THE BENCH & BEYOND

Newsletter of San Diego Biomedical Research Institute

Giving Every Patient A Fighting Chance

Over the past year, COVID-19 has evolved and spread throughout the world, causing the first global pandemic in 100 years. As of January 14th, over 92 million cases have been reported worldwide with 23 million reported in the United States. Whether it be hospitalization, economic hardship, the death of a loved one, the long process of recovery, or social isolation, most of us have faced challenges caused by COVID-19. It is expected that the world will continue to feel the impacts of the pandemic for many years.

Despite these realities, with the beginning of 2021, there is a sense of optimism. The COVID-19 vaccine is already being distributed to front-line workers and the elderly and will be ready for mass distribution within a couple of months. We will once again be able to see our loved ones, travel safely, and resume our everyday activities.

LOOKING FORWARD

Now that we see light at the end of the tunnel with respect to COVID-19, SDBRI scientists have already begun to think about ways to prevent another global pandemic. Specifically, SDBRI scientists are focusing on the development of a vaccine that will protect against future coronaviruses.

A recent ground-breaking report from Boston University of Medicine explains that several viruses that cause the common cold may protect against a severe form of COVID-19. These potentially protective common cold viruses are also members of the coronavirus family. The report suggests that, if someone has had a common cold in the last five years, they may have developed an immune response that will protect against severe symptoms of COVID-19. This has led scientists at SDBRI to consider not only what this means for the development of a vaccine to the current coronavirus, but also the potential for a universal coronavirus vaccine- a vaccine that will protect against all coronaviruses, including ones that we don't even know about yet.

LOOKING FORWARD CONT.

A universal vaccine is beneficial because it protects against all strains of a particular family of viruses. The simplest way to understand a universal vaccine is to consider what life would be like if we had a universal flu vaccine. Currently a flu shot needs to be given annually because it must go through modifications every year to protect against what scientists believe will be the most common flu strain for that season. A universal flu vaccine would be effective against all strains and would not need to be modified year after year.

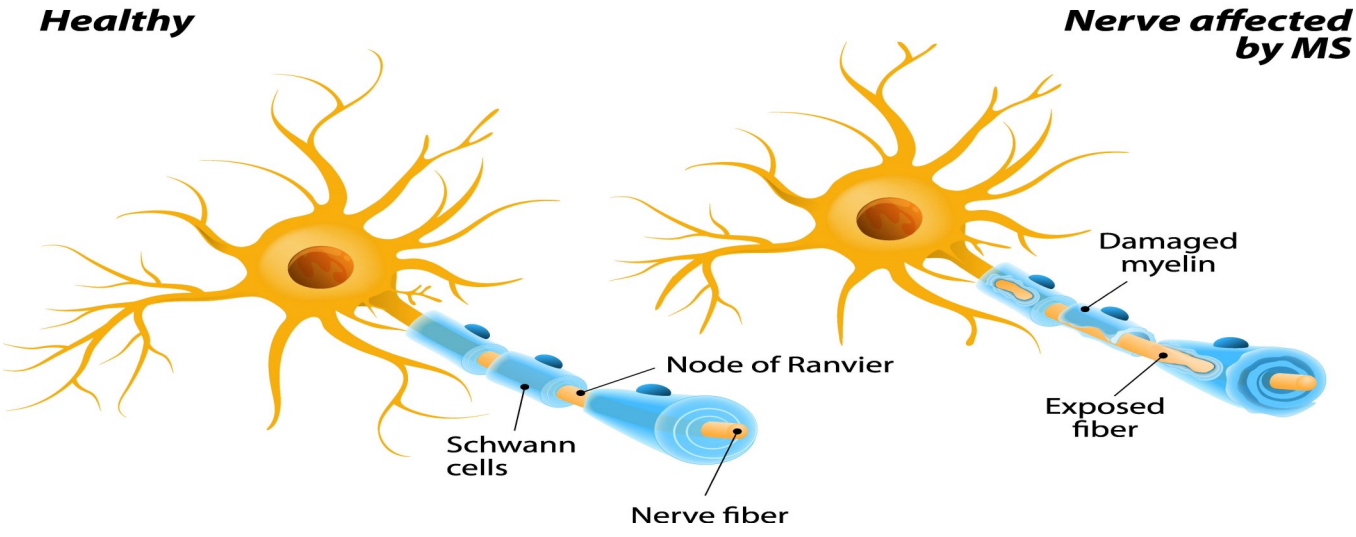
A universal vaccine for coronavirus is attractive because of the concern that new lethal coronaviruses that infect humans might develop. While there are four coronaviruses that merely cause the common cold, in addition to the virus that causes COVID-19, there are others that cause more serious illnesses. In 2003, SARS-CoV-1 (SARS1), a virus very similar to the virus that causes COVID-19, infected 8000 people and had a death rate of 10%. Then in 2012, the Middle East Respiratory Syndrome (MERS) virus emerged, killing over 30% of the people it infected with a total of 800 deaths. Thankfully neither of these escalated into a global pandemic. Scientists conducting research on SARS1 and MERS have applied what they know to develop COVID-19 vaccines. However, the vaccines that will be distributed in the coming months, will only target SARS-CoV-2, the coronavirus that causes COVID-19, leaving everyone vulnerable to any potential novel coronaviruses that may arise in the future.

SDBRI scientists are getting ahead of the curve and have begun the development of a universal coronavirus vaccine that would protect against all strains of coronavirus.

OTHER RESEARCH AT SDBRI

Despite the restrictions caused by the pandemic, scientists at SDBRI continue to work diligently on their research, grant submissions, and publications. One of our scientists, Dr. Richard Milner, focuses on designing therapeutic approaches aimed at combatting neurological disease by increasing blood supply and reducing the breakdown of blood vessels.

In 2020, Dr. Milner published three high impact papers which looked at the potential therapeutic treatments for Multiple Sclerosis (MS), an autoimmune disease that targets the spinal cord and brain, collectively known as Central Nervous System (CNS). MS destroys what is known as the myelin sheath, a protective barrier that surrounds the nerve fibers. When this is destroyed, nerves can become damaged, leading to delayed nerve conduction, which results in loss of sensation and motor function in MS patients.



OTHER RESEARCH AT SDBRI CONT.

The first of Dr. Milner's papers evaluated Activated Protein C (APC) as a potential treatment for an experimental form of MS. Dr. Milner and his team focused on how treatment with exogenous APC influenced inflammation, immune cell infiltration, and the breakdown of blood vessels in the CNS. The team found evidence that APC has strong therapeutic potential for MS. It was also determined that to ensure the protection of the barrier surrounding the nerves, the structural integrity of the blood vessels needs to be enhanced and inflammation in the CNS needs to be suppressed.

In his second paper, Dr. Milner and his research group looked at the impact of the application of low oxygen levels (hypoxia) in an experimental model of MS. Interestingly, they found that when applied to preexisting experimental MS, mild hypoxic therapy accelerated clinical recovery, resulting in long-term stable reductions in clinical scores. In support of the clinical findings, at the microscopic level, this intervention led to parallel reductions in blood vessel disruption, accumulation of immune cells, and destruction of the myelin sheath.

Dr. Milner's third paper explored whether immune cells in the CNS could play a protective role in conditions of low oxygen levels. Dr. Milner and his team found that low oxygen levels provoked vascular leaks in the cerebral blood vessels that were associated with accumulation and activation of CNS-resident immune cells known as microglia. This demonstrates the ability of low oxygen levels to trigger a blood-brain barrier disruption, potentially allowing for pathogenic material to enter the CNS, leading to neurological dysfunction. Importantly, pharmacological depletion of microglia made the vascular leak much worse, demonstrating that microglia could play a protective role in maintaining the structural integrity of blood vessels in the hypoxic brain.

Dr. Milner's research is just a small part of what scientists have been working on here at SDBRI. This research gives us important, novel insight on potential treatments for devastating neurological diseases such as MS, and highlights areas that should be targeted by researchers in the future.