Unselfish molecules may have helped give birth to the genetic material of life (w/ Video)

March 8 2010

One of the biggest questions facing scientists today is how life began. How did non-living molecules come together in that primordial ooze to form the polymers of life? Scientists at the Georgia Institute of Technology have discovered that small molecules could have acted as "molecular midwives" in helping the building blocks of life's genetic material form long chains and may have assisted in selecting the base pairs of the DNA double helix. The research appears in the online early edition of the *Proceedings of the National Academy of Sciences* beginning March 8, 2010.

"Our hypothesis is that before there were protein enzymes to make DNA and RNA, there were small molecules present on the pre-biotic Earth that helped make these polymers by promoting molecular self-assembly," said Nicholas V. Hud, professor in the School of Chemistry and Biochemistry at the Georgia Institute of Technology. "We've found that the molecule ethidium can assist short oligonucleotides in forming long polymers and can also select the structure of the base pairs that hold together two strands of DNA."

One of the biggest problems in getting a polymer to form is that, as it grows, its two ends often react with each other instead of forming longer chains. The problem is known as strand cyclization, but Hud and his team discovered that using a molecule that binds between neighboring base pairs of DNA, known as an intercalator, can bring short pieces of DNA and RNA together in a manner that helps them create much longer molecules.

"If you have the intercalator present, you can get polymers. With no intercalator, it doesn't work, it's that simple," said Hud.

Hud and his team also tested how much influence a midwife molecule might have had on creating DNA's Watson-Crick base pairs (A pairs with T, and G pairs with C). They found that the midwife used could determine the base pairing structure of the polymers that formed. Ethidium was most helpful for forming polymers with Watson-Crick base pairs. Another molecule that they call aza3 made polymers in which each A base is paired with another A.

"In our experiment, we found that the midwife molecules present had a direct effect on the kind of base pairs that formed. We're not saying that ethidium was the original midwife, but we've shown that the principle of a small molecule working as a midwife is sound. In our lab, we're now searching for the identity of a molecule that could have helped make the first genetic polymers, a sort of 'unselfish' molecule that was not part of the first genetic polymers, but was critical to their formation," said Hud.

Provided by Georgia Institute of Technology

Citation: Unselfish molecules may have helped give birth to the genetic material of life (w/ Video) (2010, March 8) retrieved 20 April 2024 from https://phys.org/news/2010-03-unselfish-molecules-birth-genetic-material.html