



## How one company is empowering synthetic biology by making high-fidelity DNA at scale



“Gene synthesis is a fundamental building block of synthetic biology. In order for synthetic biology to realize its potential, there has to be a radical change in gene synthesis technology,” says **Evonetix CEO Tim Brears**.

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I remember watching *Star Trek: The Final Frontier* as a kid. My dad loved it and could watch it repeatedly without tiring, and so watching it was more of a forced activity, but I nonetheless enjoyed the otherworldly, futuristic gadgets used by Captain Kirk and the rest of the *USS Enterprise* crew. I never would have thought that some of those fun science fiction imaginations would become reality in my lifetime.

And, I am fortunate enough to see in my lifetime the arrival of yet another new frontier: the next frontier in biological sciences. As little as 40 years ago, the idea of synthesizing whole genes, new genetic pathways — entire genomes, even — was the stuff of science fiction, far into a future I could barely picture. Today, such scientific techniques are not only a reality, but are a cornerstone of **synthetic biology**.

Considering that the structure of DNA was solved a little less than seven decades ago, and that the human genome sequence was finished in 2003 (a process that took 13 years) — perhaps the most significant biological achievement of the 21st century — it is mind-boggling that techniques such as DNA sequencing and genome editing are happening every day in labs across the world. It's already been nearly a decade since **the first synthetic genome** was finished; we are no longer creating these powerful new techniques but are refining and optimizing them so that we can fully benefit from their potential.

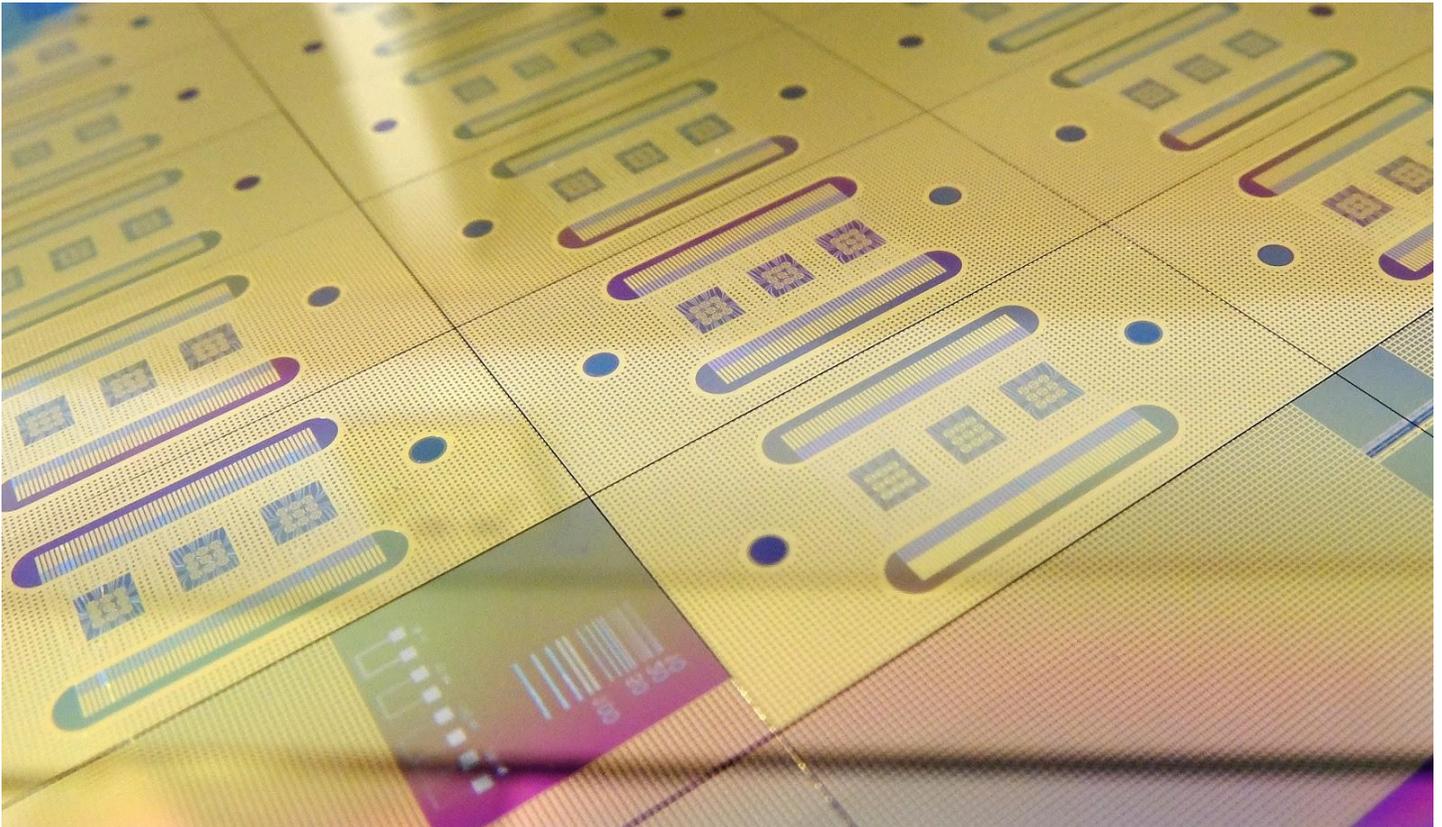
“The huge increase in DNA sequence information available to mankind over the past ten years presents the unprecedented opportunity to engineer metabolic pathways and organisms, improve industrial processes, create new processes, engineer genomes with new and improved traits, and **use DNA as a medium for data storage**,” says **Timothy Brears**, CEO of Cambridge-based DNA synthesis company **Evonetix**.

DNA synthesis is one of the fundamental building blocks of synthetic biology. Without it, we cannot edit genomes to correct disease-associated genes, engineer organisms to produce beneficial proteins for use in healthcare or agriculture, or create new genomes with unimaginable potential. Yet the capability to produce high-fidelity DNA at scale remains out of reach — a critical problem that must be resolved as the synthetic biology industry grows.

## **A new approach to DNA synthesis**

Evonetix is developing **a platform to highly parallelize DNA synthesis**, which would make the process very high throughput. Their technology is based on a novel silicon array that is manufactured with semiconductor microfabrication techniques. The array contains 10,000 miniature reaction sites, each of which can be exquisitely and independently controlled thermally. The ability to control every single reaction, down to single base chemistry, ensures that what comes off the chip is error free.

The error-removal process is also under thermal control, with oligonucleotides selectively annealed in a sequential building process during which errors are removed. It is not enough to produce large amounts of DNA quickly — the DNA must be of utmost quality. Error detection occurs on the same chip as oligonucleotide synthesis and assembly, greatly decreasing time to high-fidelity synthetic DNA.



*Evonetix's silicon array chip. Photo from Evonetix.*

Making DNA at scale and with high fidelity is what differentiates the Evonetix approach. Notably, Evonetix silicon array technology is compatible with both chemical and enzymatic DNA synthesis, and Brears says that the company is developing both approaches.

Brears, who has extensive experience in fundraising and in corporate development in pharma, ag biotech, and food science, joined the Evonetix team as CEO in 2017. To him, the decision was a no-brainer. **Synthetic biology will impact all of the sectors** he's previously worked in — and more. It has the potential to “hugely impact how we manage the Earth's resources, as well as fundamentally changing a number of multi-billion dollar industries including pharmaceuticals, industrial biotech, renewables, agriculture, materials science, and data storage,” he says. “Who wouldn't be interested in that?” He hopes to lead the company to the point of fully developing its game-changing DNA synthesis technology.

### **The most successful teams are interdisciplinary**

The challenge is daunting, but if any team can change the DNA synthesis industry in the fundamental ways that Evonetix hopes to, **it is the Evonetix team**. Physicists, semiconductor experts, electronics and software engineers, chemists, and biologists — all experts in their fields — are working together to make Evonetix's dream a reality. Through his past experiences in pharma, ag biotech, and food science, Brears has seen that the biggest progress toward radical new technologies is made by those companies utilizing inter-disciplinary technology. And that, he says, is Evonetix's “sweet spot.”



*The Evonetix team. Photo from Evonetix.*

## **A benchtop future**

Evonetix is still an early stage company in the optimization phase. **They've already made significant progress** and expect even more in the year to come. But Brears has visions that go beyond 2019. "We expect that our highly parallel device, with minimal infrastructure, will be developed as a bench-top DNA writer which could be supplied to any synthetic biology laboratory," he says. "A gene writer on every lab bench! That would be a great enabler of the synthetic biology revolution!" Perhaps it would also be a sign that we've reached the next frontier in biology, boldly going where no man has gone before.

*The sponsor, DCVC (Data Collective), is an investor in Evonetix.*

*This article was written by Embriette Hyde and posted [here](#) on the 21st September 2018*