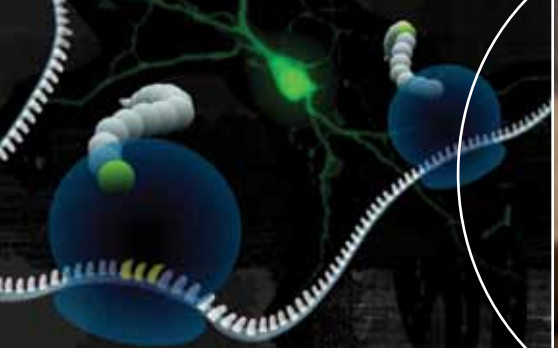

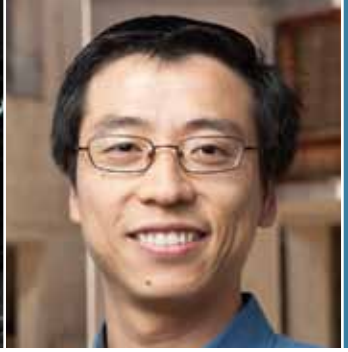

Lei Wang

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"The genetic code, which is shared by plants, animals, and bacteria, includes 64 codons encoding 20 different amino acids and three stop signals. We are trying to expand the code and insert artificial amino acids into proteins in mammalian cells and multicellular organisms, which provides novel tools to address challenging questions that are insurmountable with conventional means. Currently, we are also studying the evolution of the genetic code."

Cells provide a dazzling variety of functions that cover all of our body's needs, yet they make do with a very limited number of molecular building blocks. With few exceptions, all known forms of life use the same common 20 amino acids—and only those 20—to make all the proteins necessary to keep organisms as diverse as humans, earthworms, tiny daisies, and giant sequoias alive. During protein synthesis, amino acids are brought out one by one by molecules known as transfer RNAs (tRNA) and added to the growing protein chain according to the instructions spelled out in the body's genes until a stop codon—for which no corresponding tRNA/ amino acid pair exists—lets everybody know that this particular job is done.

Each of the 20 amino acids is matched to specific transfer RNAs and by extension to nucleotide triplets in genes and messenger RNAs according to what has become known as the universal genetic code. Although different algorithms, or codes, were undoubtedly tested during a long period of chemical evolution, the modern code proved so robust that, once established, it gave birth to the entire tree of life. But how individual amino acids were assigned to specific three-letter codons during the evolution of the genetic code is still subject to speculation. Although different hypotheses abound, data were hard to come by.

When Wang and his team probed the genetic code in bacteria, they found evidence that direct interactions between amino acids and nucleotide triplet codons (or the matching anti-codons carried by tRNAs, which "read" messenger RNAs) helped establish matching pairs. After only two waves of "matching," all 20 amino acids were firmly assigned, setting the stage for the emergence of proteins with unique, defined sequences and unchanging properties. Once that critical step had been taken, the last common ancestor was ready to give rise, over billions of years, to the wonders of a planet teeming with life.

For more information, please visit
salk.edu/faculty/wang.html

Left to right:

Standing: James Gregory, Bin Shen, Zheng Xiang, Sam Ulin, Irene Coin, Jeff Takimoto, June Brennan, David Johnson

Seated: Xingyu She, Ji-Yong Kang, Lei Wang, Angela Parrish, Vanessa Lacey