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Researchers find new recipe for novel proteins

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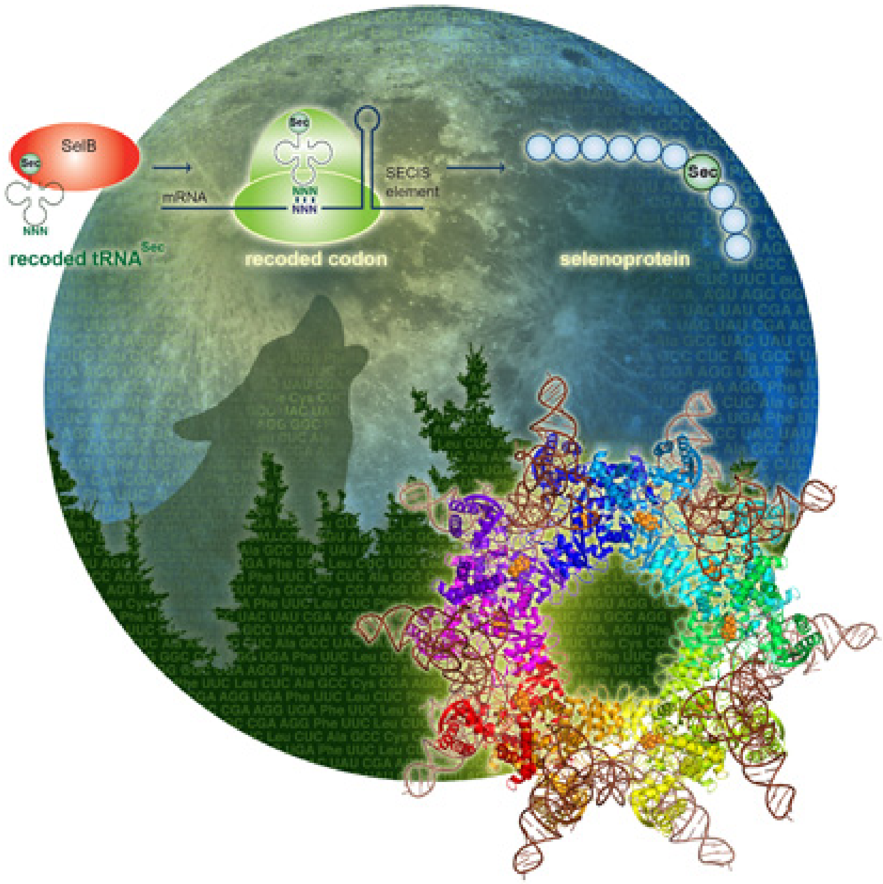

Credit: Patrick Lynch

(Phys.org) —Yale researchers have discovered a targeted way to make proteins not generally found in nature by expanding the information encrypted in the genetic code.

Working with bacteria, the Yale team rewrote most of the genetic instructions that encode all 20 amino acids – the building blocks of any protein - to create a specific, 21st amino acid, researchers report in the January 2014 issue of the journal *Angewandte Chemie*.

The finding adds another method to quest of synthetic biologists goal of expanding life's genetic code to produce novel proteins that do not exist in nature but may be valuable for a wide variety of industrial, medical or pharmaceutical purposes.

"Achieving this would open the doors to a whole new world of designer proteins with novel catalytic and mechanistic properties and possibly even biomedical applications," said Markus Bröcker, postdoctoral associate in molecular biophysics and biochemistry at the Yale School of Medicine and lead author of the paper.

The authors used a decoding system that occurs naturally in the cell to insert the information for the additional amino acid selenocysteine, the 21st amino acid.

Living organisms use 64 different codons – or combinations of three of the four nucleic acids that comprise DNA – as the basis for the 20 amino acids that are found in regular proteins. To test whether they could change this genetic recipe, the Yale team took advantage of the extra molecular decoding step involved only in the insertion of the amino acid selenocysteine into proteins. The researchers succeeded in using this seleoncysteine-specific machinery to alter the meaning of 58 out of 64 codons. As a result, the bacteria specifically inserted seleoncysteine instead of other amino acids into proteins.

The technique is different than one recently described by Yale and

Harvard researchers that involved recoding and engineering throughout the entire genome of bacteria. The goal of the two approaches however is the same – to create novel forms of proteins that can speed up chemical reactions, create stronger or more flexible materials, even create more potent antibodies or improve nutritional value of food.

"Both recent studies highlight the relevance genetic recoding nowadays has as a foundation for engineering of novel proteins," said Dieter Söll, Sterling Professor for Biochemistry and Chemistry and senior author of the paper.

Provided by Yale University

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