Synthetic DNA greatly expanding capability to produce new drugs

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In the May 15, 2014, edition of the journal *Nature*, Floyd Romesberg's chemistry lab at San Diego's Scripps Research Institute published a paper titled "A Semi-Synthetic Organism with an Expanded Genetic Alphabet." Romesberg and his colleagues had created a bacterium incorporating chemical building blocks that, as far as anybody knows, have never been part of any earthly life form.

New drugs are the most obvious story that could be told with the technology. A startup company called Synthorx, created by Romesberg and the venture fund Avalon Ventures, says it has exploited E. coli bacteria containing X and Y to help manufacture a protein, a step the company's president and CEO Court Turner describes as "our baby unicorn."

The technology might also pave the way to new biotech drugs. Nearly all such drugs, proteins like insulin or the blood cell-booster erythropoietin, are made inside a bacterium or other cell. But synthetic DNA could vastly expand what drugs are possible. That is because a normal cell builds proteins from just 20 amino acids, stringing them together into long chains. Exactly which amino acid gets added next is specified by three-letter sequences of DNA, called codons.

Although the math gets complicated, with the addition of the new bases X (chemical name d5SICS) and Y (chemical name dNaM), Romesberg approximately tripled the number of possible codons, and theoretically increased to 172 the number of different amino acids a cell could build a protein from.

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