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The Central Dogma of Biology

The discovery of DNA in the 1950s had sweeping implications for the field of biology (NIH, “The Discovery”). As a result, Francis Crick, one of the people who discovered DNA, suggested that the key processes associated with DNA and RNA should be referred to as the central dogma (“What is the 'Central Dogma'?”). The processes of the central dogma are replication, transcription, and translation (“What is the 'Central Dogma'?”). Replication refers to DNA being duplicated, which occurs before cells divide (“What is the 'Central Dogma'?”). Next, transcription refers to mRNA (messenger RNA) being created from DNA (“What is the 'Central Dogma'?”). Finally, translation refers to mRNA being read and translated into proteins (“What is the 'Central Dogma'?”). Each of these processes is complex and involves multiple components and steps.

When a cell is ready to divide, replication begins with the strands of DNA unraveling (Cooper). The area where the strands unravel is known as a replication fork, and this is where DNA synthesis begins (Cooper). An enzyme known as a DNA polymerase is used to join the subunits, known as nucleotides, that help make up DNA (Cooper). Since DNA can only be synthesized in one direction, the 5’ to 3’ direction, the DNA of one strand is synthesized in fragments known as Okazaki fragments (Cooper). An enzyme known as a DNA ligase is used to join these fragments together into one continuous strand (Cooper). Next, DNA polymerase helps proofread the DNA strand for errors, making the process of DNA replication highly accurate

(Cooper). Once all the DNA has been replicated, the chromosomes separate, and the cell divides into two cells (“What is the 'Central Dogma'?”).

Another important process in cells is transcription. Like replication, transcription begins with the DNA strands unraveling (Cooper). An RNA polymerase is responsible for joining mRNA (messenger RNA) nucleotides that are matched with corresponding DNA nucleotides on the strand of the target gene (Cooper). Each target gene contains the code for a specific protein needed by the organism (Cooper). The transcription begins when RNA polymerase binds to the promoter region of the target gene (Cooper). Transcription continues until the RNA polymerase reaches a termination sequence (Cooper). After transcription is complete, the mRNA transcript is released, and it is ready for the next step, translation (Cooper).

Translation occurs in cellular organelles known as ribosomes (Cooper). Translation is the process of the ribosome “reading” the mRNA transcript and translating it into a protein the organism can use (Cooper). In order to achieve this, tRNA (transfer RNA) matches up with the mRNA transcript (Cooper). Each tRNA carries a subunit known as an amino acid (Cooper). Together, the sequence of amino acids formed through translation makes up a protein (NIH, “Structural Biology”). After the protein is released from the ribosome, it can serve a variety of functions for the organism. Some functions of proteins include being an oxygen carrier in the bloodstream, creating the structure of hair and fingernails, and being a component in muscles (NIH, “Structural Biology”).

In conclusion, the central dogma is composed of three processes that are essential both to human life and the study of biology. Replication, transcription, and translation are more than just terms in a textbook; they enable scientists to understand, research, and treat genetic diseases. Knowledge of the central dogma has ultimately led to exciting advancements in the medical

field, such as the use of gene therapy. Thanks to the central dogma, diseases like cystic fibrosis, Parkinson's disease, and even some cancers could one day be cured through gene therapy (“What is gene therapy?”). As the future of the biology field, biology students should strive to understand the central dogma so that one day they can be part of these scientific achievements.

Works Cited

Cooper, Geoffrey. *The Cell*. 2nd ed. E-book, 2000.

National Institutes of Health (NIH). "The Discovery of the Double Helix, 1951-1953", https://profiles.nlm.nih.gov/spotlight/sc/feature/doublehelix. Accessed 21 Feb. 2021.

National Institutes of Health (NIH). "Structural Biology", https://www.nigms.nih.gov/education/fact-sheets/Pages/structural-biology.aspx. Accessed 21 Feb. 2021.

"What is gene therapy?", *Your Genome*, 21 July 2021, https://www.yourgenome.org/facts/what-is-gene-therapy.

"What is the 'Central Dogma'?", *Your Genome*, 21 July 2021, https://www.yourgenome.org/facts/what-is-the-central-dogma.