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Synthetic Biology: New Pathway, New Drug Threat?

By Nandhakumar Gunasekaran

Synopsis

Synthetic biology is an emerging field in science and technology that can make a positive impact in numerous areas. There are also concerns that it could be misused to exacerbate the illicit drug threat. Authorities worldwide need to nip this potential threat in the bud.

Commentary

SYNTHETIC BIOLOGY is gaining recognition as an emerging field in science and technology that characterises the fusion of technologies between the physical, digital and biological spheres as part of the Fourth Industrial Revolution. A multi-disciplinary science that combines elements from the scientific, engineering and technological disciplines, synthetic biology involves the use of biotechnology and DNA manipulation to create or modify living things in order to introduce new functions or improve existing ones.

Synthetic biology can make a positive impact in numerous areas such as agriculture, energy and medicine. One example in medicine is research aimed at being able to synthetically programme bacteria for the production of antibiotics or other valuable biochemical compounds, which opens up possibilities for the production of new drugs to combat diseases. Although the process is synthetic, the end-products would be natural.

However, synthetic biology can also be misused by malevolent actors for the purpose of illicit drug production. They could augment existing drug pipelines as well as create new ones for the production and distribution of harmful drugs. Considering, for example, how fentanyl - a synthetic drug – is out of control now in the United States (US), the authorities need to take appropriate steps to address this potential threat.

Threat from Drug Trade

Criminal elements such as drug syndicates and other organised crime groups could seek to exploit breakthroughs in synthetic biology in order to boost the drug trade with new means of production. Techniques such as DNA editing and DNA synthesis could be used in the production of opiates by processing sugar through genetically-modified yeast. Opiates such as morphine and oxycodone, which are mainly used as pain relief drugs, can cause a user to spiral into dependence and addiction if used improperly. The ease with which such new means of production could be replicated and concealed could work to the advantage of the drug trade.

Drugs created using the capabilities of synthetic biology could be produced and distributed using existing drug pipelines around the world. The first pipeline is the illegal online sale internationally of dangerous synthetic opioids such as fentanyl, which is particularly a problem in the US. Second is the pilfering, improper prescription and unauthorised re-selling of prescription pain medications, which coupled with illegal online sales, contributes to the ongoing opioid epidemic in the West.

A third pipeline, which concerns Southeast Asia, involves the production and distribution of synthetic drugs such as methamphetamines through Myanmar, Laos and Thailand. Drugs from this region, long known as the 'Golden Triangle', are then brought to market in the rest of Southeast Asia and beyond. With the appropriate investment of resources and expertise, these drug pipelines could be adapted to leverage on drugs produced using synthetic biology.

Biohackers: New Threat Dimension?

Another group of actors who could misuse synthetic biology are biohackers from the Do-It-Yourself (DIY) bio-movement. Biohackers largely comprise amateur biologists engaging in experimental activities related to synthetic biology in community- or home-based laboratories. The open-source nature of knowledge and materials in the synthetic biology field enables biohackers to build up their competencies.

The biohacking community is currently deemed to have limited capabilities for malevolent pursuits. However, rapid advances in synthetic biology capabilities, lower costs, and greater knowledge and skills over time may steer certain biohackers to illegally produce drugs for distribution or their own use.

There is also the unwelcome prospect of organised criminal groups recruiting biohackers or subverting their work for illicit purposes. This could lead to the creation of entirely new drug pipelines. Drugs such as yeast-based opiates could be financed by criminal groups, and produced and distributed by biohackers through a decentralised network of underground laboratories. Such drugs could be sold online anonymously and using cryptocurrencies to evade the detection of authorities.

Tackling the Drug Problem

The relevant authorities need to adopt a number of measures to tackle the potential misuse of synthetic biology to produce illicit drugs.

First, they should develop and enforce regulations that prevent deliberate and accidental misuse of synthetic biology research and applications. However, regulations should be balanced so they do not impede research done for legitimate and beneficial purposes. A major challenge for policymakers will be ensuring that regulations keep pace with advances in this fast-growing field. One such area would be the development of new means of drug production using genetically-modified material.

Second, stakeholders from government, industry, academia and the biohacking community could collaborate in inculcating norms related to ethics and conduct to ensure that progress made in synthetic biology is legitimate and beneficial. There is a concomitant need to raise awareness about security risks related to synthetic biology, including the consequences of allowing synthetic biology to be misused for illicit drug production.

Third, drug enforcement should not be overlooked. Strategic plans and operational countermeasures by authorities in law enforcement, intelligence and border security must address the potential threat posed by criminal elements in the drug trade exploiting synthetic biology. This includes potential threats from biohackers, which authorities can keep track of by building a relationship with the biohacker community, most of whom would not have malicious intent, and can serve as a source of intelligence.

To nip this potential drug threat in the bud, it is vital that the emerging field of synthetic biology not be used as an unwitting pathway by malevolent actors in the drug trade. Authorities worldwide need to act in a timely and comprehensive manner before it is too late.

Nandhakumar Gunasekaran is Senior Analyst in the Science and Technology Studies Programme (STSP) in the Office of the Executive Deputy Chairman, S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University, Singapore.

Nanyang Technological University
Block S4, Level B3, 50 Nanyang Avenue, Singapore 639798
Tel: +65 6790 6982 | Fax: +65 6794 0617 | www.rsis.edu.sg