

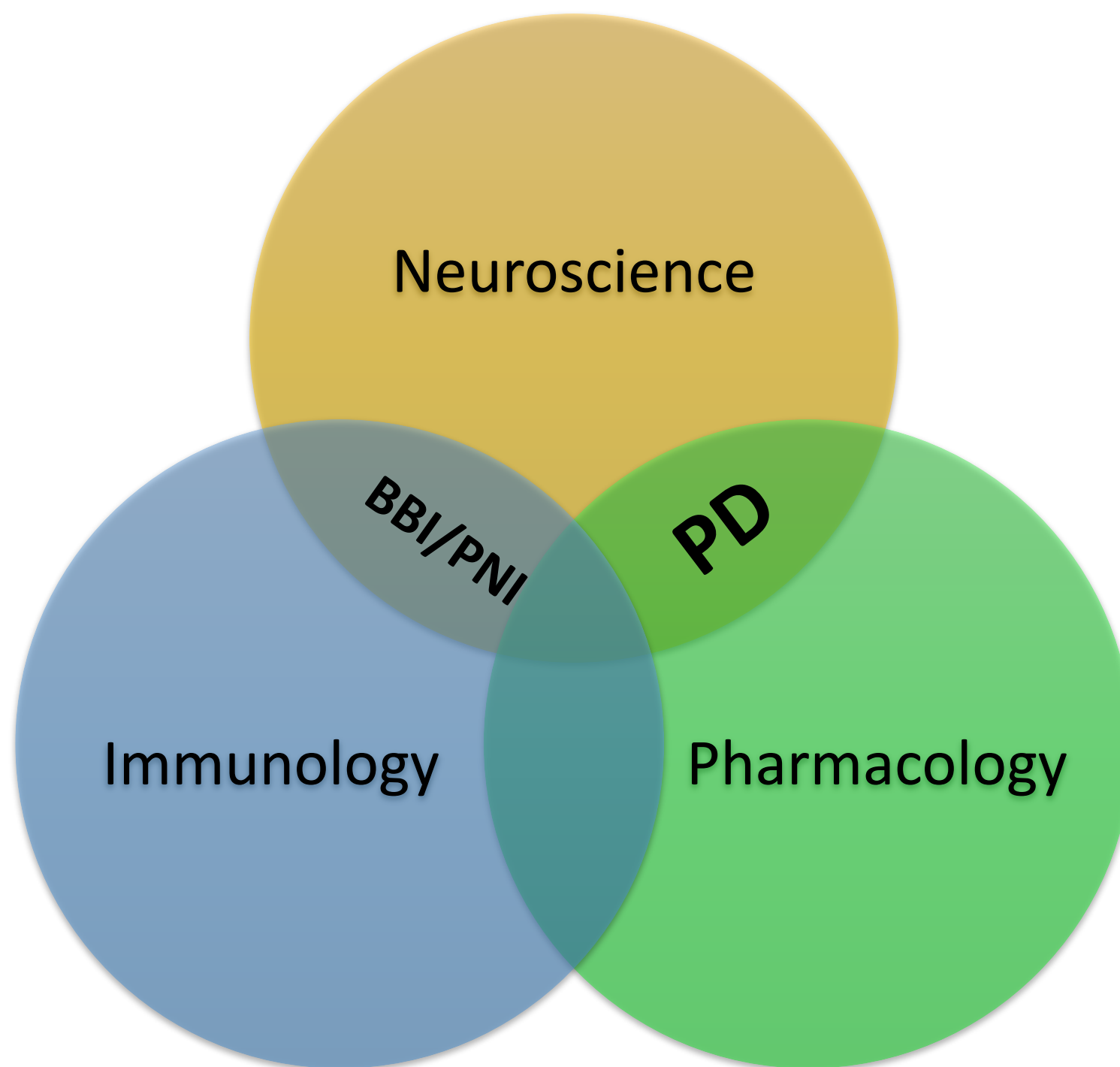


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# Measuring the Mind-Body Connection to augment human performance

Prof Mark Hutchinson, Director

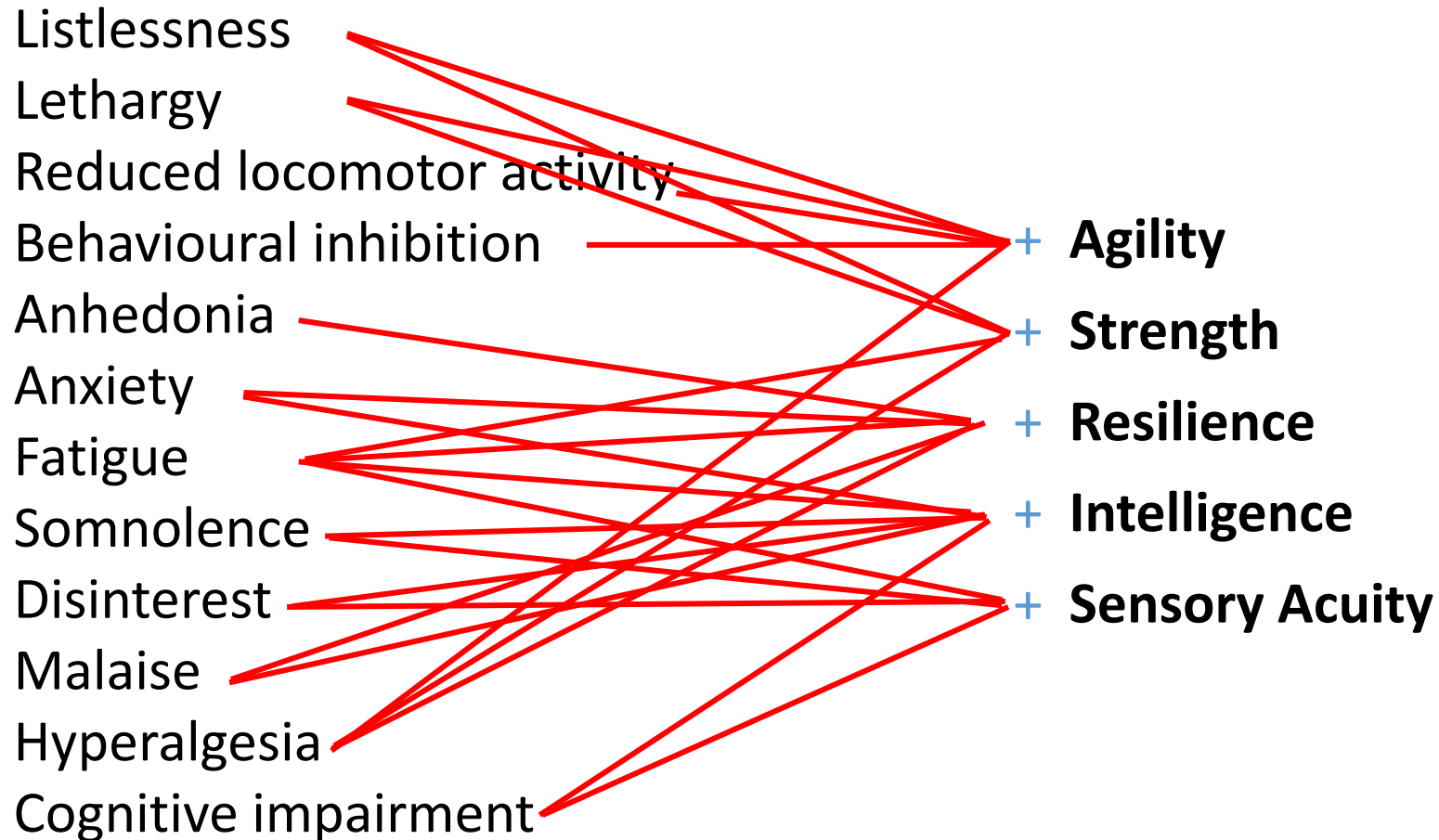




# HOW DO **YOU** KNOW YOU ARE **SICK**?

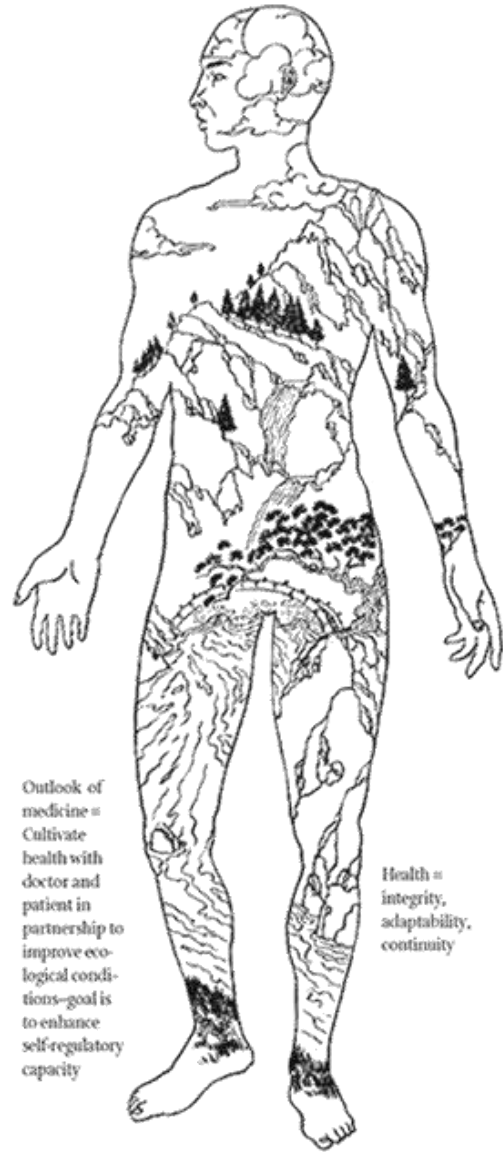


# WHAT IS SICKNESS?



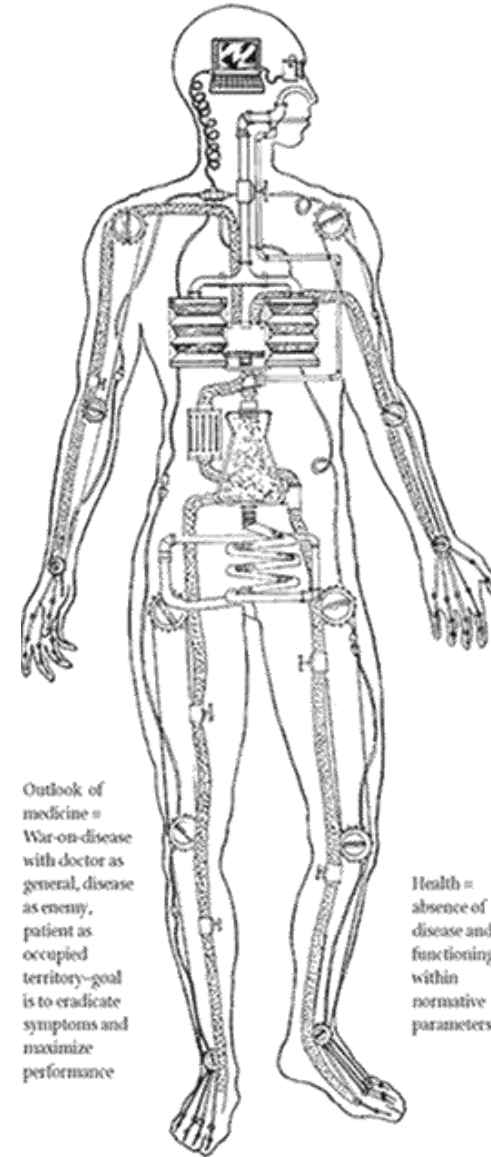
# WHAT IS HEALTH?

# GARDEN VS MACHINE



Outlook of medicine =  
Cultivate health with doctor and patient in partnership to improve ecological conditions—goal is to enhance self-regulatory capacity

Health = integrity, adaptability, continuity

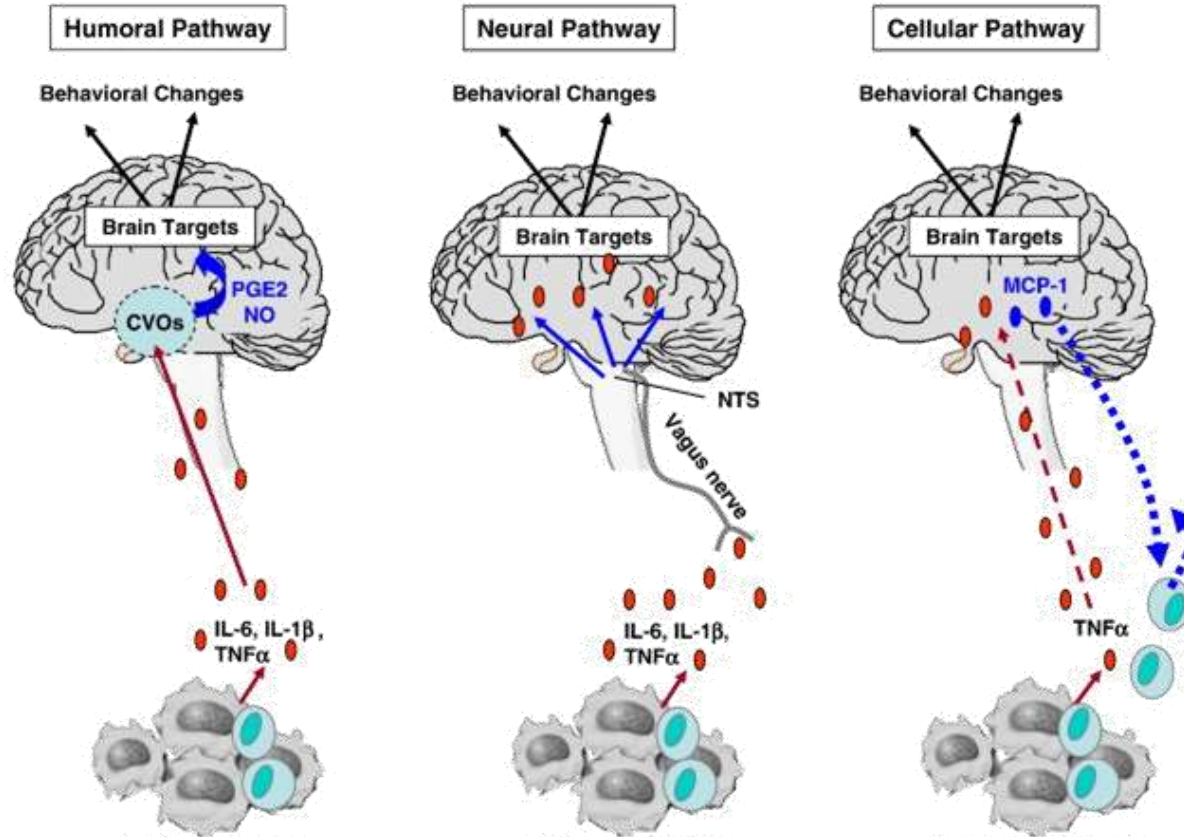


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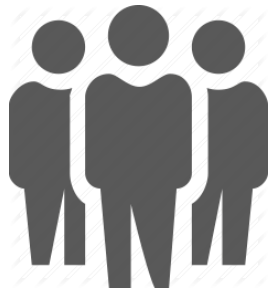
Health = absence of disease and functioning within normative parameters

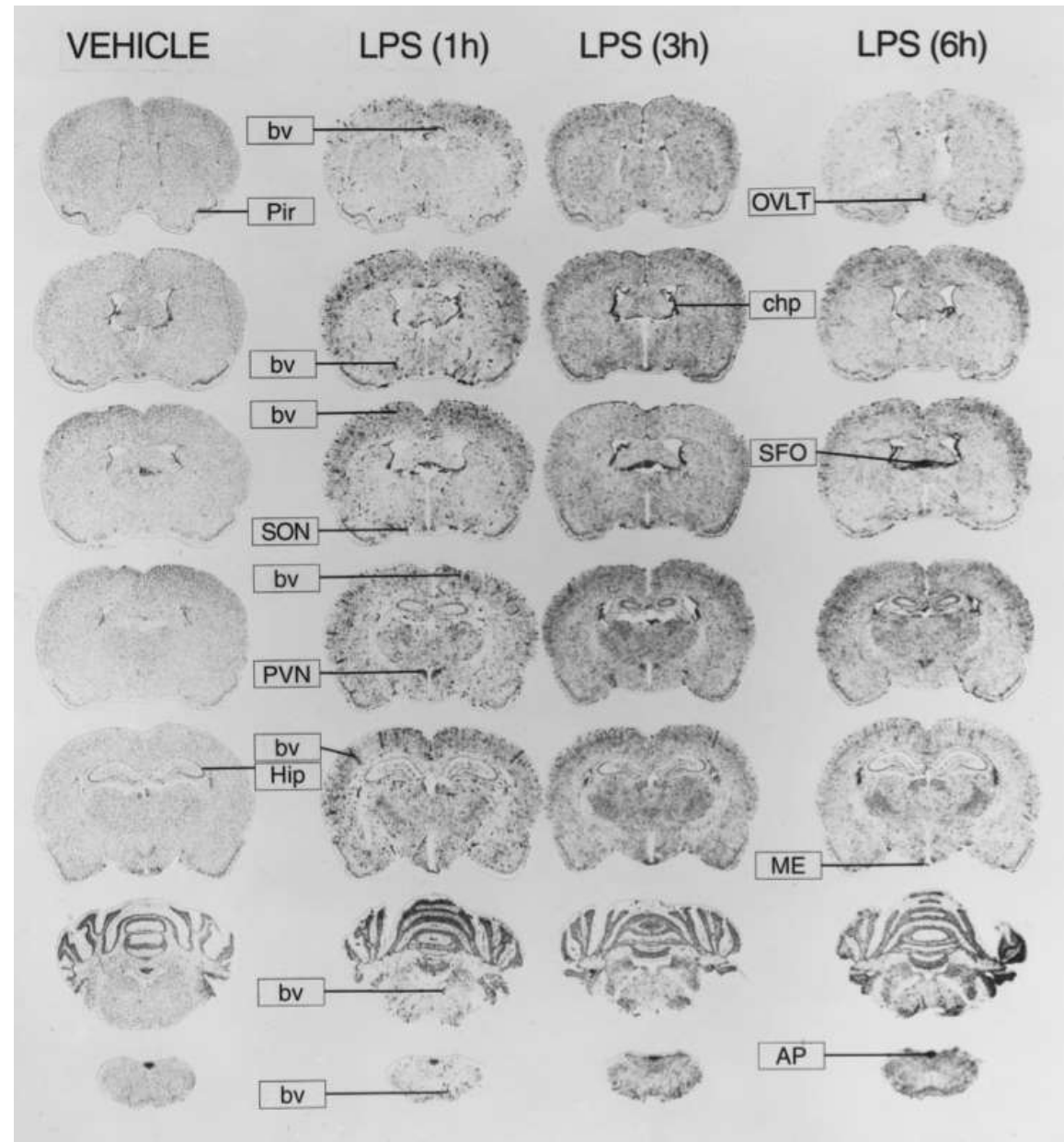
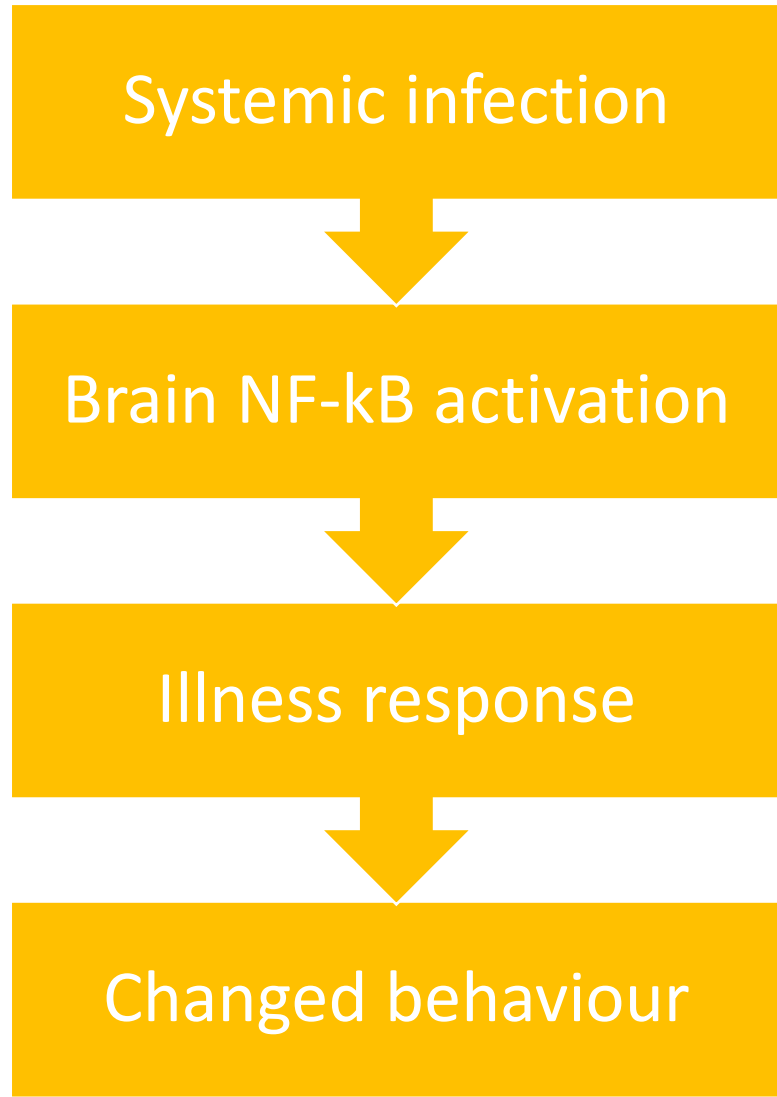


# HOW DO YOU KNOW YOU ARE SICK?



the “sickness response”  
immune-to-brain communication

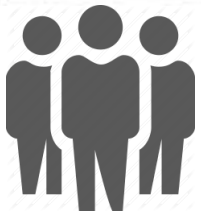
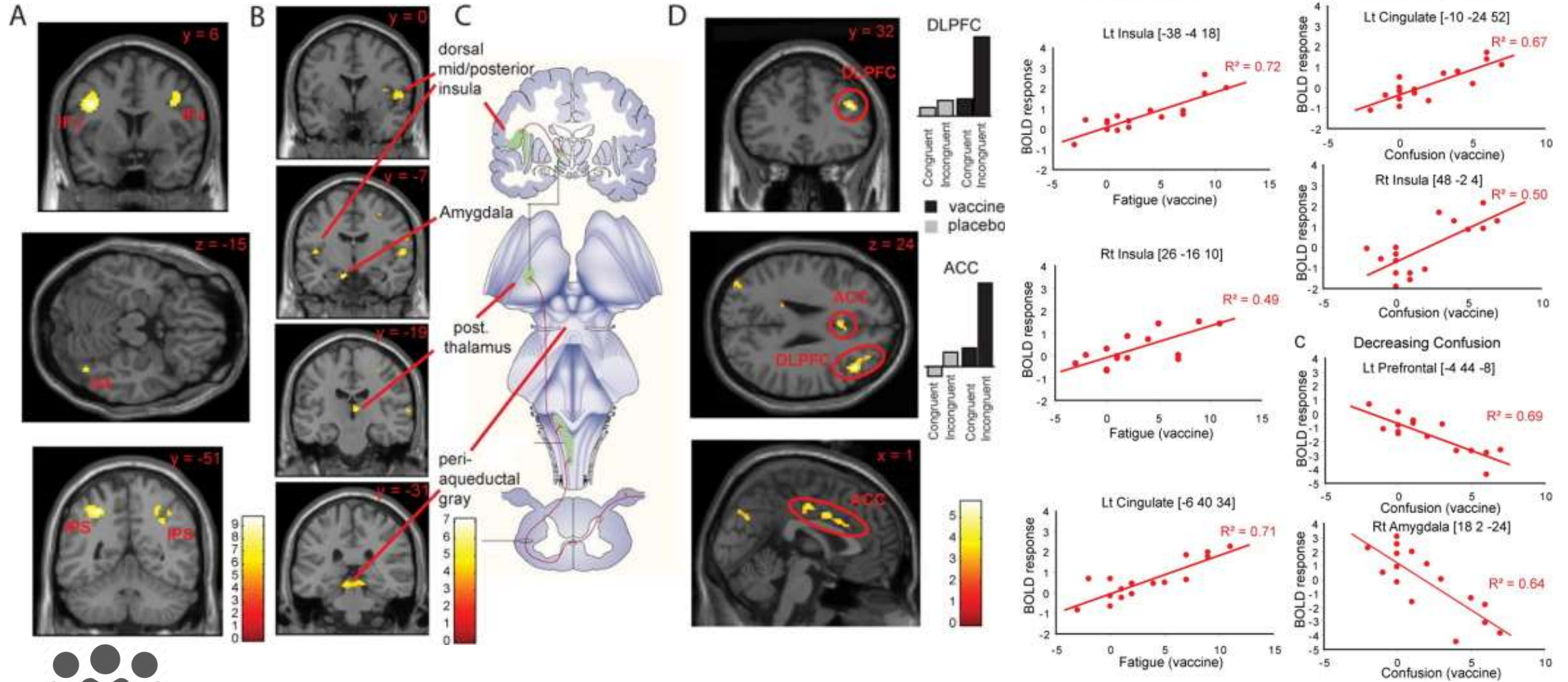




Laflamme et al (1999)



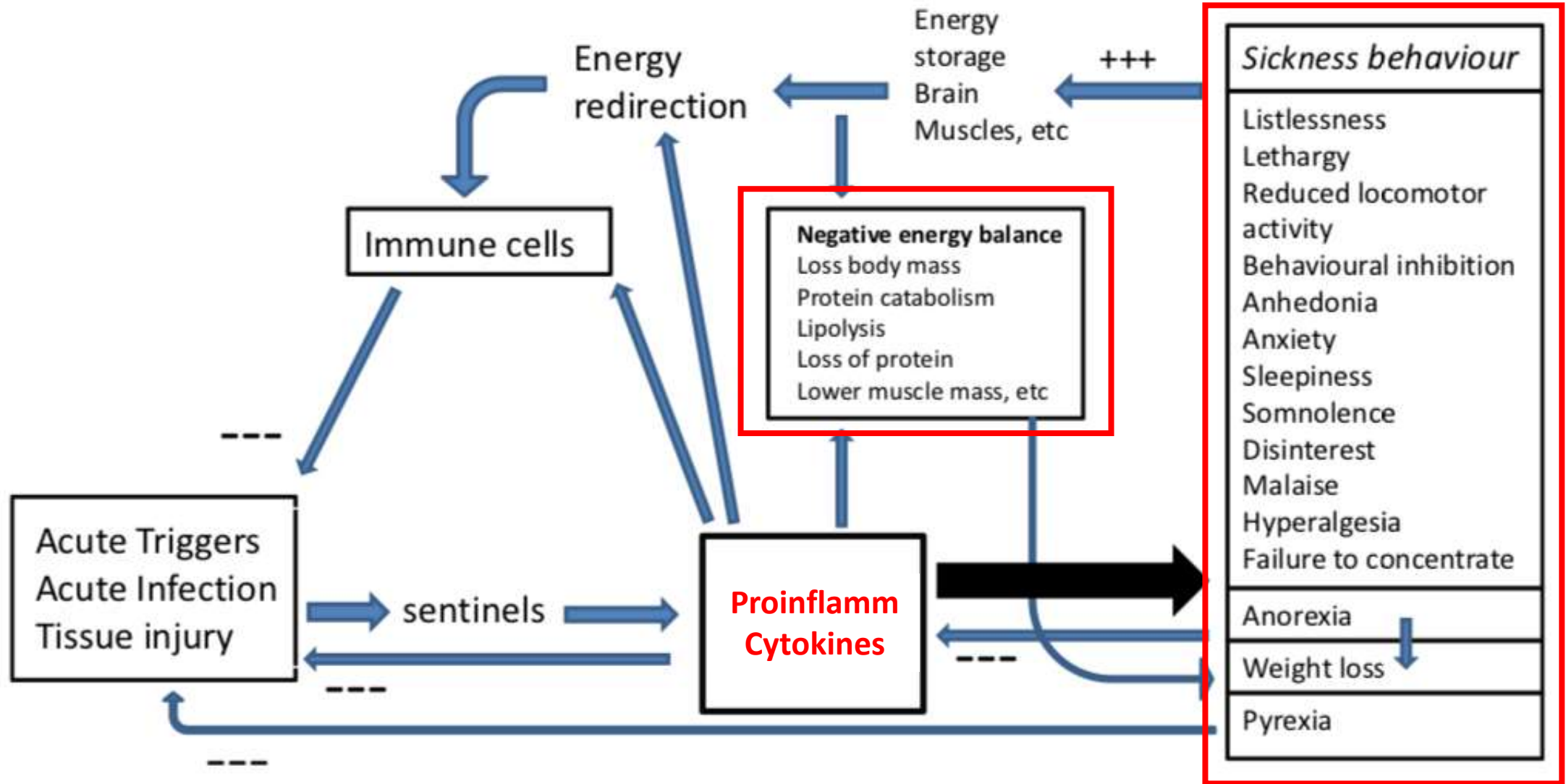
# Your immunology can change your brain



Harrison et al (2009)



# Your immunology can change your body



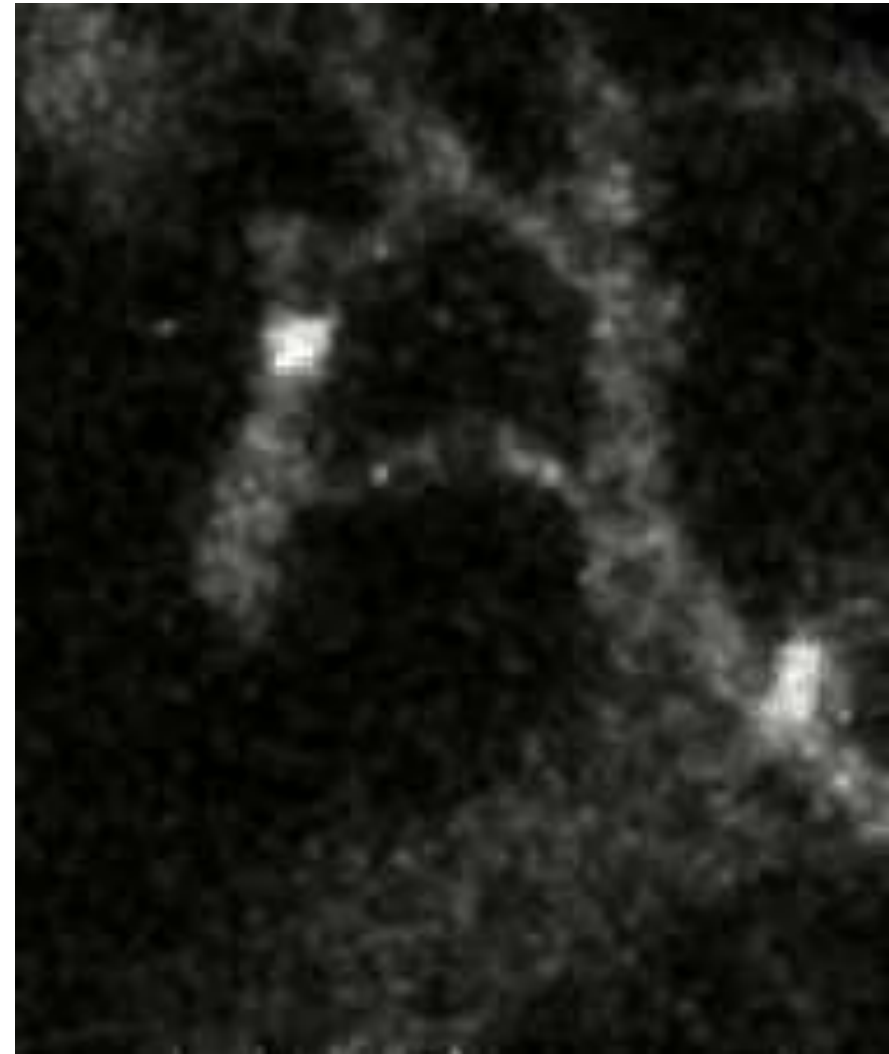
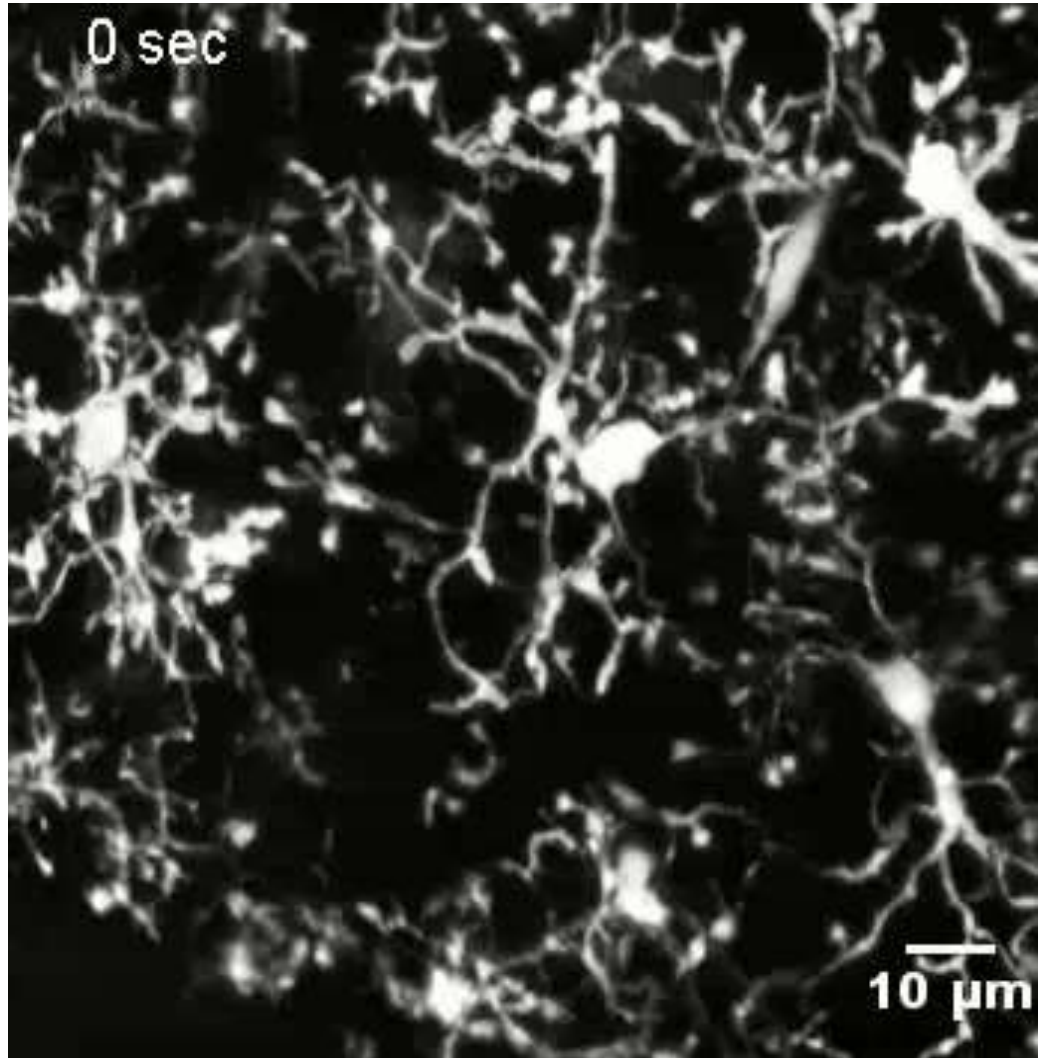
Maes et al (2012)



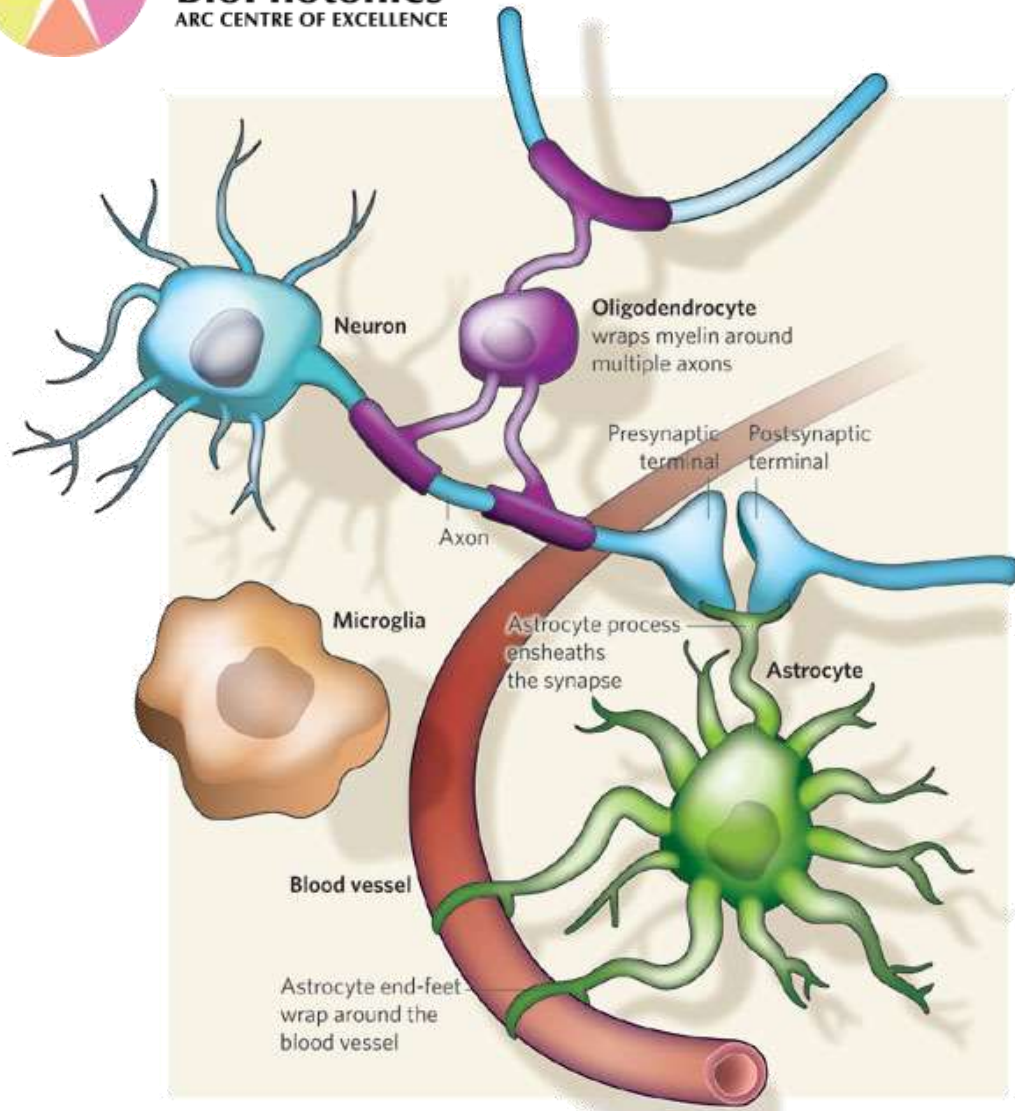


**KEEP  
CALM  
AND  
GET YOUR  
FLU SHOT**

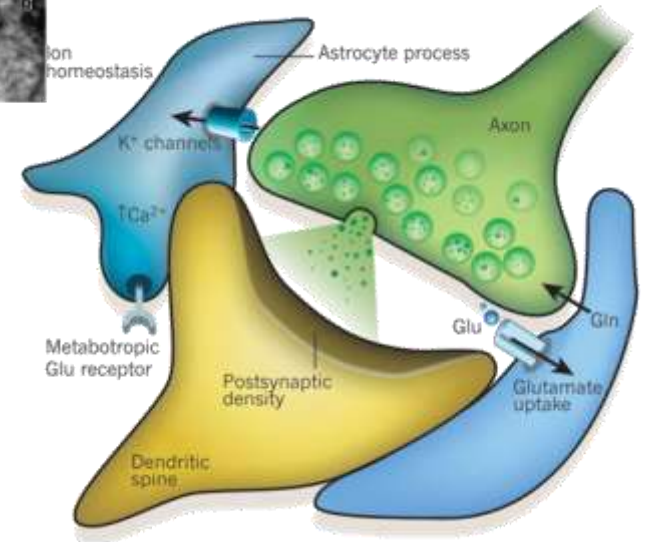
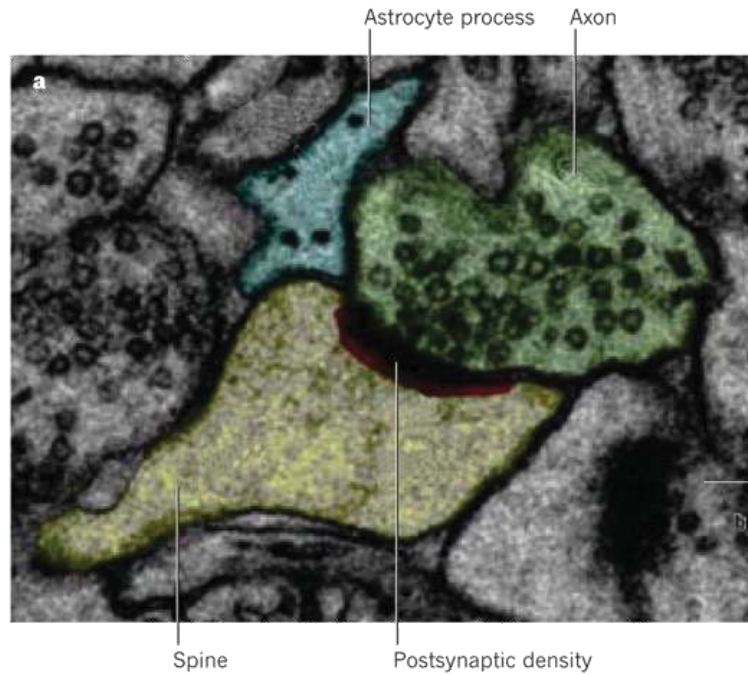
# THE CENTRAL IMMUNE SYSTEM



# GLIA: the other 90%

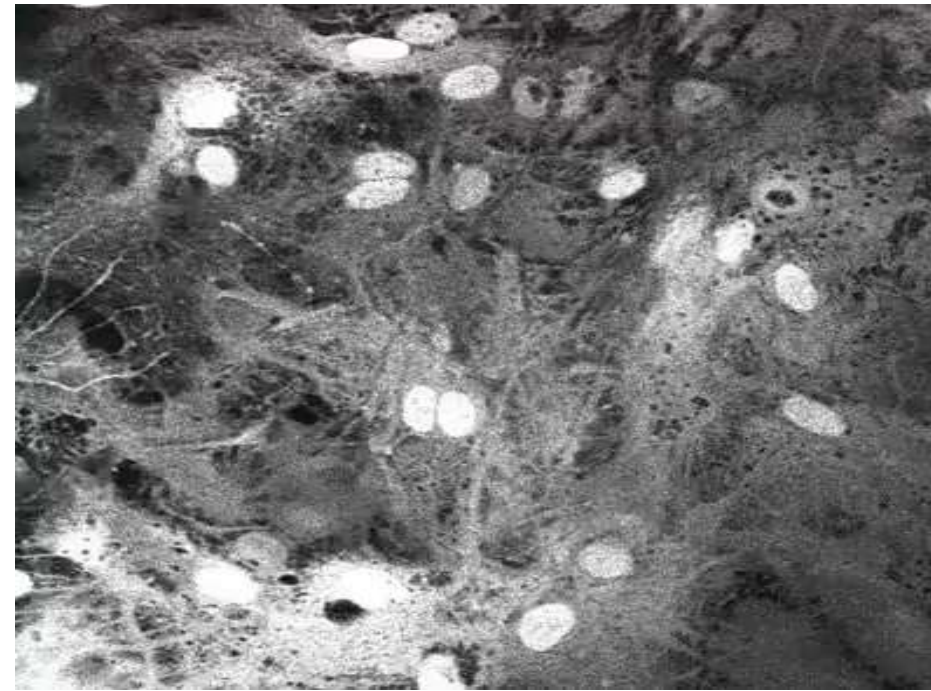
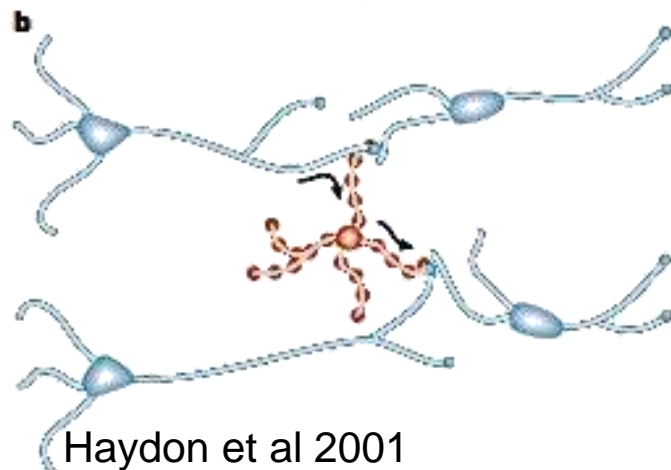
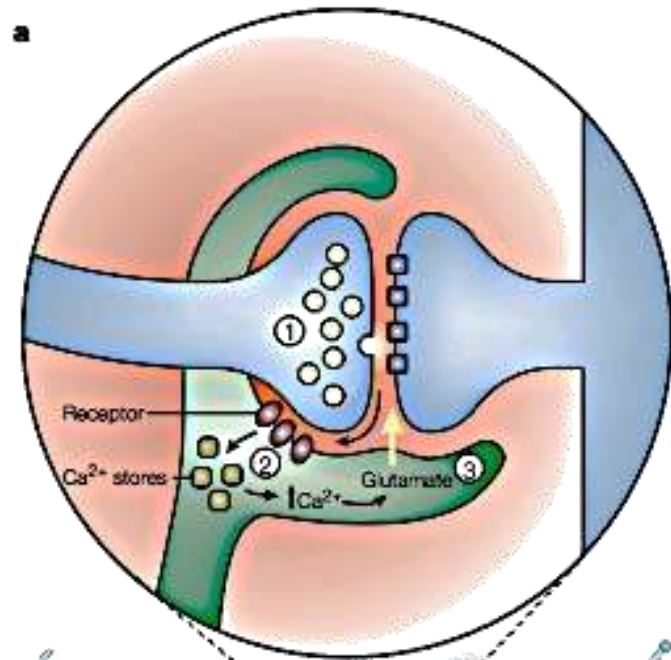


Allen et al 2009



Barres et al 2010

# Untold power of lateral sensitization



# POWER IN **GLIAL** COMPLEXITY

## BRAIN V1.0

$10^{11}$  NEURONS

WITH  $10^{14}$  SYNAPSES

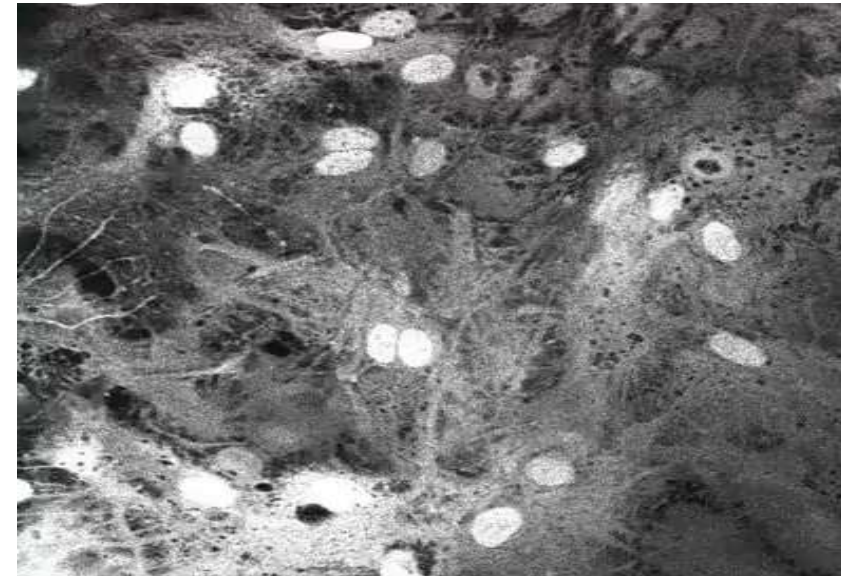
## BRAIN V2.0

$10^{12}$  GLIA

90% WITH 30,000  
INTERCONNECTIONS

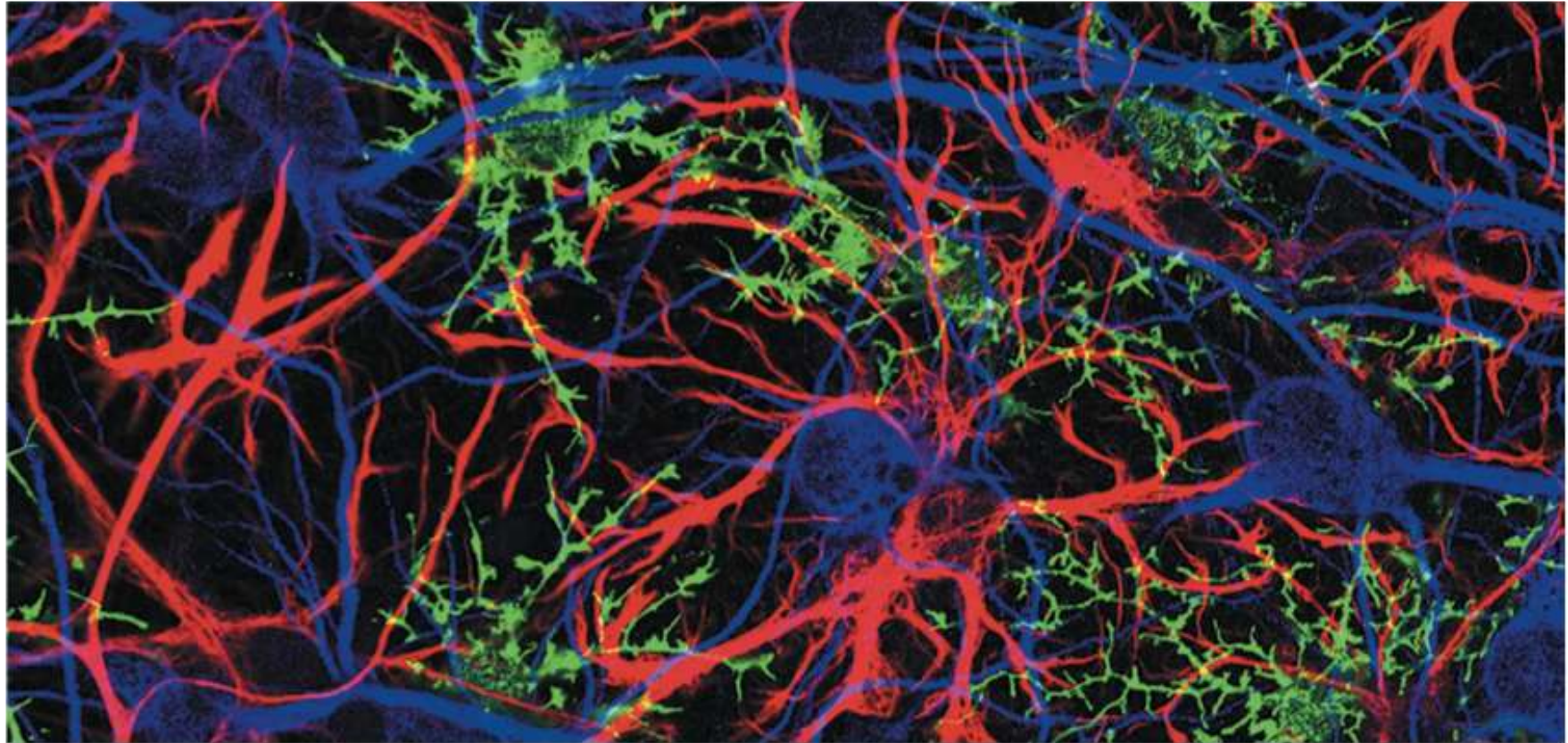


+



# THE OTHER BRAIN

JONATHAN COHEN

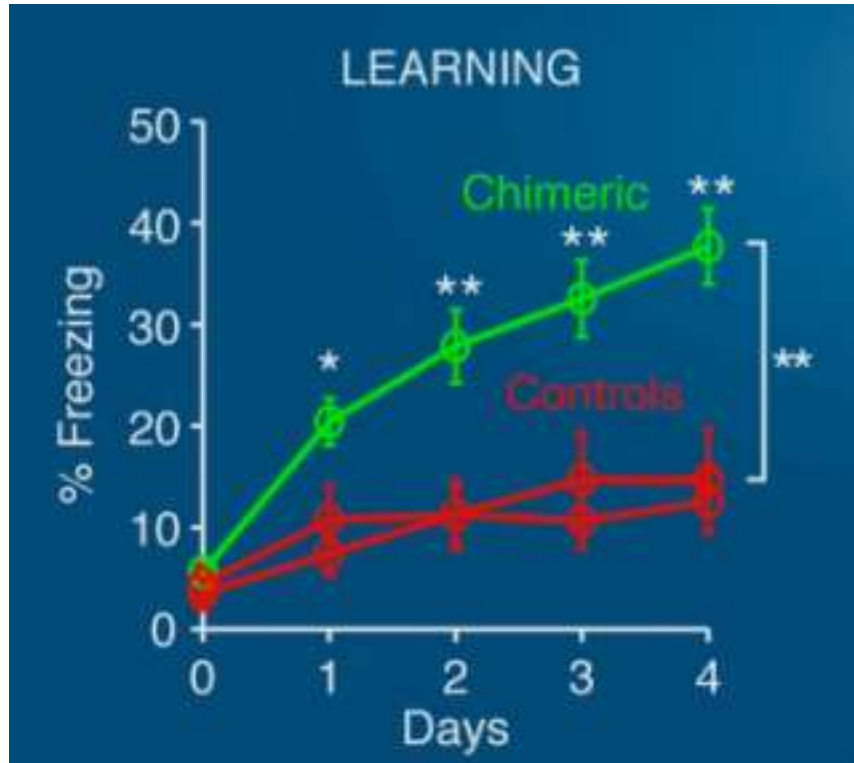


Astrocytes (red) and immature oligodendrocytes (green), types of glial cell, intertwine with neurons (blue) from the brain's hippocampus.

## Map the other brain

Glia, the non-neuronal cells that make up most of the brain, must not be left out of an ambitious US mapping initiative, says **R. Douglas Fields**.

# The **GLIAL** difference



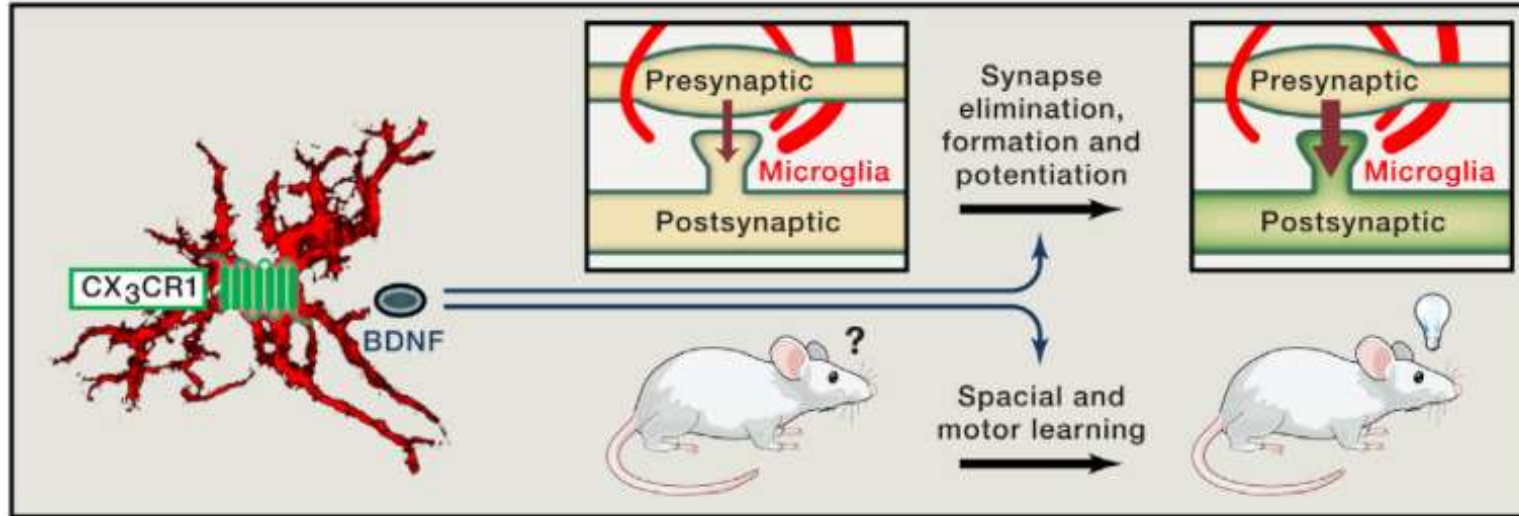
Goldman et al 2013



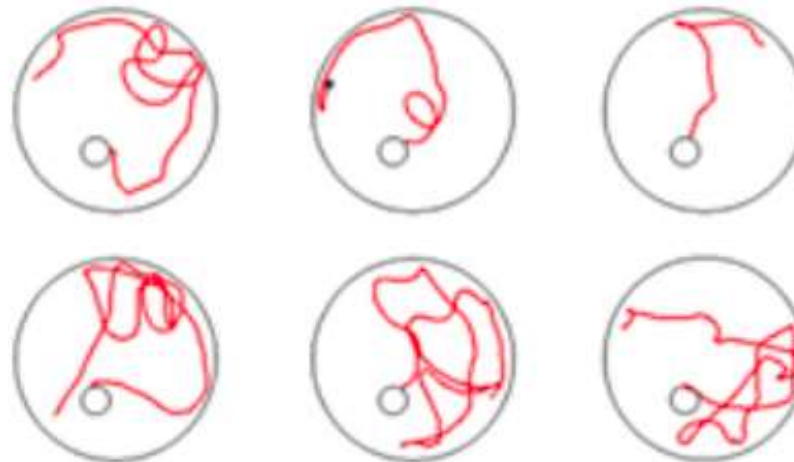


# No conscious memory without peripheral **IMMUNOLOGY**

Synaptic pruning



Learning  
& Memory

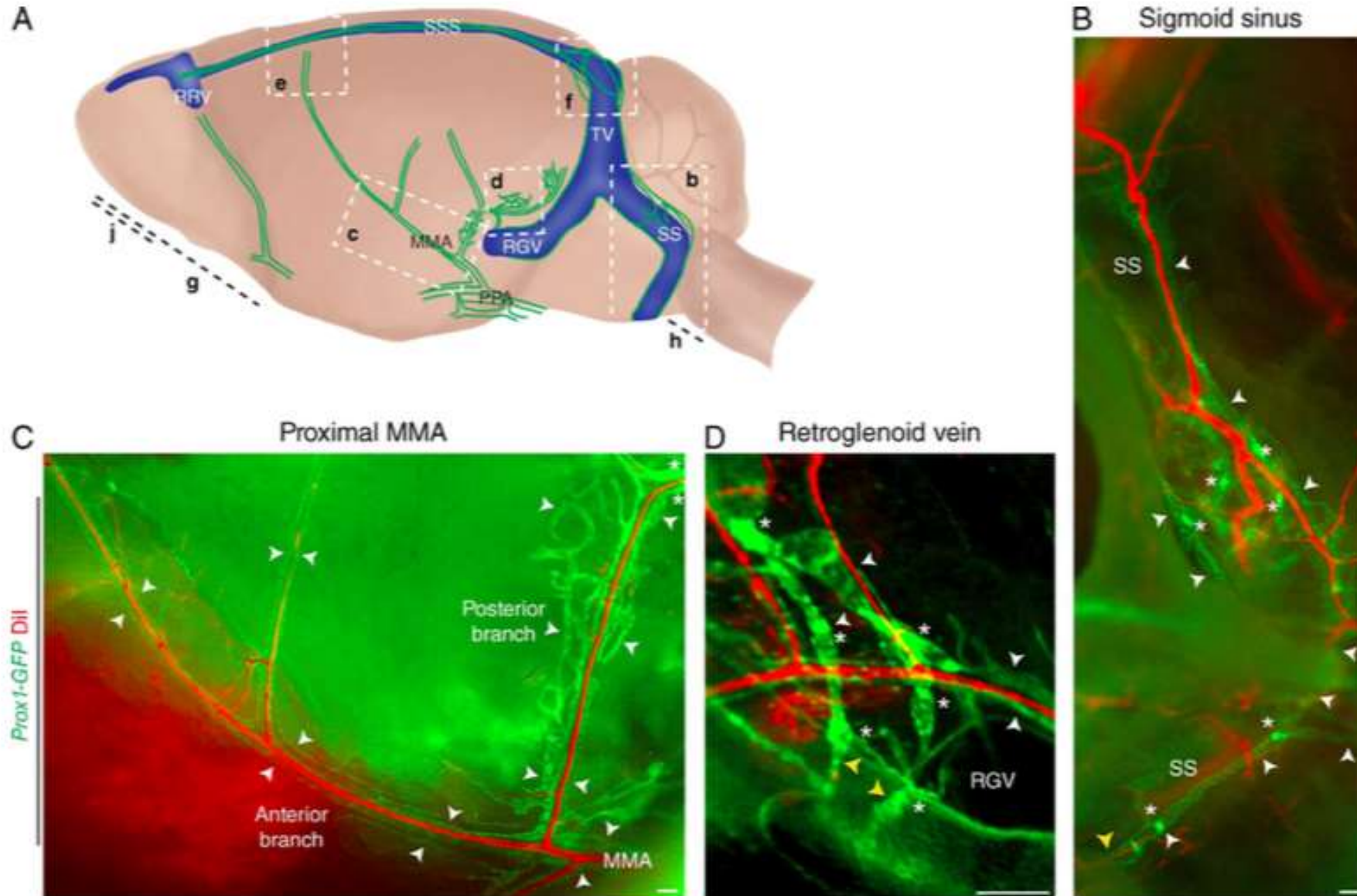


**+ T cells**

**- T cells**



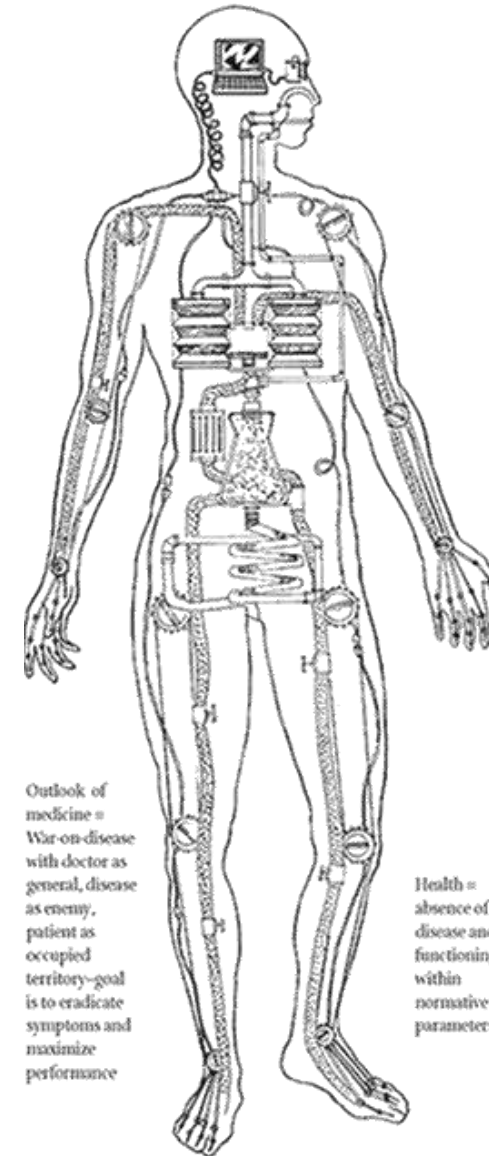
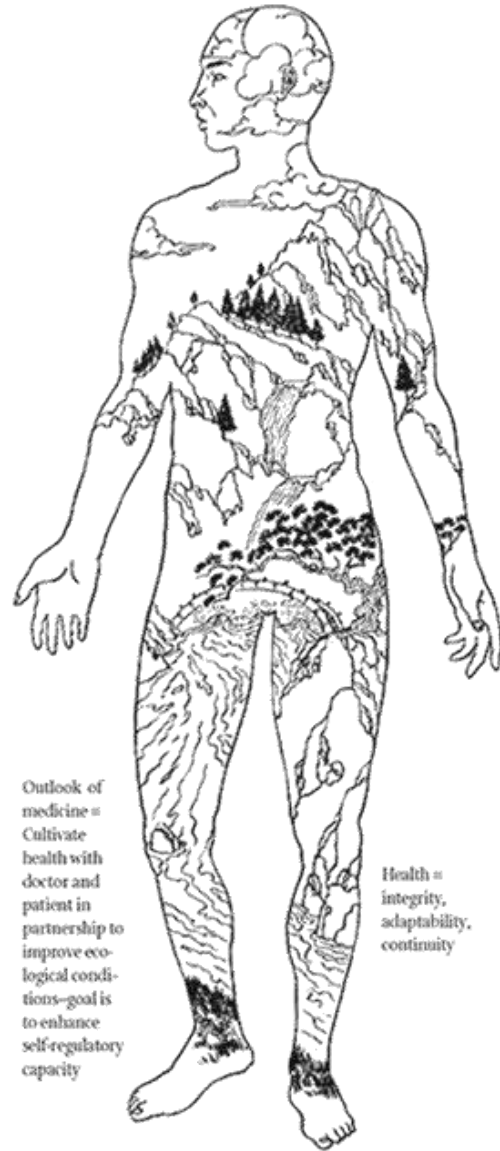
# Brain lymphatics: A Game Changer...



Alitalo et al 2015, Kipnis et al 2015



# GARDEN VS MACHINE





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two way street

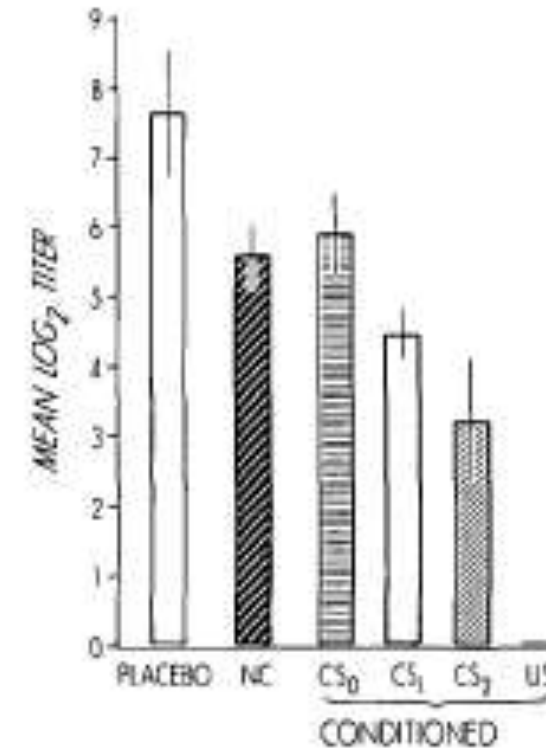
# The **brain** can change immunology

Ader & Cohen showed that taste conditioning affected immune function.  
First experiments that demonstrated that the nervous system can affect the immune system.

TABLE 1. Experimental Treatments

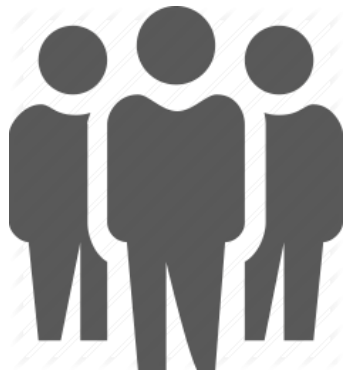
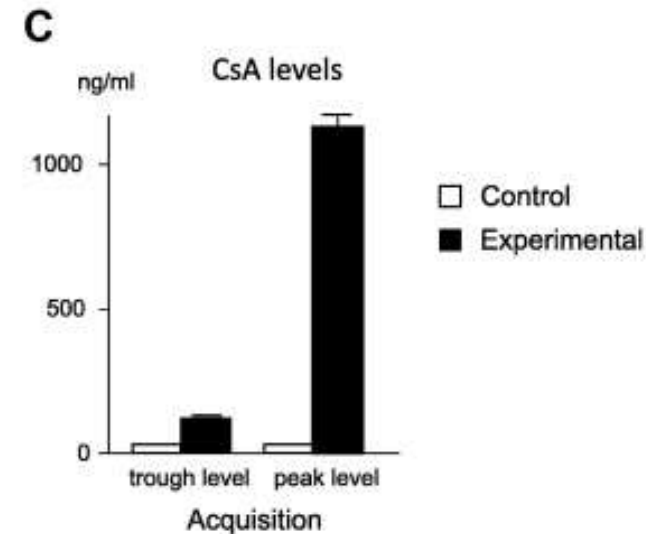
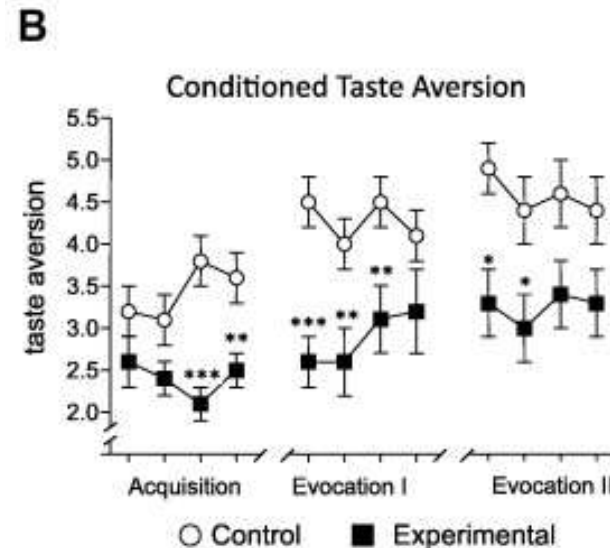
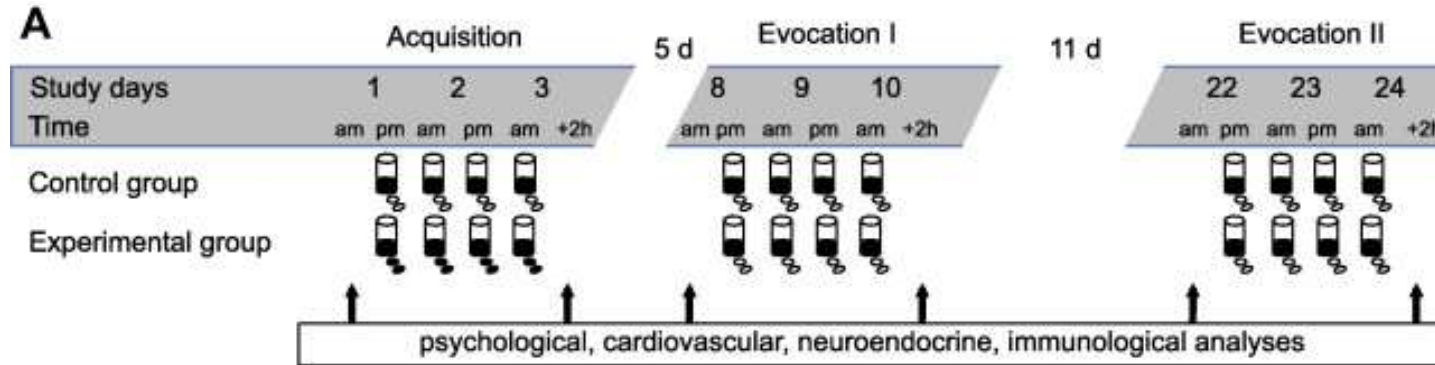
Group	Day 0		Subgroup	N	Day 3		Day 6	
	Drnk. Soln.	Inj.			Drnk. Soln.	Inj.	Drnk. Soln.	Inj.
Conditioned (N= 67)	Saach.	CY	CS <sub>1</sub>	11	Sacch	Sal	H <sub>2</sub> O	—
				9	H <sub>2</sub> O	—	Sacch	Sal
			CS <sub>0</sub>	10	H <sub>2</sub> O	Sal	H <sub>2</sub> O	—
				9	H <sub>2</sub> O	—	H <sub>2</sub> O	Sal
			US	10	H <sub>2</sub> O	CY	H <sub>2</sub> O	—
				9	H <sub>2</sub> O	—	H <sub>2</sub> O	CY
		CS <sub>2</sub>	9	Sacch	Sal	Saach	—	
Nonconditioned (N=19)	H <sub>2</sub> O	CY	NC	10	Sacch	Sal	H <sub>2</sub> O	—
				9	H <sub>2</sub> O	—	Sacch	Sal
Placebo (N=10)	H <sub>2</sub> O	Placebo	P	10	H <sub>2</sub> O	—	H <sub>2</sub> O	—

ROBERT ADER AND NICHOLAS COHEN



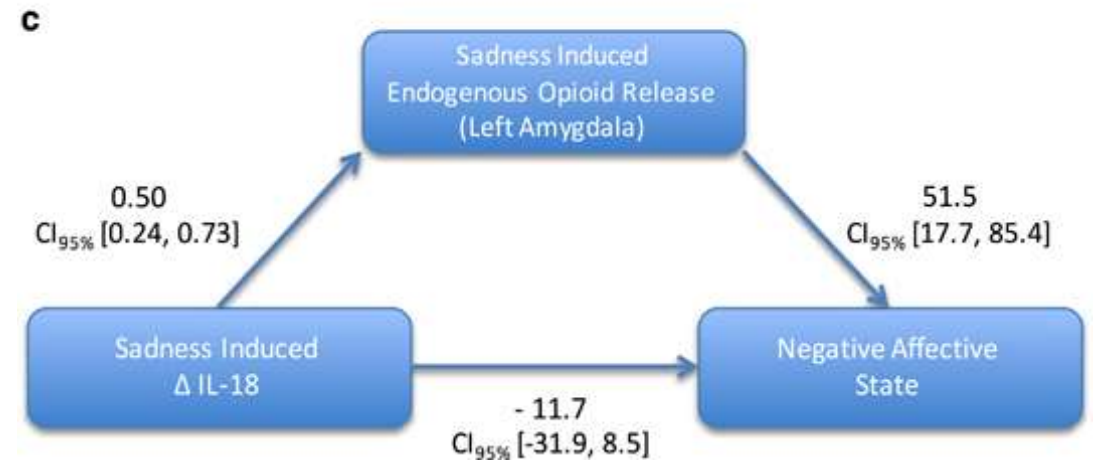
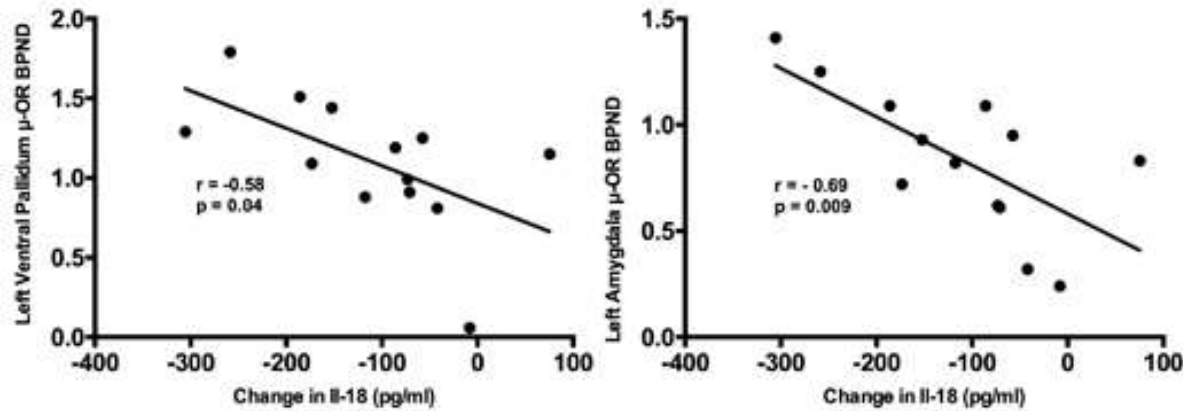
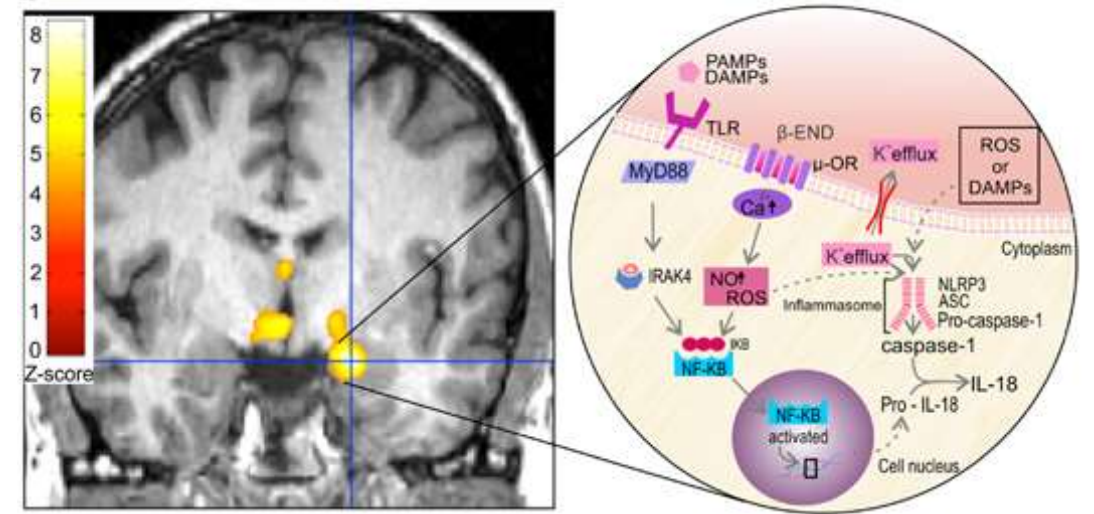
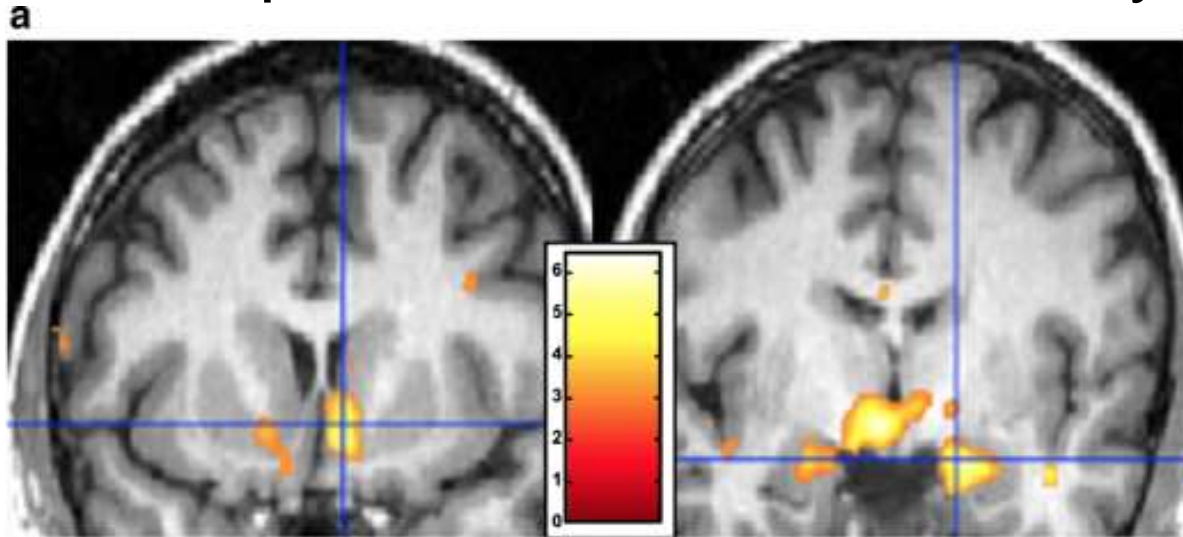
# The **brain** can change **immunology**

Cyclosporin A + with a green-colored, novel-tasting drink  
(150 ml strawberry milk aromatized with lavender oil)

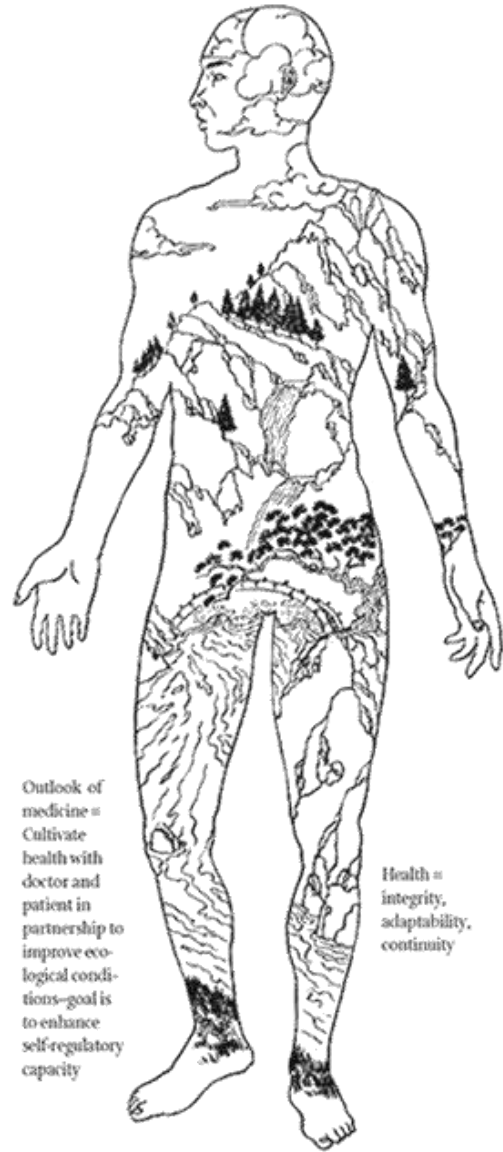


# The **brain** can change immunology

Experimental sadness acutely changes peripheral immunology

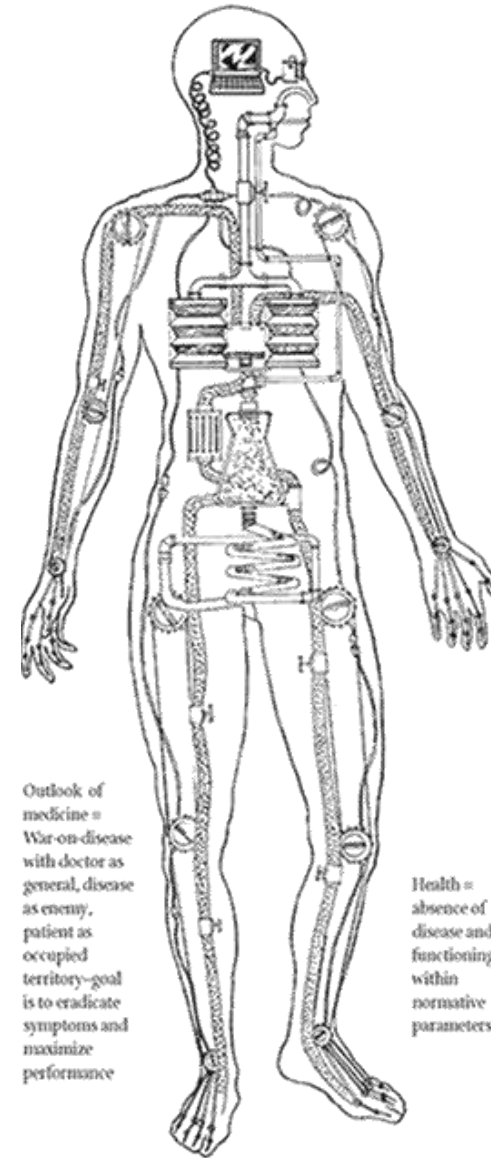


# GARDEN & MACHINE



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Health = integrity, adaptability, continuity



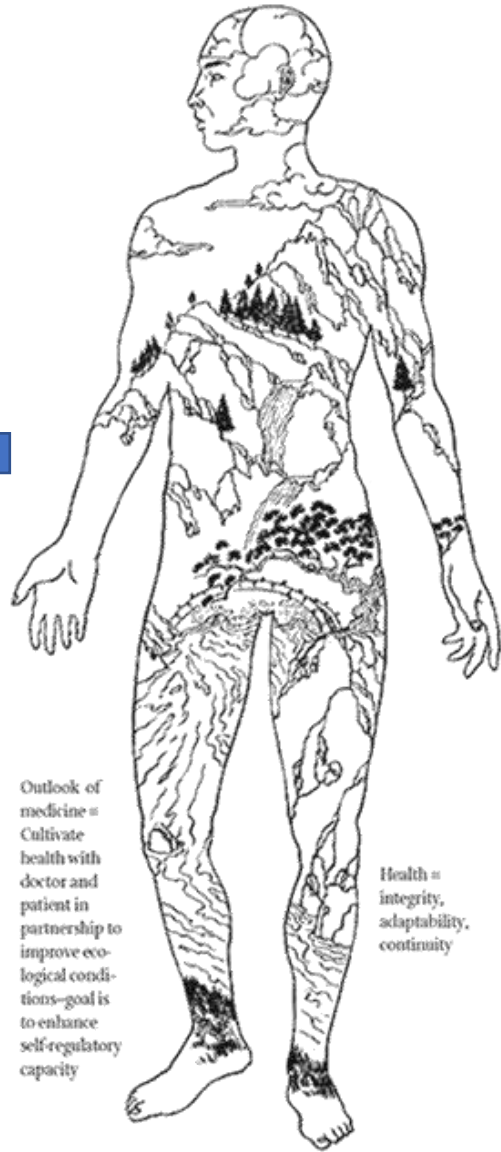
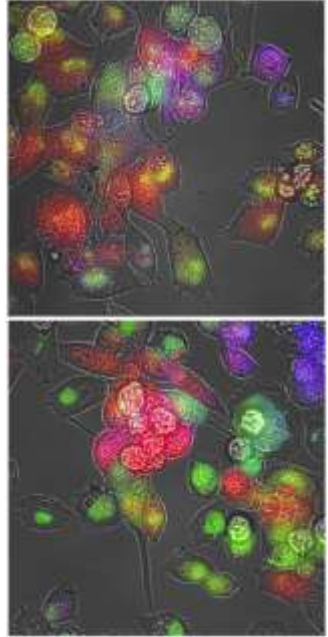
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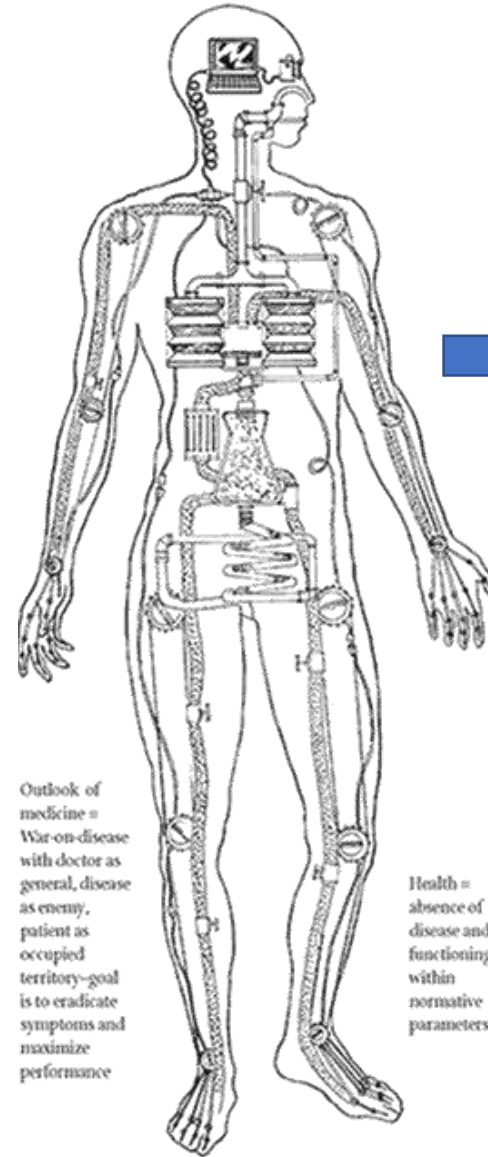


# GARDEN & MACHINE



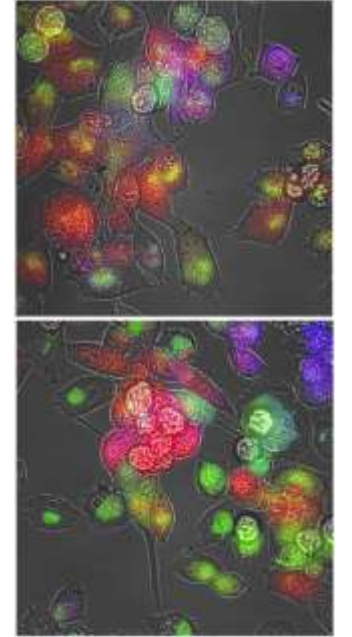
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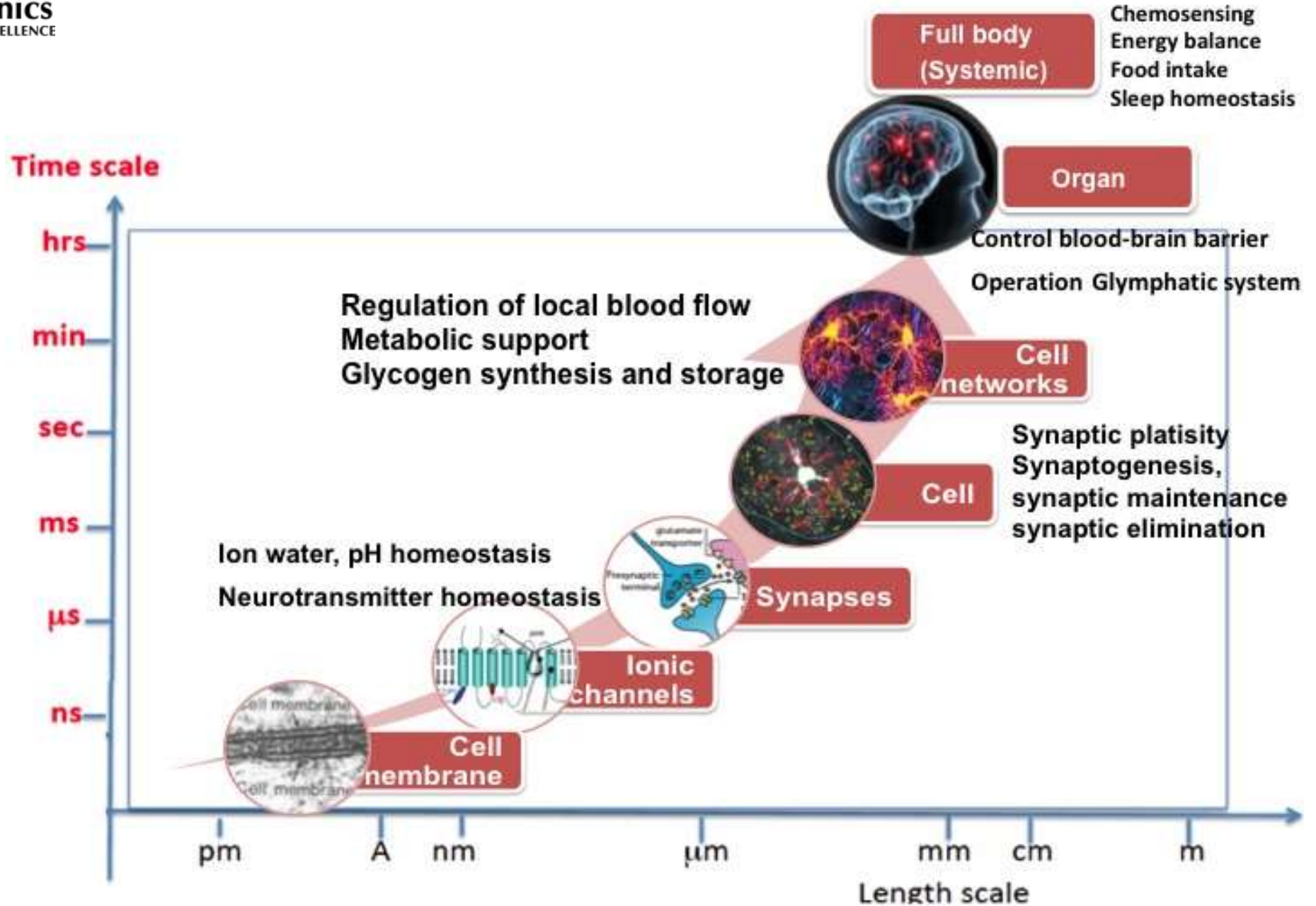
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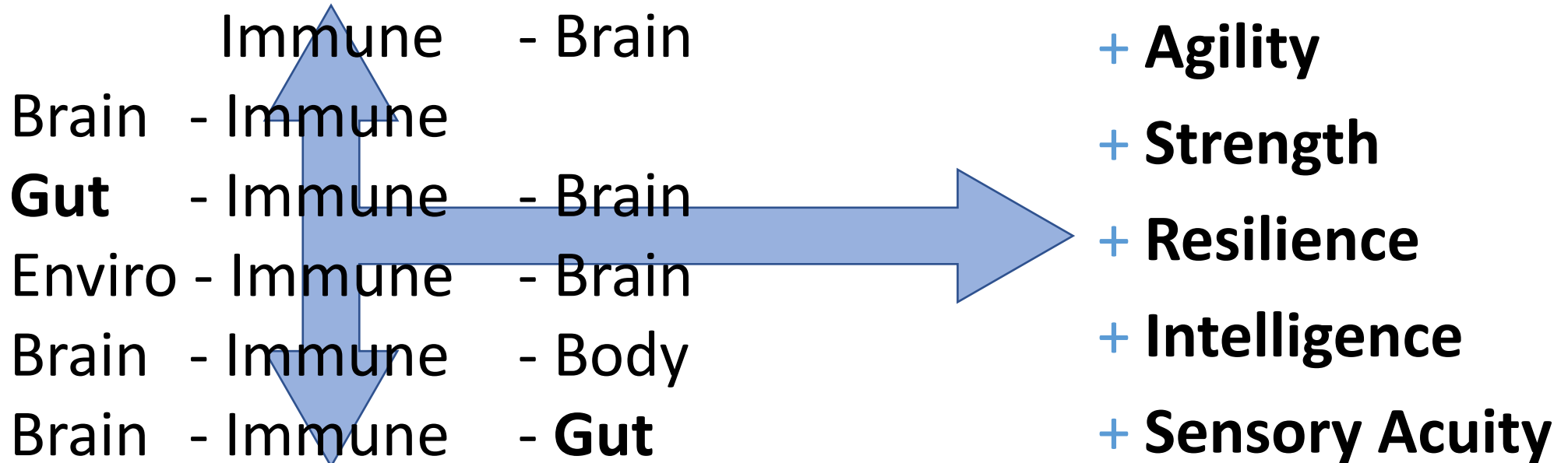


# Convergence of multiscale systems monitoring



# HARNESSING THE MIND-BODY CONNECTION

## Manipulate



## Monitor



Australian Government  
Australian Research Council



**AFOSR**  
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH



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