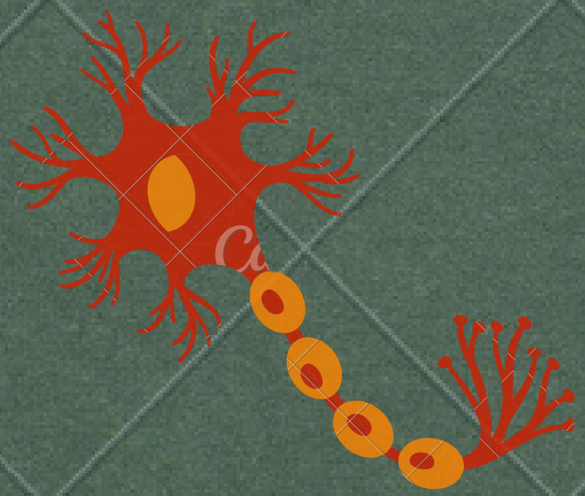
The Future of the Treatment for **Multiple Sclerosis** *using mathematical methods*

ABEERA AJMAL | HANIA SHAHID | MANAHIL MANZOOR

Myelinated and unmyelinated neurons



A neuron is a nerve cell. It processes and transmits information using electrical and chemical signals. It can be myelinated and myelinated, what is the difference?

A myelinated neuron is simply covered by myelin sheath, which has multiple benefits:

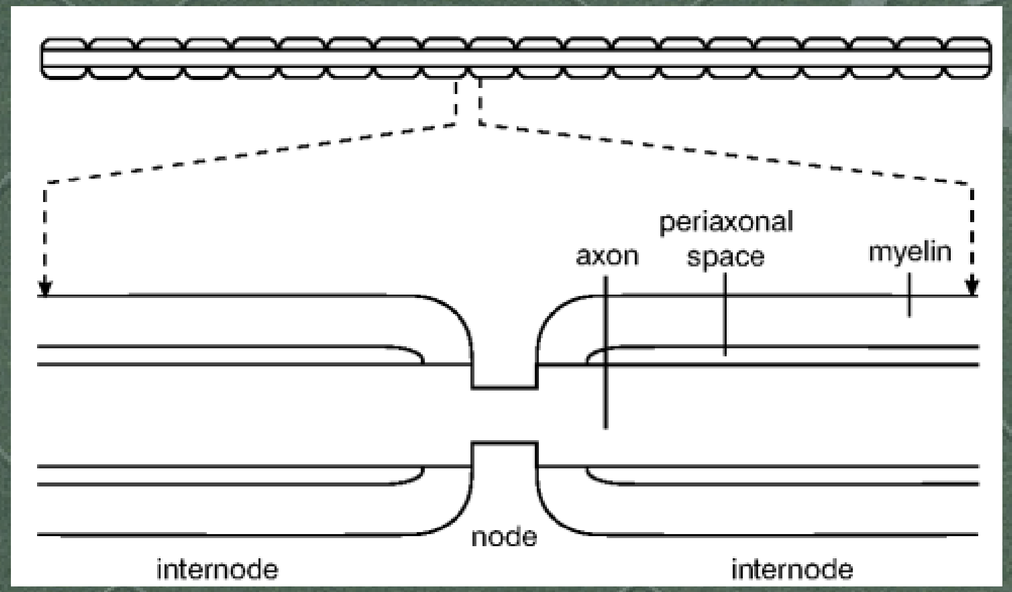
- Nerve impulses are faster
- Ensures that communication between distant body parts is continued and agile communication is kept alive
- Prevents loss of impulses during conduction

Hodgkin-Huxley model of Myelinated neurons

HOW CAN WE MODEL A MYELINATED NEURON?

Mc. Intyre and Richardson, in 2000, carried this simulation out, and we will be discussing their methodology and findings in this project.

THE NERVE STRUCTURE THAT WAS MODELLED



There were three divisions involved:

i)Extracellular simulation of the axon through electrode current

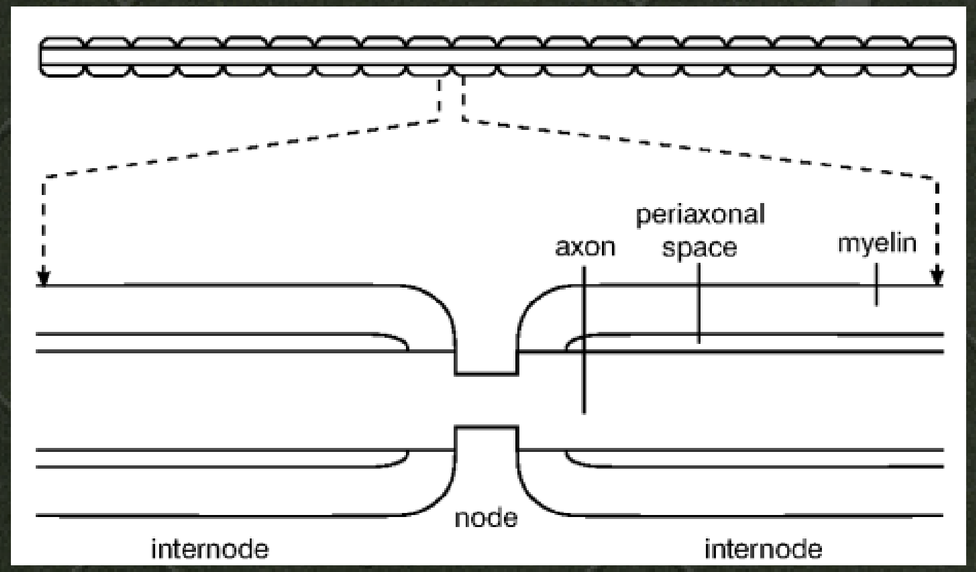
ii) Intracellular current injections

iii) Reduced set of intracellular injuctions that accurately simulate extracellular potentials

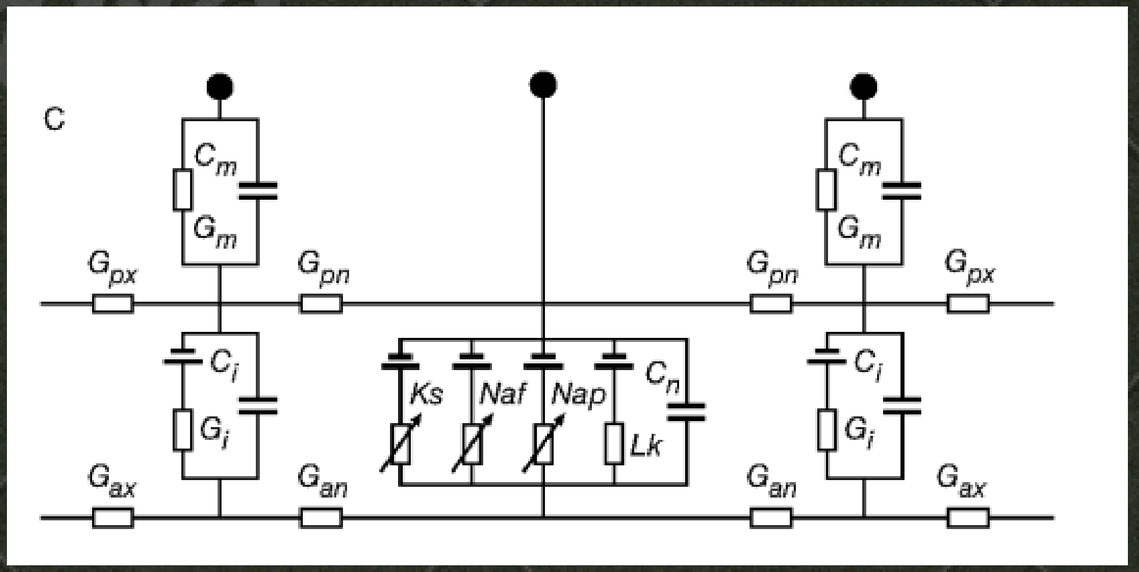
Tested using PSPICE simulation, then looked at the following:

- Strength-duration property
- Current-distance property
- Conduction velocity
- Action potential shape

DIAGRAM OF THE STIMULATED NEURON

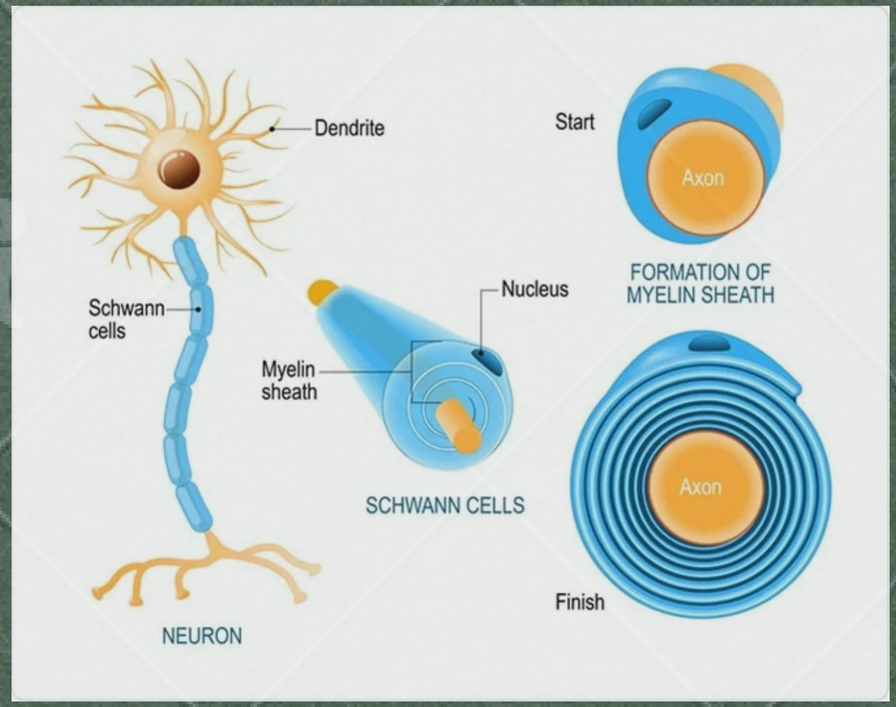


SCHEMATIC OF THE STIMULATED NEURON



Myelin and Multiple Sclerosis

- Myelin acts as electrical insulation for the axon.
- Electrical signal travels much faster and more efficiently
- With lack of myelin, the opposite occurs.
- Multiple sclerosis is a disease that affects the central nervous system, caused by the lack of myelination.



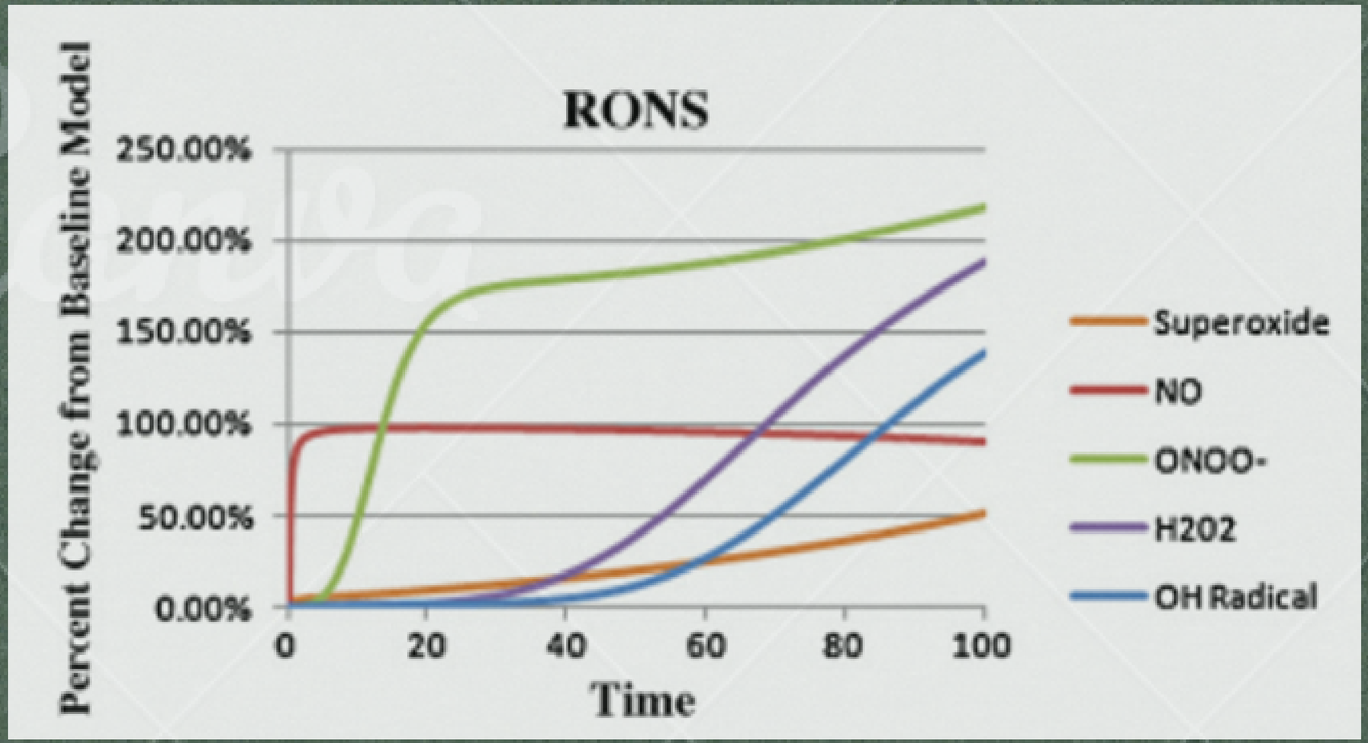
What causes the apoptosis of oligodendrocytes?

REASON 1

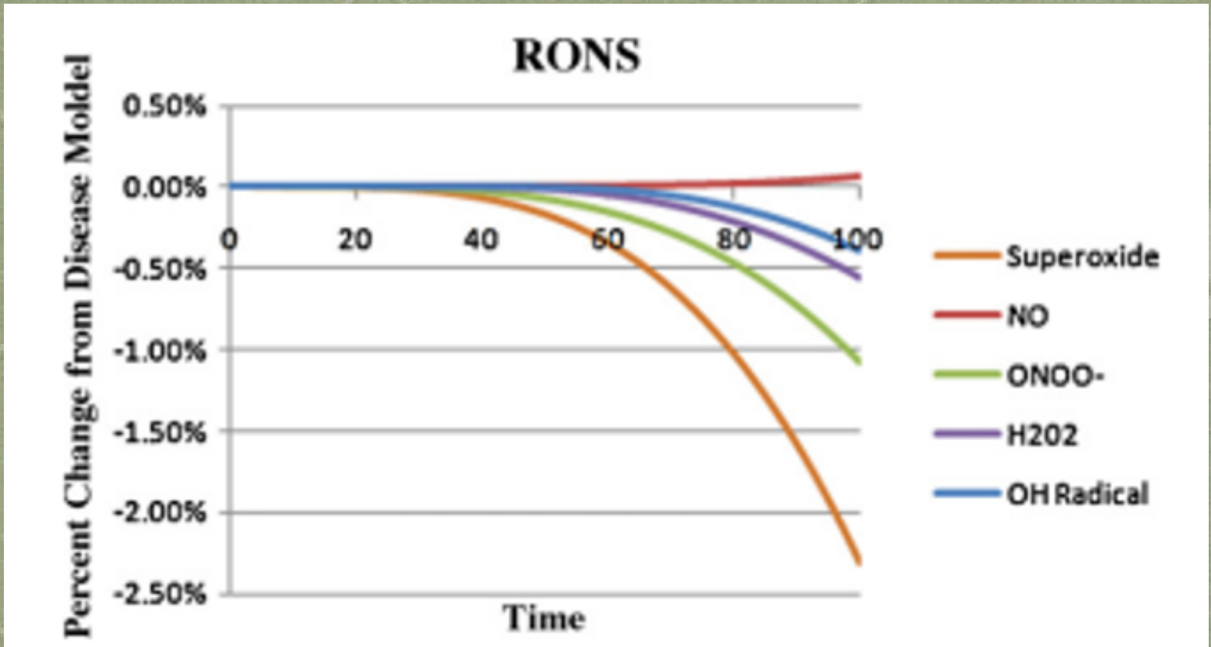
The prodcution of reactive oxygen and nitrogen speciies in excess. harms the nerve cell by damaging essential components of nerve cells such as
DNA or mRNA

REASON 2

The accumulation of Ca+2 ions leads to the production of the aforementioned reactive oxygen and nitrogen species as
well in a multiple sclerosis effected cell

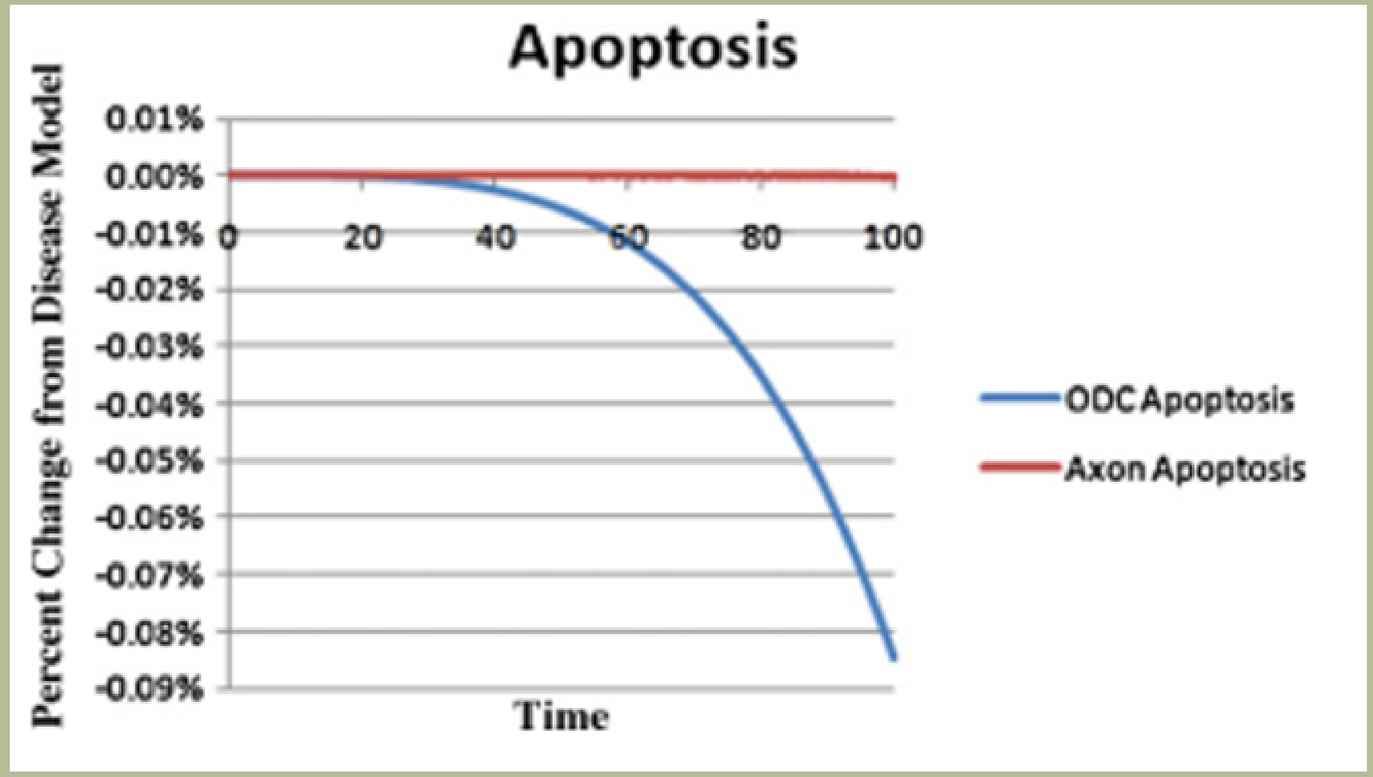


Treatment stage



- The treatement model of apoptosis created by preventing the activation of pro-inflammatory cytokines.
- It was also created by greatly lowering the rate of the opening of the PTP

Post treatment stage



Propositions for Cures to Multiple Sclerosis

- **We try now to address methods which, in theory, provide ways to improve the health of people with multiple sclerosis.**

1. An artificial method of myelination: using drugs, hormones, or steroids
   - Would increase the speed of the electrical signal
2. Increase ion concentration in the intracellular and extracellular fluid to make up for the lack of myelination.
   - Diffusion of these ions would occur faster because of the greater concentration gradient.

Other Applications of Artificial Myelation

- Considering that hypothetically we can increase speed of nervous processing by increasing myelation, there may be other possible considerations.
- Could it be possible to create super-fast reflexes? Could this be done for anyone?
- What about increased intelligence?
- May also be used to treat other mental or neural conditions.

Ethical Setbacks

May be unfair if people who are healthy benefit from this, intelligence or thinking speed may become commercialized.

Most procedures that change the body's behavior so drastically is bound to have side effects. Would these be too extreme?

Thank You