Antisense Cancer Therapy: Do Antisense Oligonucleotides Hold Promise as a Cure for Cancer?

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Cancer is a dreadful disease causing a major percentage of deaths all over the world. Cancer is the second leading cause of death in the United States, trailing cardiovascular disease. According to National Cancer Institute statistics, over half a million deaths and a million and half new cases are predicted in the year 2017 [1]. The human body is composed of trillions of cells, and they perform specific functions with the aid of proteins. Genes impact the production of these proteins, and an error contained in these genes can yield aberrant versions of these proteins. In some cases, this can result in cancer. A newly diagnosed patient is often concerned for the following reasons: 1) they are afraid of cancer treatments being costly, 2) cancer survival rates are sometimes low and chances of recurrence of some cancers are high, and 3) the false paradigm that cancer is incurable.

Until modern times, cancer diagnosis and treatment exhibited very low success rates. Over the centuries, our understanding of cancer improved and new strategies for combating cancer were created. Certain types of cancers are fully treatable and others could be prevented if diagnosed at the early stage. Despite tremendous efforts by researchers, fighting cancer is very challenging because there is an enormous similarity between diseased cells and healthy cells. Detection is the first step to defeat cancer. Fortunately, modern advancements in medicine provide ways to perform early stage diagnosis of cancer. For example, imaging tests, mammography, cytology, biopsy, and Pap smears [2]. The importance of early diagnosis of cancer relies in the virtue of cancer. Unlike other diseases, cancer invades its surrounding environment and spreads to other parts of the body. This is known as metastasis, which compounds the difficulty in treatment. Several techniques (invasive & non-invasive) are used to image cancer, but commonly used techniques are MRI and PET scan, but these techniques are expensive and not ideal for routine checkups. Relentless efforts in biomedical research have improved the effectiveness of non-invasive imaging techniques and made them cost effective. Several groups have been working on fluorescence imaging techniques in biomedical sciences to design effective and cheap strategies to image cancer. Innus Mohammad and co-workers developed a strategy to image hypoxic regions in tumor cells utilizing Indocyanine Green bis-acid [3]. Several other groups are working in this area to improve the effectiveness of non-invasive detection of cancer at early stage [4-7]. After the detection, doctors suggest the appropriate treatment procedures to patients. The most common treatments for cancer are a) surgery, b) chemotherapy, c) radiation therapy, and d) targeted therapy.

Surgery is frequently used to diagnose and treat breast cancer, but surgical treatments have side effects such as pain, infection, loss of organ function, bleeding, and blood clots. Some tumors are difficult to access during the surgery and can’t be removed completely. The remaining tumorous tissue has a greater risk of tumor regrowth. As an alternative to surgery, chemotherapy drugs are developed based on the idea of targeting cell division of rapidly growing cells. Unfortunately, there are other cells that grow rapidly in our body including: hair, gastrointestinal epithelia and bone marrow. As a result, patients undergoing chemotherapy experience hair loss and gastrointestinal problems. In radiation therapy, tumors are exposed to high energy radiation to kill cancer cells. Although the current advanced techniques
antisense therapeutic research [9-22]. Currently, over a hundred oligonucleotides are in clinical trials from 30 different pharmaceutical companies [23]. The resurgence of antisense therapy looks promising, with key players in the field are anticipating drugs to hit the market very soon.

Along with working towards better strategies to defeat cancer, I believe that informational sessions for cancer patients to create hope is also very important. As mentioned earlier, creating awareness about the modern advancements in the medical field and the availability of new classes of treatments helps to allay patients' fear. There is a war quote by Sun Tzu: "Victorious warriors win first and then go to war, while defeated warriors go to war first and then seek to win." Helping a patient understand their options and how treatment is often successful can improve patient outlook and tolerance of treatments.

References