# **Directions: Work with a partner to read the background information, complete the online interactive and to answer the discussion questions.**

**Background Essay**

The function of DNA in the living world is at once bafflingly complex and surprisingly simple. The genetic code carried in molecules of DNA is responsible for a stunning variety of life forms. Orchids in the Amazon, tubeworms on the ocean floor, and giraffes on the Serengeti have all arisen, and survive and thrive in their respective environments, because of the function of DNA.

Inside every living cell, DNA directs vital activities, such as growth, division, movement, respiration, and even death, by providing the instructions that cells use to build proteins. DNA gives rise to the physical and behavioral adaptations that make organisms unique. And yet, the chemical language in which DNA's instructions are written is stunningly simple. It consists of just four letters, which correspond to the four functional molecules, called nucleotides, from which DNA is built: adenine (A), thymine (T), cytosine (C), and guanine (G). Particular sequences of these four molecules function as genes by providing the instructions required to build one or more proteins.

The DNA molecule resembles a twisted ladder, with pairs of nucleotides forming the ladder's rungs. As a rule, adenine always pairs with thymine and cytosine with guanine. When a cell requires a particular protein, an activation signal stimulates the release of an enzyme called RNA polymerase, which causes the DNA to "unzip" between nucleotide pairs in the region of the appropriate gene. As the RNA polymerase molecule moves along one of the unzipped DNA strands, it assembles a similar nucleic acid molecule, known as messenger RNA (mRNA), using free nucleotides found inside the nucleus. The mRNA molecule is a mirror image of the DNA strand that is being read, except that the nucleotide uracil (U) is substituted for thymine. This is called transcription. After this process is complete, the mRNA is transported outside the nucleus to the cytoplasm, where it can be translated into a protein.

Structures found in the cytoplasm, called ribosomes, perform the process of translation, in which amino acid chains, or proteins, are assembled based on mRNA code. Ribosomes read mRNA nucleotides three at a time. Each mRNA triplet, called a codon, corresponds to a particular amino acid or provides the signal that tells the ribosome to begin or stop translation. As it reads the mRNA codons, the ribosome attaches amino acids to each other in a chain that corresponds to those codons. When the ribosome reaches a "stop codon," translation ceases and the ribosome releases the finished protein.

[**ONLINE INTERACTIVE LINK**](https://contrib.pbslearningmedia.org/WGBH/conv20/lsps07-int-celltrans/index.html)

**Discussion questions: please answer using complete sentences**

* How does DNA direct protein synthesis from inside the nucleus?
* How does the RNA polymerase know which genes to bind to?
* Describe the relationship between the sequence of the mRNA molecule and the amino acid sequence of the resulting protein.
* What is the relationship between DNA and RNA?
* What do you think the advantage is of containing DNA inside a nuclear membrane?