

Mscs: making science change

Business



One hundred years ago, the idea of brain surgery was certainly still a novel one and when the first brain surgeon in the United States, William Williams Keen, began his work he faced opposition and received little approval for his ideas and methods.

Nonetheless, he set the stage for many advancements to come, particularly in the area of neurology and neurosurgery. With modern technology, current approaches to dealing with brain tumors typically include invasive surgeries, chemotherapy, radiation, and other such treatments that are now readily available. In recent years, studies surrounding the idea of noninvasive neurosurgery have formed. Specifically, noninvasive neurosurgery uses the technology of Magnetic Resonance Image Guided Focused Ultrasound Surgery (MRgFUS) to directly ablate tumors with focused ultrasound waves and beams. Today however, scientists at the Johns Hopkins Cancer Research Building have discovered a new form of destroying brain tumors.

Though still in the initial phases of research, individuals at Hopkins have stumbled upon something science has never seen before. Currently, in the Department of Neurosurgery, scientists are using mesenchymal stem cells also known as MSCs, cells isolated from human bone marrow, to determine their impact on tumors in mice. Though “ many studies have reported contradicting results, with some investigators finding that MSCs promise tumor growth and others reporting that MSC inhibit tumor growth” (Klopp), researchers are aware of the attraction that MSCs have toward cancerous cells and hope to figure out what this means. As of now, researchers at Hopkins are solely focusing on studying the effects of MSCs on brain tumors. In what is called The Method Project researchers “ are trying to figure out the <https://assignbuster.com/mscs-making-science-change/>

best injection method for MSCs to reach brain tumors” (Wijesekera). The MSCs are being injected through the heart, the tail-vein, the nose, as well as the sub arachnoid, an area at the base of the head near the neck.

A second project related to the Method Project at Hopkins is called the Resection project in which researchers “ are seeing if how much we resect the brain tumor has an effect on the pain level/neurological status/survival of the mouse” (Wijesekera). Within the Method Project, researchers at Hopkins have found that MSCs have a tendency to naturally migrate towards cancerous tumors unlike other stem cells. It is believed that the reason this migration occurs might be because of the fact that the “ stemness would be a hallmark or a phenotype of cancer, probably linked to dedifferentiation, characterization in a cancer” (Antoniou). Once mice are injected with MSCs at different spots throughout their body, they are observed for a number of days until their inevitable death. Later on, once they die due to the cancer growing within them, their organs are harvested, sectioned, and mounted onto slides for further observation.

From there, researchers will be able to tell which injection site allows for the most quantifiable number of MSCs to reach the cancer tissues in the brain of the mice as opposed to not making it there or becoming trapped in what are called filter organs, such as the liver or kidneys. Eventually, MSCs can be tailored in way that allows them to secret different molecules such as chemotherapy molecules or small signaling molecules that will tell the tumor cells to die. And if all is successful with this research, it will eventually be applied to humans and patients in hospitals. One question that arises is where to extract the MSCs from in the body. Seeing that: “ MSCs have been <https://assignbuster.com/mscs-making-science-change/>

isolated from many types of adult and fetal tissues, using [certain] methodologies.

Bone marrow and adipose tissues are rich sources of MSCs. MSCs have also been isolated from many other adult tissues including kidney, skin and the parathyroid gland. MSCs for MSC-like cells have also been isolated from fetal tissues including the skin, umbilical cord, and placenta. These tissue-derived MSCs share a number of important characteristics with bone marrow-derived MSCs including cell surface marker expression, plastic adherence, and the capacity to differentiate into cells of mesenchymal lineage (i. e. fat, bone, muscle, and cartilage) under appropriate conditions” (Klopp).

Once the best possible derivation of MSCs is determined, the research projects will further be able to specialize certain types of MSCs for specific treatments. In conclusion, rather than performing brain surgery, administering chemotherapy, treating with radiation or MRgFUS, physicians will now have the capability to inject stem cells into patients. If a tumor is unable to be operated on because it is wrapped around vital areas of the brain or for some other reason, surgeons will be able to inject stem cells that will noninvasively terminate the cancer cells, doing the job for them. While the majority of the Method Project is still in the preliminary phases of research, some data collection is beginning to happen. As of now, researchers are in the process of taking cell samples from the mice and counting the number of cells before and after mesenchymal stem cell treatments and or injections are given to mice with induced brain tumors, including glioblastomas, one of the most invasive and relentless forms of brain cancer. Multiple other projects in the lab are taking place that are also <https://assignbuster.com/mscs-making-science-change/>

experimenting with stem cells and in particular mesenchymal stem cells (MSCs).

And in other labs the use of MSCs to work with pancreatic cancers is becoming increasingly popular. While, there is still a great deal of research that needs to be conducted before MSCs even come close to making it out of the lab and into the operating rooms and hospitals to treat patients and eventually present as a legitimate cure for cancer. Generally speaking: Malignant tumor cells live within a complex microenvironment better known as tumor 'stroma'. Some of the complex building blocks found in solid tumors are the supporting cells that include the following: fibroblasts, endothelium, pericytes, lymphatics, and a mononuclear infiltrate. These stromal elements have a critical role in tumor survival, structural support, and vascularization. Thus, any therapy targeting both the stromal components and the malignant cells could lead to an efficient anticancer therapeutic approach.

Next, we will take a closer look at the properties that MSCs possess that could make them an ideal anticancer agent (Moniri). In years past similar projects have occurred, even though the benefits of MSCs are just recently being discovered. While “ the use of stem cells in treating cancer has been controversial, with some studies finding that stem cells force tumors to enter programmed cell death. However other studies find that stem cells actually promote tumor growth by inducing infiltration of new blood vessels” (BioMed). In one particular study researchers “ found that MSC altered vasculature inside the tumor — although new blood vessels were generated, overall they were longer and fewer than in untreated tumors.

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This could be restricting the oxygen and nutrients to the tumor, limiting cell division. Our study confirms others which propose that stem cells, in particular MSC, might be one way forwards in treating cancer” (BioMed).

While it is still uncertain as to whether or not MSCs actually promote tumor growth or inhibit it, “ many mechanisms have been reported to account for these observations, such as chemokine signaling, modulation of apoptosis [cell death], vascular support, and immune modulation” (Klopp).

Furthermore, while MSCs are being used to experiment with many different forms of cancer it has been found in some research projects that “ for both the subcutaneous and lung tumors, injection of MSC reduced cell division, consequently slowing the rate of tumor growth. Part of the mode of action of stem cells therefore appears to be due to with angiogenesis, but the mechanism behind this is still unclear” (BioMed).

From mesenchymal stem cells to noninvasive neurosurgery, science clearly has a lot to offer our world in terms of medicine and research. Though these topics only concern a small aspect of life, they can be applied to large-scale issues as well. With time, effort, and concentration scientists and students alike can come together to revolutionize the face of medicine in ways we never thought possible. Eventually, innovations and nuances explored in the United States will be applied to other countries, and the world will work together to explore our surroundings. For now however, involved and intricate research must be further explored to develop these ideas and finalize the methods and cures around us. Works Cited Antoniou, Aline, et al.

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