



DEFENSE TECHNOLOGY MONITOR

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Related Categories: Cybersecurity and Cyberwarfare; Science and Technology

GENE EDITING FOR MEDICINE... AND MORE?

The controversial gene-editing technology known as CRISPR was recently used inside a human body for a first-ever therapy at the Casey Eye Institute at Oregon Health & Science University in Portland. For individuals suffering from Leber's Disease, vision loss usually occurs within the first several months of their lives, before rendering the person permanently blind. However, the new therapy injects the CRISPR-developed drug AGN-151587 directly into the eye, where it essentially seeks out and overwrites the malfunctioning genes. While such therapies could revolutionize medicine and treat individuals suffering from any number of genetic conditions, CRISPR is controversial due to ethical and security concerns over issues such as creating bioweapons or genetically-enhanced super soldiers — particularly after Chinese scientist He Jiankui's 2018 editing of two embryos, which resulted in the birth of twin girls but raised serious ethical and regulatory concerns. (*Cnet*, March 4, 2020)

HOW SMART WATCHES HELP AERIAL NAVIGATION

U.S. Global Positioning System (GPS) satellites are a cornerstone of modern navigation and synchronization — a spy plane pilot's best friend. Unfortunately for American pilots, when flying reconnaissance flights over, or near, an adversary's territory, their satellite connection could be jammed. For that reason, American U-2 pilots are now being outfitted with special watches that gather navigation information from numerous satellites in order to assist in flying in GPS-denied environments. According to Gen. James "Mike" Holmes, head of Air Combat Command, the technology allows U-2 pilots to fly not only with the assistance of GPS, "but also Chinese [BeiDou] and the Russian [GLONASS] system and the European [Galileo] system so that if somebody jams GPS, they still get the others." While military officials are tight-lipped about the manufacturers and technical capabilities of such watches, defense watchers note that the U.S. military bought 100 Garmin D2 Charlie navigation watches back in 2018. (*Defense One*, March 5, 2020)

A NEW QUANTUM-SENSING RECEIVER

Quantum technologies are as varied in their potential national security applications as they are complex. U.S. Army researchers, however, appear to have found a new one. A newly-developed quantum sensing receiver can reportedly be used to detect communication signals across the entire radio frequency spectrum (0-100 GHz) using Rydberg atoms. The development is significant because a multitude of antennas and receivers are currently necessary to achieve the same spectral coverage. David Meyer, a scientist at the U.S. Army Combat Capabilities Development Command's Army Research Laboratory, has stated that "these new sensors can be very small and virtually undetectable, giving soldiers a disruptive advantage... Quantum mechanics allows us to know the sensor calibration and ultimate performance to a very high degree, and it's identical for every sensor. This result is an important step in determining how this system could be used in the field." (*Phys.org*, March 19, 2020)

TOWARD HUMAN-COMPUTER HYBRID AI

While many companies are developing artificial intelligence capabilities by mimicking the human brain via software, Australian start-up Cortical Labs is literally building mini-brains by embedding neurons into specially-developed computer chips. The company acquires biological neurons by either coaxing human skin cells to revert back to stem cells and then stimulating them into human neurons, or by extracting neurons from mouse embryos. The neurons are then embedded within a special serum on a computer chip, which is saturated with thousands of electrodes. The results are impressive; AI developed by Cortical Labs has approached the equivalent processing power of a dragonfly, and is capable of playing the computer game Pong. However, its developers believe that the systems could eventually far surpass traditional AI programs. Additionally, a major advantage over non-biological systems is that, if perfected, the Cortical Labs' AI could require several orders of magnitude less power to operate than do today's neural networks, something which has been a major impediment for AI systems developed by companies like Google. (*Fortune*, March 30, 2020)

AI MIND-READING ON THE HORIZON

The ability to read people's minds may not be solely a science fiction fantasy any more. An artificial intelligence developed by researchers at the University of California, San Francisco can interpret human brain signals into 250 words in real time from pre-generated sets of 30-50 sentences. During testing, the system was able to discern volunteers' words at a remarkable efficiency of 97% by analyzing their brain activity while they read sentences aloud. While the lexical knowledge of regular English speakers encompasses about 20,000 words, such an AI marks an important step in human-focused computing. California researchers trained the AI by gathering neural signals via brain implants from four female test subjects. The AI will likely face difficulties in forming sentences in real-time as more words are added to its lexicon, but could compensate by interacting with other implants or technologies. Such technologies, in turn, could even enable person-to-person telepathy, according to a study by the Royal Society, and similar brain-human interface technology is being researched by companies such as Facebook and Elon Musk's Neuralink (See *Defense Technology Monitor* no. 16). (London *Independent*, March 31, 2020)