Our 2nd Annual STEM Writing Contest

CRISPR: The Future of Cancer Research and Treatment

In 1953, American molecular biologist, James Watson, pioneered double helix deoxyribonucleic acid (DNA) that is known to many of us today as the fundamental of studies in genetics and biotech. This breakthrough discovery later became the backbone of innovative research and cutting-edge technology in the field of genetic engineering. New genetic engineering techniques emerged in the 21st century, based on technology known as CRISPR-Cas9, which allowed for the customization of genetic sequences in living organisms by changing DNA; this innovation amazed the scientific world so much that biochemical pioneers Jennifer Doudna and Emmanuelle Charpentier took home the 2020 Nobel Prize in chemistry.

Genetic engineering has transformed practical and theoretical aspects of gene function and organization. CRISPR, like many other advancements in the field of science and medicine, was inspired by nature. The process is similar to a simple defense mechanism found in some microbes.

Specifically, CRISPR has the ability to alter the DNA of human cells, cutting and rearranging genes, like a very precise and easy-to-use pair of scissors. This new gene editing tool has shifted the line between possible and impossible. “CRISPR is becoming a mainstream methodology used in many cancer biology studies because of the convenience of the technique,” said Jerry Li, M.D., Ph.D., of NCI’s Division of Cancer Biology. Interest in CRISPR has allowed researchers to utilize a multitude of guide RNAs to manipulate and evaluate thousands of genes at a time to pick and find drug targets.

CRISPR stands for “clustered regularly interspaced short palindromic repeats.” Scientists begin with RNA, which is a molecule that can read genetic information in the DNA. Then, the RNA finds an area in the nucleus (compartment in a cell where genetic material is stored) of a cell that requires editing activity. The RNA guides Cas9 to the exact spot where Cas9 locks on to the double-stranded DNA and snips at that spot, creating a break in both strands of the DNA molecules. Through this “snipping” process, scientists are able to make gene mutations to understand genetic diseases and even disable certain genes that play a role in inherited diseases.

Of course, the scientific community must proceed cautiously, because like all newly discovered innovations, CRISPR still has strengths and pitfalls to be discovered. Debates regarding best practices and the ethical concerns of gene editing in humans still persist.

Nevertheless, CRISPR has far-reaching implications in the cancer research and treatment area. Trials on patients to test a CRISPR-made cancer therapy removed certain genes and has

suggested that the treatment is safe and effective. “This [trial] was really a proof-of-principle, feasibility, and safety thing that now opens up the whole world of CRISPR editing and other techniques of [gene] editing to hopefully make the next generation of therapies,” Edward Stadtmauer, M.D., of the University of Pennsylvania said.

This revolutionary discovery may just be the beginning of a new method in transforming the future of cancer treatment.

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