Ageing at a snails pace

SPARC/ Research into Ageing Public Dissemination Event

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What happens in normal brain ageing?

- Alterations in strength of connections

What happens in normal brain ageing?

- Decreases in connectivity

What happens in normal brain ageing?

- Some loss of nerve cells
Signs of normal brain ageing

• Impaired cognition
• Deficits in performing motor tasks

Causes of normal brain ageing

• Oxidative Stress
• “Use it or lose it”

Rationale Behind Work

• Human brain complex
  100,000,000,000 neurones
  Each neurone makes 1000 connections
  100,000,000,000,000 connections

Model System
Snail Brain

The behaviour

Model System

Behaviour → Neurone
Phases changing

- Decrease in Feeding Frequency
- Duration of Protraction
- Duration of Rasp
- Duration of Swallow

Increasing age decreases firing rates

Serotonin Cells
Connectivity

Connectivity

Serotonin Cell

- Protraction
- Rasp
- Swallow

Serotonergic Transmission

Serotonergic Transmission

Measuring the Strength of Connection

Measuring the Strength of Connection

- Protraction neurone
- Serotonin Cell

Compensation

Compensation

Nerve Cells controlling Protraction

Firing rate Serotonin Cells + Strength of Connection = Compensation (Protraction normal)
Effect of Prozac on reuptake

After addition of Prozac

Prozac

Strength of Connection

YOUNG

OLD

Serotonergic Transmission

Increased sensitivity to serotonin

Protraction Phase Neurone

+ serotonin

Sensitivity

YOUNG

OLD
Summary So Far

• Age-related slowing in feeding rate.
• A decrease in the firing rate of serotonin cells.
• Compensation allows protraction phase to function normally.

No Compensation

Nerve Cells controlling the Swallow Phase

Firing rate of Serotonin cells + Strength of connection = No Compensation

Swallow Phase Neurones

Strength of Connection

YOUNG

OLD

Increased sensitivity to serotonin

Sensitivity

YOUNG

OLD

+ serotonin
Summary

• Compensation occurs at some connections but not at others.

• Unique opportunity to study the mechanisms of brain ageing and to understand why age targets certain connections but not others.

Learning and Memory

• As we age there is an increased incidence of cognitive decline.

• Main problems are related to the speed of processing

• Can we use our snail model to find out what is going wrong?

Snails Can Learn and Remember

What have we learnt?

• Old snails learn more slowly

• Old snails can not remember for as long

WHY?
Proteomics

- Brain is complex and contains many 1000's of proteins.
- Signalling requires the correct balance of these proteins.
- Proteomics allows us to compare the protein composition of our young and old nerve cells.

Preliminary Results

- Common link is a dysfunction in K⁺ channels.
- Proteins that regulate the excitability of nerve cells.
- Currently investigating why K⁺ channels are more susceptible than other channels.
- Potential that these channels maybe the target for future drug treatment to enable healthy brain ageing.

Acknowledgements

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