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Microglia and neurodegenerative diseases

Foreword

Aim : Understand the role of the microglial cells in Alzheimer.

Microglia : glial cell, plays the macrophage's role who cannot enter in the SNC.

Their role is to maintain the medium of the neuronal tissue (by regulation and elimination of intruder).

In the case of Alzeihmer we have a formation of amyloid plaque (AP) that shouldn't be here. So the microglial cell cannot get rid of all. High concentration of microglia expressed by risk gene of Alzeihmer disease (AD). The microglial protection is very important in the struggle against AD (if the expression of microglia is altered and its response against B - amyloid, then we have an increased risk to drift into AD)

Moreover the microglia can turn against the neuron. We can have a loss of synapse (by engulfment) / increase of tau protein (involved in AP formation) / inflammatory factor turning against neurons / activation of neurotoxic astrocytes

The simulation

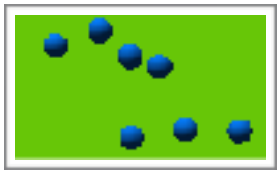
Medium : Neurosystem agents

- Neurons (at least 2) in white
- Synapses (space between the nerves)
- Microglia in blue
- Syntheses of neurotransmetteur (NT) in yellow
- Amyloïd plaque (AP) in black

Healthy nerve

Sick nerve with AP

Neurotransmitters



Microglial cells

Programm :

- Seeing the evolution between neuron and MG interaction
- MG touches plaque then disparition of plaque
- Make neuron create NT (in shape of pyramid : yellow if nerve is healthy / pink if nerve is sick)
- Microglia need to block NT (eliminate them when gets hit by)

Simulation : Two different things : Good and bad action of microglia

<u>If microglia was « hurt less » and wasn't impacted by Alzeihmer and AP.</u>

- AP turn the neuron in black, « get its sick »
- When microglia (in blue) « clean » the neuron « turn back in white : healthy »
- NTs are secreting by nerves

Illustration to explain the disease

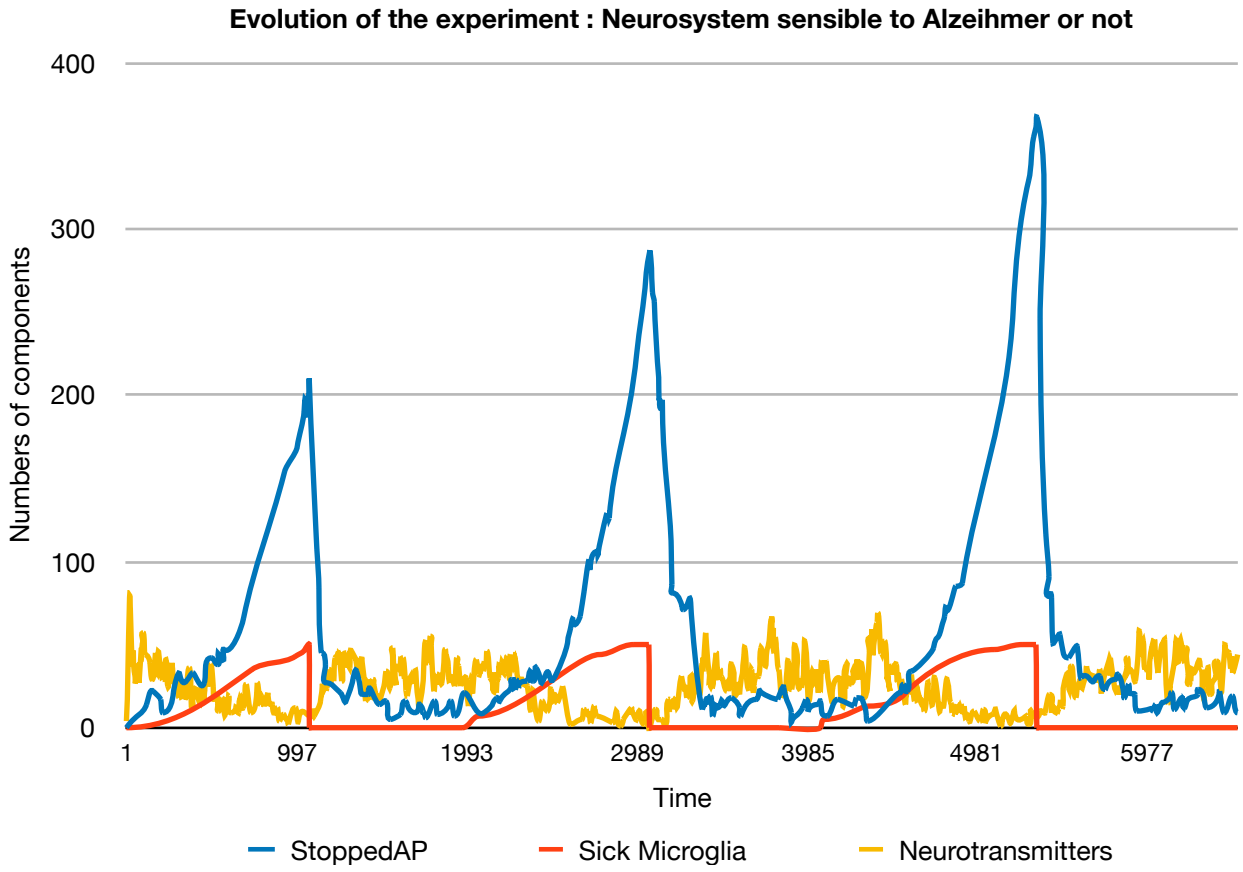
Moreover, microglia is « hurtful » and is impacted by the disease

- Microglia can't clean the nerves anymore because of its interaction with blocked AP, microglia become « sick » and turn red. Accumulation of AP.

- Microglia are arranged (randomly) in synapses, stacked on neurons if « sick - red »

- Microglia are slowing down the flow of NTs in synapses for two reasons :

  - NTs are getting « eat » by microglial cells
  - NTs are less synthesized because nerves are sick



The peak appears when we pushed the « Convert to light side » toggled button : the goal of this action is to simulate the fact that the Microglia aren't affected by APs and so by Alzeihmer disease.

(TRY IT : you'll see) 

Here is few numbers after making my simulation running around 1000 times for each case : Microglia sick or Microglia safe (not impacted by disease and cleaning the nerves)