SECOND DRAFT

1977, scientists collecting samples of water near Leningrad made a startling discovery. A virus, cyanophage S-2L, isolated from these samples carried a surprising property within its DNA. DNA is an essential molecule for life, and its complexities are insights into our past and future. Standardly, DNA is composed of four nucleotides, each having a different base: adenine (A), thymine (T), guanine (G), and cytosine (C). However, cyanophage S-2L had all cases of A substituted with 2-aminoadenine, or Z. The bases within DNA form A:T and G:C pairs and is how two single strands of DNA recognize another and form hydrogen bonds between them, producing a double helix. A:T form two hydrogen bonds, while G:C contains three bonds between them. In this virus, G:C still maintains three bonds. However, Z pairs up with T and also forms three bonds, contributing to the virus's increased stability and rigidity. This virus can utilize such properties for survival. Being a virus in the middle of the ocean is already hard enough. Viruses are small and encounter water molecules of similar size, making their journey difficult. Viruses also cannot swim. A virus must have "luck" and be close enough to its host to infect and replicate. However, luck can only take a virus so far. Viruses are exposed to many external factors hindering their journey, one of them being ocean waters and the sun's major one. Outside, we face much exposure to much UV radiation. However, due to this virus being more stable, it could withstand degradation of its hydrogen bonds caused by exposure to sunlight, which is a plus because how can you replicate if you are degraded? So, the virus reaches its host, now what happens? Instead of wiping out host DNA, then using its host to replicate, the virus instead uses host genes during the infection process. In cyanophage S-2L, the host uses two major proteins for Z-synthesis, PurZ, the viral protein, and PurB, the host's protein. By using the host's genes, this virus is more likely to avoid nucleases, which are housekeeping proteins, which can potentially go and snip out non-host DNA (for more info, refer to figure on paper). Because of these properties, scientists hope to include them in conversations surrounding gene therapies and improving drug delivery. However, scientists have yet to deduce whether the virus is compatible with current DNA machinery. Interestingly Z-DNA may not be a new thing! A 2011 analysis of a 1969 carbonaceous (carbon-containing) meteorite revealed standard and nonstandard DNA structures, including the Z base, likely from prebiotic origins, indicating that Z could play a role in early forms of life. Because of the lack of research surrounding Z-DNA, scientists hope to fuel interests to identify ways to integrate this fascinating discovery.

Characters:

* A virus has Z bases instead of A bases, expanding our genetic alphabet!
* This virus has increased thermal and physical stability and other added pluses that help in replication!
* This virus uses host genes upon infection!
* Meteorite analyses have identified Z-genomes along with standard DNA!

ORIGINAL DRAFT

DNA is an essential molecule for life, with its complexities being insights for newfound understandings of the world we live in. It is common knowledge that DNA is composed of four nucleotides, with each one having a different base: adenine, thymine, guanine, and cytosine. However, DNA virus cyanophage S-2L expanded our knowledge of DNA, as all cases of A were substituted with 2-aminoadenine, or Z. Interestingly, the standard compliments (A:T and G:C) still stand, except Z:T replaces A:T. The Z:T compliment also has three hydrogen bonds (compared to the two that A:T has), contributing to dZ-DNA carrying higher stability at higher temperatures than DNA and increased rigidity. dZ-DNA is also more resistant against nuclease activity and maintains a higher binding accuracy than DNA. These characteristics make dZ-DNA a great candidate for advancing gene therapies and drug delivery, though it is uncertain whether dZ-DNA can adapt to our complex cellular system. Much has yet to be elucidated about Z-synthesis. Still, scientists have identified that two proteins, PurZ and PurB, and Z-specific polymerase, DpoZ, which can discriminate between bases A and Z and exclude A, are crucial for Z synthesis. Interestingly, Z-genomes are thought to have co-evolved with DNA, with a 1969 composite meteorite analysis revealing the existence of standard and nonstandard DNA, including the Z base, stemming most likely from prebiotic origins. Because of the lack of research surrounding dZ-DNA, scientists hope to fuel interests to identify ways to integrate this fascinating discovery.