Microreviews in Cell and Molecular Biology 2012

New Breakthroughs Involving Oligodendrocytes and Stems Cells, and Their Impact on Multiple Sclerosis

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Key Words:
Stem Cells, Oligodendrocytes, Multiple Sclerosis

Multiple sclerosis is an autoimmune disease that involves the demyelination of nerves in the Central Nervous System (CNS). Myelin is produced by cells known as oligodendrocytes (2). These oligodendrocytes provide insulation along the axons in the Central Nervous Center and allow signals to travel quickly and efficiently. When the production of these special cells ceases, interruption in nervous system communication can occur. This is the case with multiple sclerosis (MS). Studies have been conducted trying solve this problem by transplanting oligodendrocytes into mice to increase myelin production, with promising results(3). Recently, advances have been made in stem cell research that looks hopeful. These studies have indicated that stem cells have the unique ability to 'morph' into other types of cells. Many hope that stem cells may be utilized to produce healthy oligodendrocytes in MS patients that produce faulty cells, but this research is still in its infancy (1). Experiments involving the use of stem cells to create oligodendrocyte progenitor cells (OPCs) have produced lack luster results. If OPCs could be successfully created, this would effectively serve as a treatment for MS. Currently, stem cells cannot match normal production rates or cannot create complete OPCs. These are some of the hurdles that science is currently trying to overcome. This research is not only important to the treatment of multiple sclerosis, but to the entire medical community as a whole. If stem cell research can be fully explored, stem cells may be the next big medical breakthrough

Introduction

Myelin is a crucial component of the CNS, and allows nervous signals to travel at incredible speed. If this covering of myelin is damaged or the production of myelin stops, the travel of nervous signals may slow or even cease all together. This can result in pain or loss of feeling in individuals that suffer from any demyelinating related illnesses. For these reasons, myelin and the cells that produce myelin are currently the subjects of numerous scientific studies. The cells responsible for producing myelin are known as oligodendrocytes, but the cells that many scientists are interested in are oligodendrocyte progenitor cells (OPCs) (2,1). OPCs are the cells that produce the oligodendrocytes. Many believe that faulty OPCs are the main cause of multiple sclerosis. When the OPCs that produce oligodendrocytes are flawed, the oligodendrocytes that they produce are flawed as well. Finding a way to fix this problem has been the driving force behind MS research. Some studies have been conducted aiming to determine how to transplant healthy precursor cells into an individual suffering from a demyelinating illness such as MS (3). These scientists quickly found that transplantation of cells runs the risk of rejection, so they began to search for other ways to repair or replace faulty OPCs. Once the potential of stem cell research was realized, many believed that stem cells could provide a way to create healthy OPCs and oligodendrocytes. Experiments were then conducted to determine if healthy OPCs could be efficiently created from stem cells (1). If this could be done, many of the diseases involving issues with myelin production would have a legitimate treatment or even a possible cure. In order for stem cells to be a viable option, they would have to be able to do more than just become OPCs. This process would have to be just as quick as the normal human body, and the OPCs produced would need to be complete and functional. This is where studies begin to experience complications. The production of these new OPCs was much slower than normal and the OPCs

created were not fully functional (1). If stem cells are the answer to MS, much more research is needed.

Recent Progress

Progress has been made in both OPC and stem cell research in recent years. One study found evidence there is an optimal amount of OPCs that can be successfully transplanted into mice and produce marked improvement. In this study, mice that had been hypomyelinated (had no way of producing myelin) received OPC transplants. If the transplants were accepted, the researches recorded remarkably efficient myelination of the axons in the CNS (3). This occurrence started in the brain and spinal cord, then worked its way throughout the entire CNS. This was a phenomenon that had never been observed before. This new research is very encouraging to the medical field because many of the myelin related illnesses involve the ability to produce myelin, just not at the required rate. This is when myelin transplantation would be a very useful treatment option. However, for some patients the amount of production provided by transplanted OPCs would not be enough to counter act the rate of demyelination. This is when stem cell research begins to look like a possible option. Stem cells have been the subject of much debate in the past, but progress has still been made. Multiple studies have been conducted in the hopes of discovering more information about stem cells and how they work. In one study, stem cells demonstrated that they could be made into OPCs. However, these cells could not be produced fast enough and the cells produced were not even as functional as a normal OPCs (1). Later studies focused on solving this dilemma. One study found that with a little guidance through defined transitions the quality of cells that were produced greatly increased. The OPCs created by this guidance method began producing functional oligodendrocytes that were able to produce myelin correctly and efficiently(3). This was a huge breakthrough that provided evidence indicating it was possible that stem cells could be used to replace dysfunctional cells. These findings prompted more research, but with motoneuron progenitors instead of oligodendrocyte progenitors. Stem cell research is not just important to multiple sclerosis. MS is just one specific example of how stem cells may be used to solve medical problems. The applications stem cells could have in medicine are far more numerous than just illnesses involving myelin production issues.

Discussion

Research into oligodendrocytes and stem cells gives medicine hope that one day there may be methods to treat autoimmune disease, like multiple sclerosis, much more successfully than currently possible. However there are still many aspects that we do not fully understand, which leave us with numerous questions. One study mentioned the ethics involved with stem cells (3). Currently, most of the stem cells that scientists use come from aborted fetuses. This can be a touchy subject that sparks much debate. Physicians continue to learn new things about multiple sclerosis, and it is clear there is still much we do not understand. The cause of the disease is still under investigation. Some believe that certain conditions trigger MS, but this is still unclear. The difference in severity of symptoms in MS patient is also still a mystery. Whether MS is a result of the immune system wrongly attacking healthy oligodendrocytes, or if the immune system is working properly and riding the body of faulty oligodendrocytes is also unclear. Stem cell research is still a rather new science that has promising applications, but more research must be done before stem cells become a viable option. If stems cells turn out to be as useful as many predict, the medical implications are massive. All of these questions drive science to search for answers, and hopefully they will be found.

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