipients consistently wanted to know about the future, according to the study. People who would prefer to remain ignorant about future events tend to be more risk averse, researchers inferred, and they more frequently buy legal and life insurance than those who *do* want to know the future. Put differently, the kind of people who don't want to know the future tend to anticipate regret.

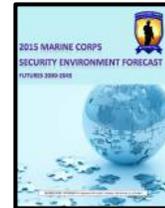
Lead study author Dr. Gerd Gigerenzer, of the Max Planck Institute for Human Development noted, "Not wanting to know appears counterintuitive and may raise eyebrows, but deliberate ignorance, as we've shown here, doesn't just exist; it is a widespread state of mind." [Do You Want to Know?](#)

## FORESIGHT NEWS

**NATO Science Fiction Futures.** Our colleagues at [NATO ACT](#) have produced a collection of science fiction futures worth review. They take a different approach (basing stories on possible trends rather than creating them out of an alternative future world) and consider implications. Click the cover page art at the right:



**Science-Fiction Futures.** On 11 January 2017 Futures Assessment Division proudly rolled out the release of the *Science Fiction Futures*, a supplement to the 2015 MCSEF. The project began the previous year in coordination with the Atlantic Council [Art of the Future Project](#). The *Science Fiction Futures* anthology, the MCSEF, and previous editions of *Notes from the Edge* can be found at the link: [Futures Assessment Division](#)



***“The man who has anticipated the coming of troubles takes away their power when they arrive.” – Seneca***

*This newsletter is intended to highlight issues and ideas which may prove significant in the evolving future. In keeping with our focus on both alternative futures and analysis, items in this bulletin will generally be of an alternative nature, or drawn from atypical sources.*