

Ageing at a snails pace

SPARC/ Research into Ageing Public Dissemination Event

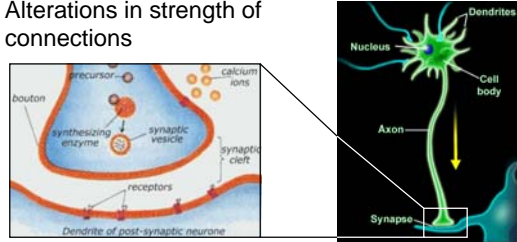
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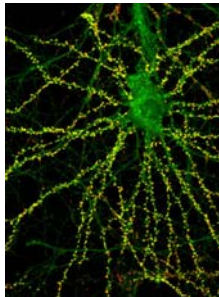
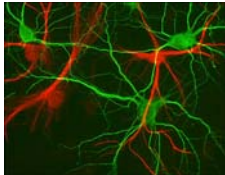
What happens in normal brain ageing?

- Alterations in strength of connections



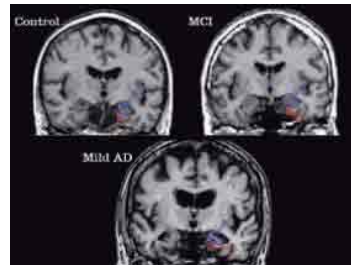
What happens in normal brain ageing?

Decreases in connectivity



What happens in normal brain ageing?

Some loss of nerve cells



Signs of normal brain ageing

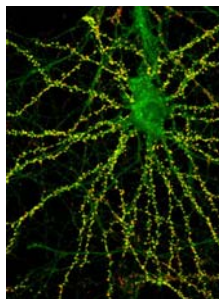
- Impaired cognition
- Deficits in performing motor tasks

Causes of normal brain ageing

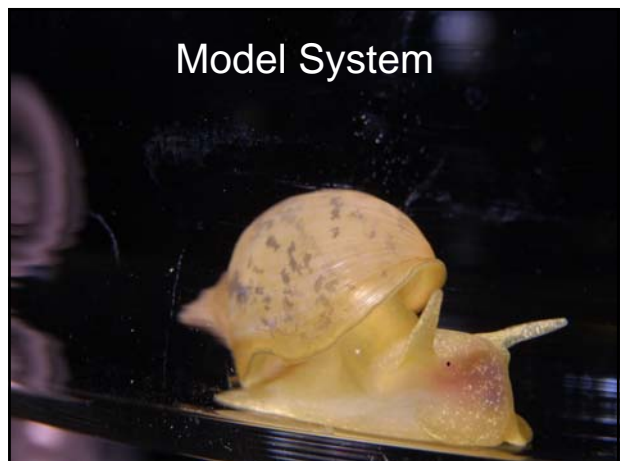
- Oxidative Stress
- “Use it or lose it”

Rationale Behind Work

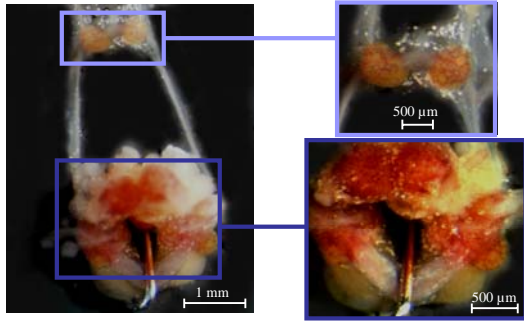
- Human brain complex
- 100,000,000,000 neurones
- Each neurone makes 1000 connections
- 100,000,000,000,000 connections



Model System



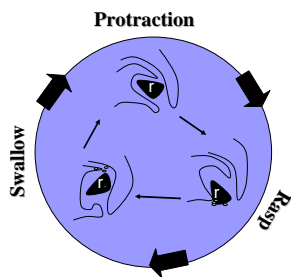
Snail Brain



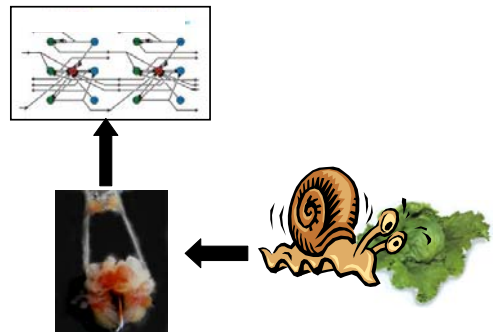
The behaviour

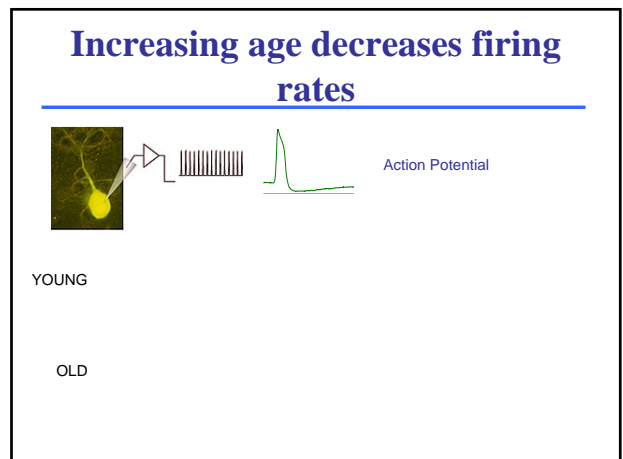
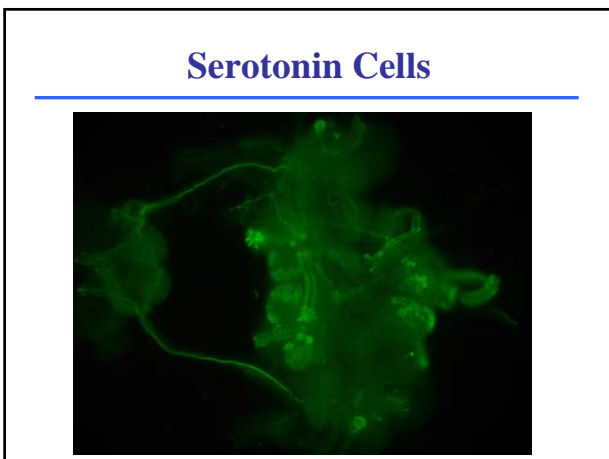
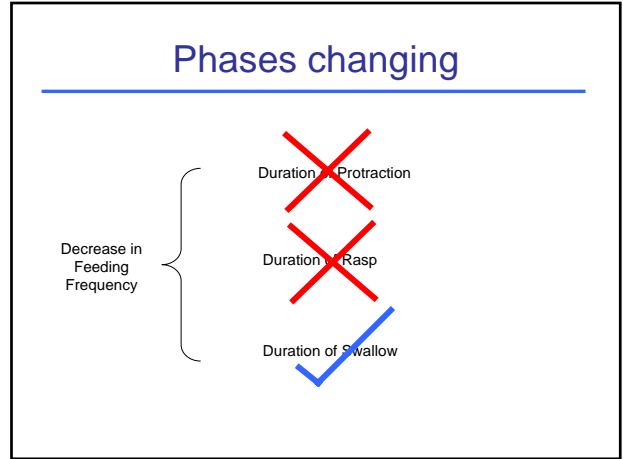
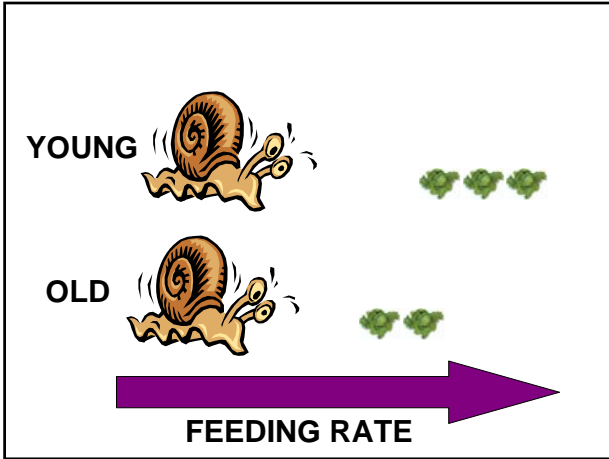


Model System

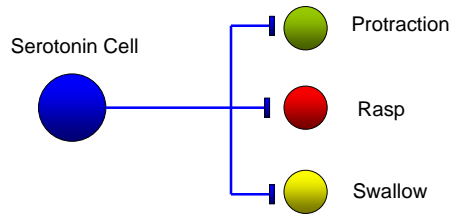


Behaviour → Neurone

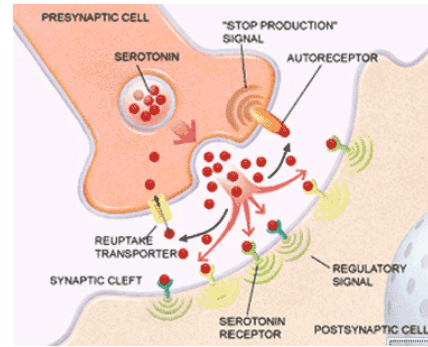




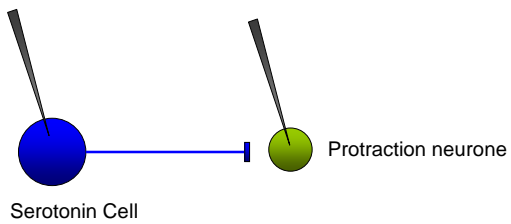
Connectivity



Serotonergic Transmission



Measuring the Strength of Connection



Compensation

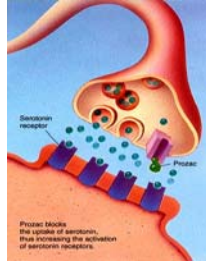
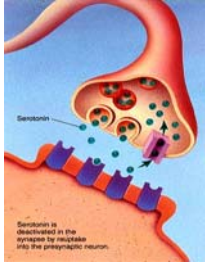
Nerve Cells controlling Protraction

$$\downarrow \text{Firing rate Serotonin Cells} + \uparrow \text{Strength of Connection} = \text{Compensation (Protraction normal)}$$

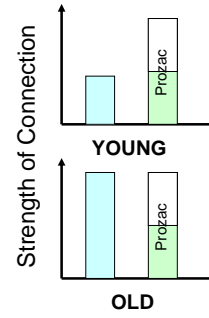
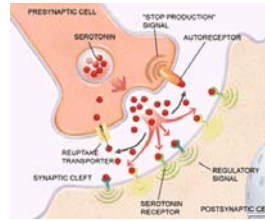


Effect of Prozac on reuptake

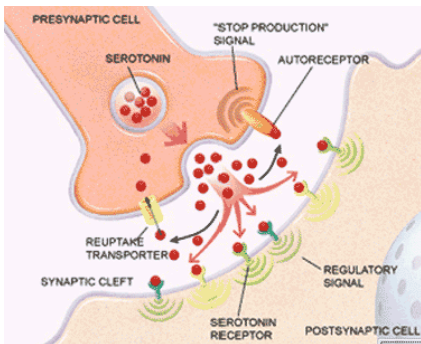
After addition of Prozac



Prozac

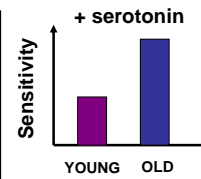
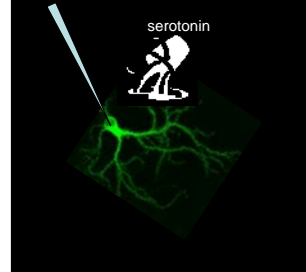


Serotonergic Transmission



Increased sensitivity to serotonin

Protraction Phase Neuron



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.

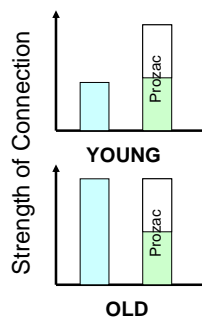
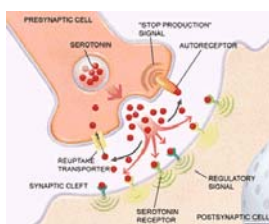
No Compensation

Nerve Cells controlling the Swallow Phase

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

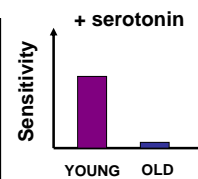
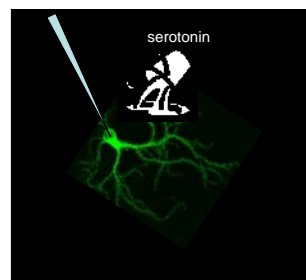


Swallow Phase Neurones



Increased sensitivity to serotonin

Swallow Phase Neurone



Summary

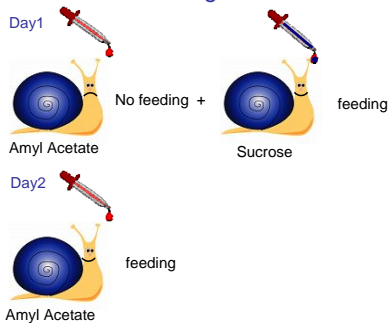
- Compensation occurs at some connections but not at others.
- Unique opportunity to study the mechanisms of brain ageing and to understand why age targets certain connections but not others.

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

Associative learning



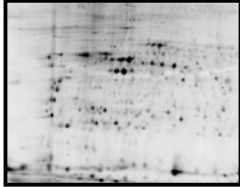
What have we learnt?

- 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

EPSRC LSI

SPARC

