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Antisense technology in cancer therapy

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According to the National Cancer Institute (NCI), the statistics show that cancer is still one of the most severe diseases, leading to death all around the world. The World Health Organisation (WHO) reported around 10 million cancer-related deaths in 2020. NCI also predicts that by the end of 2040, the number of deaths caused by cancer will be nearly 16.4 million. Therefore, researchers are striving to develop new approaches to the treatment of cancer.   Antisense technology became one of the many promising therapies since it can be used to treat viral infections, neurological diseases and cancer. This technology has constantly been evolving to increase life expectancy with every passing year. Antisense technology is a way of moderating gene expression in cells. It uses antisense oligonucleotides for targeting genes that induce the development of severe diseases at the messenger RNA (mRNA) level before they are translated into proteins. Antisense oligonucleotides can be described as short, synthetic and single-stranded nucleotides that can prevent the transcription of targeted genes once they bind to their complementary mRNA and form a dimer. This binding of antisense oligonucleotides to the mRNAs leads to the inhibition of transportation, splicing and translation processes of RNA.   It is common knowledge that cancer is caused by the mutations of proto-oncogenes that are responsible for the regular occurrence of cell division. However, once the proto-oncogenes are mutated, they become oncogenes that produce proteins at higher levels. This increases cell division while decreasing and ceasing cell differentiation and apoptosis. This leads to the formation of cancerous cells in the body. Antisense technology targets oncogenes and prevents their transcription to treat cancer. There are several antisense therapeutics developed for cancer therapy; for example, a therapeutic drug called Genasense (oblimersen sodium) targets B-cell lymphoma-2 (Bcl-2), which is an essential indicator of cancerous cells. The overexpression of Bcl-2 by the cancerous cells allows them to resist anticancer therapeutics that normally cause immediate apoptosis of the cancerous cells. The clinical trials conducted with Genasense showed that Bcl-2 antisense oligonucleotides successfully targeted the mRNA that is responsible for the translation of Bcl-2, therefore inhibiting the expression of Bcl-2 by the cancerous cells. Other antisense therapeutics targeting cancerous cell indicators include Affinitak which targets protein kinase C-alpha, OGX-011 which targets clusterin, etc. Overall, antisense technology is quite a promising approach for cancer therapy as there are successful clinical trials that support the usage of antisense oligonucleotides for the treatment of cancer.

Keywords: Antisense technology, Oligonucleotides, Cancer, Proto-oncogenes, Therapeutics, B-cell lymphoma-2

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