

Stress is bad, Exercise is good

Are the effects on immunological health really that simple?

Dr Victoria Burns:
v.e.burns@bham.ac.uk
@drvikkiburns

Healthy



Drinking
alcohol

Smoking

Eating
fruit

Drinking
alcohol

Exercising

Stress

Sleeping

Eating fat

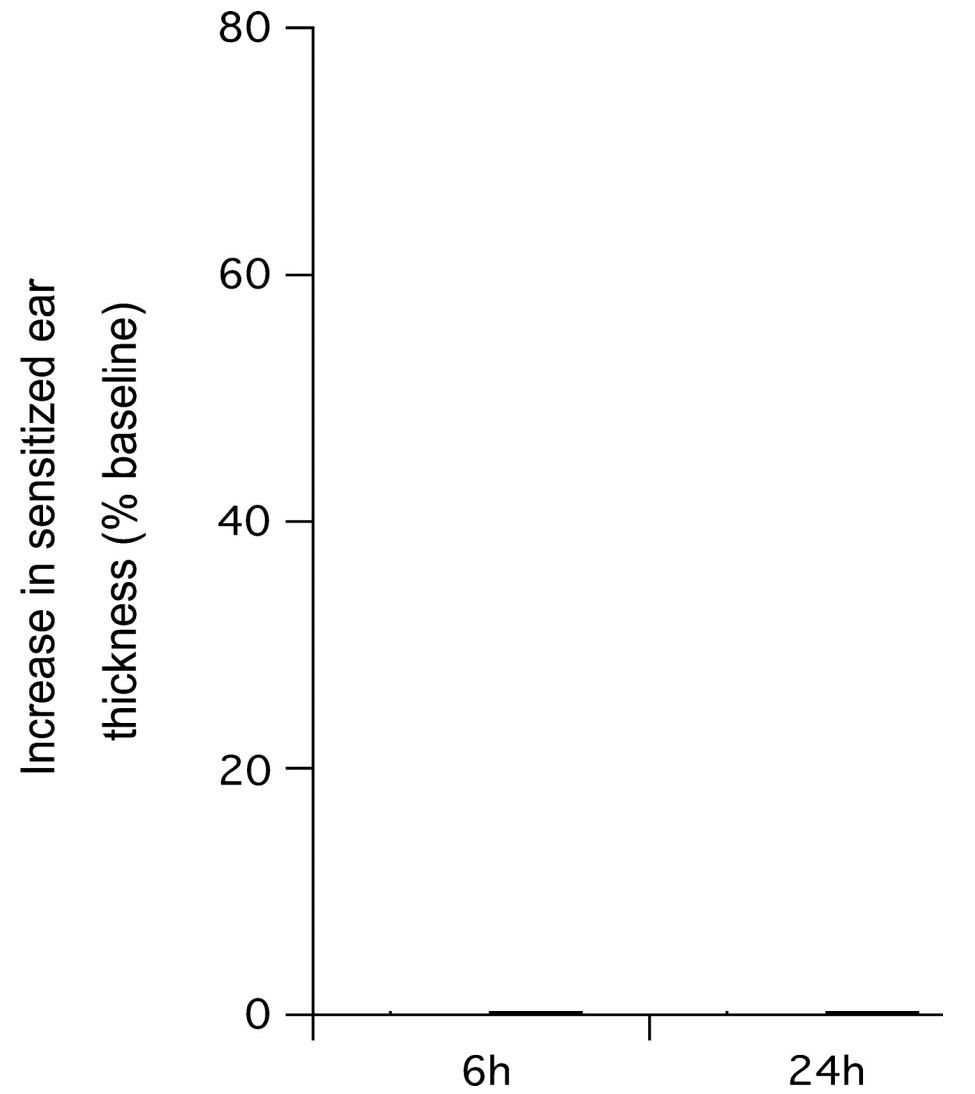
Unhealthy



Eating
fruit

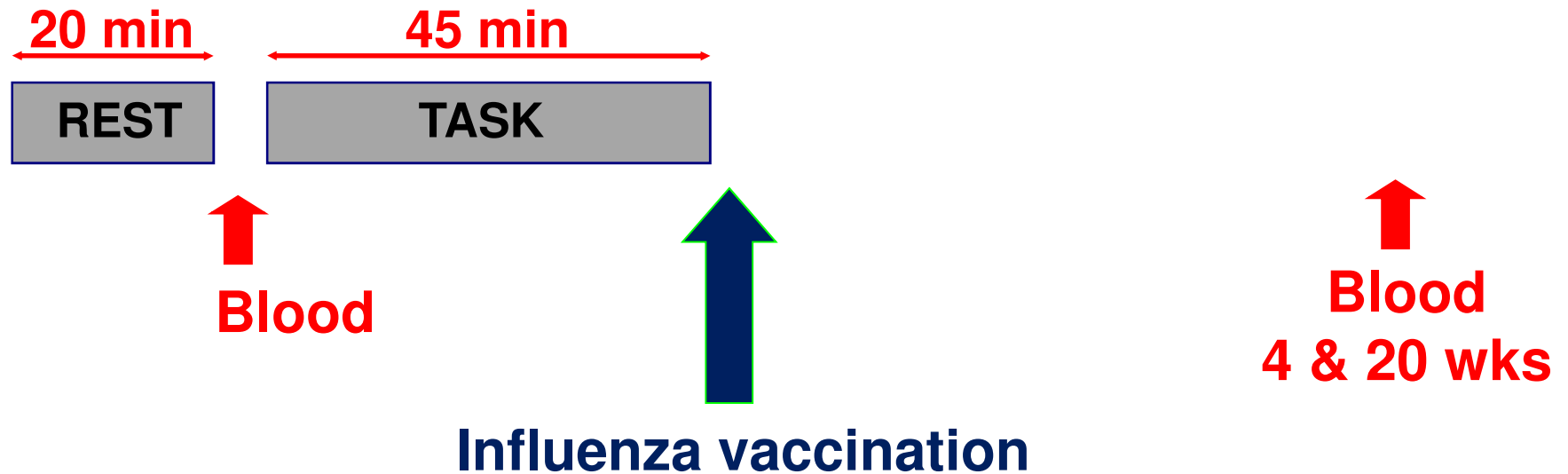
Sleeping





Viswanathan et al. 2005

Acute stress and vaccination



Stress



Exercise



Control



(Edwards et al, 2006)

Paced auditory serial addition task

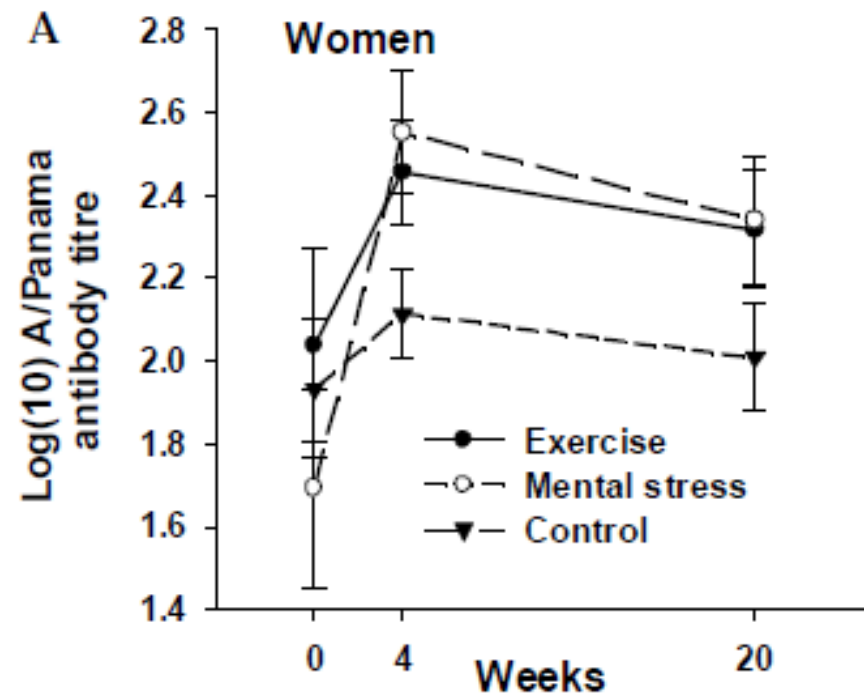
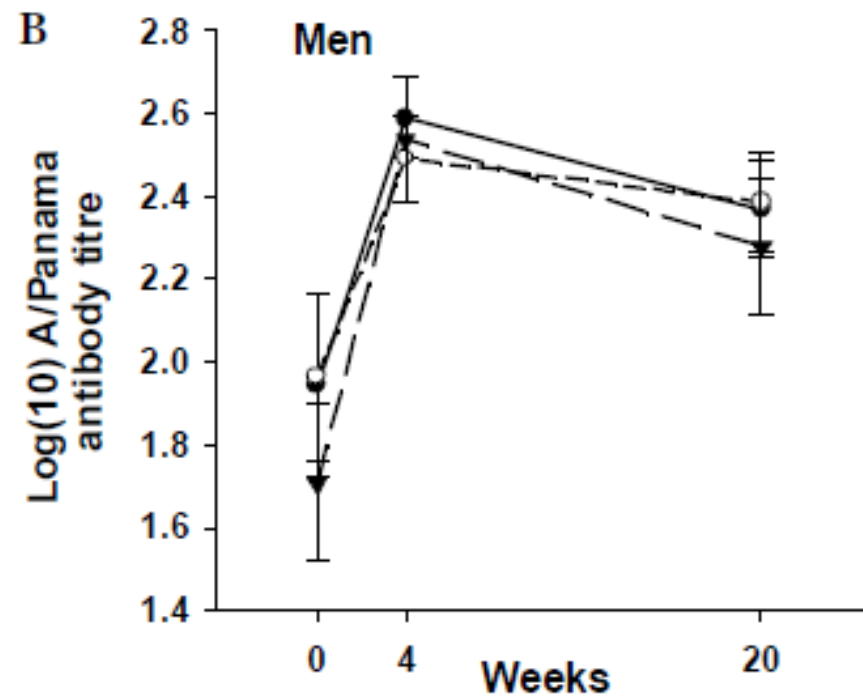
4

3 → 7

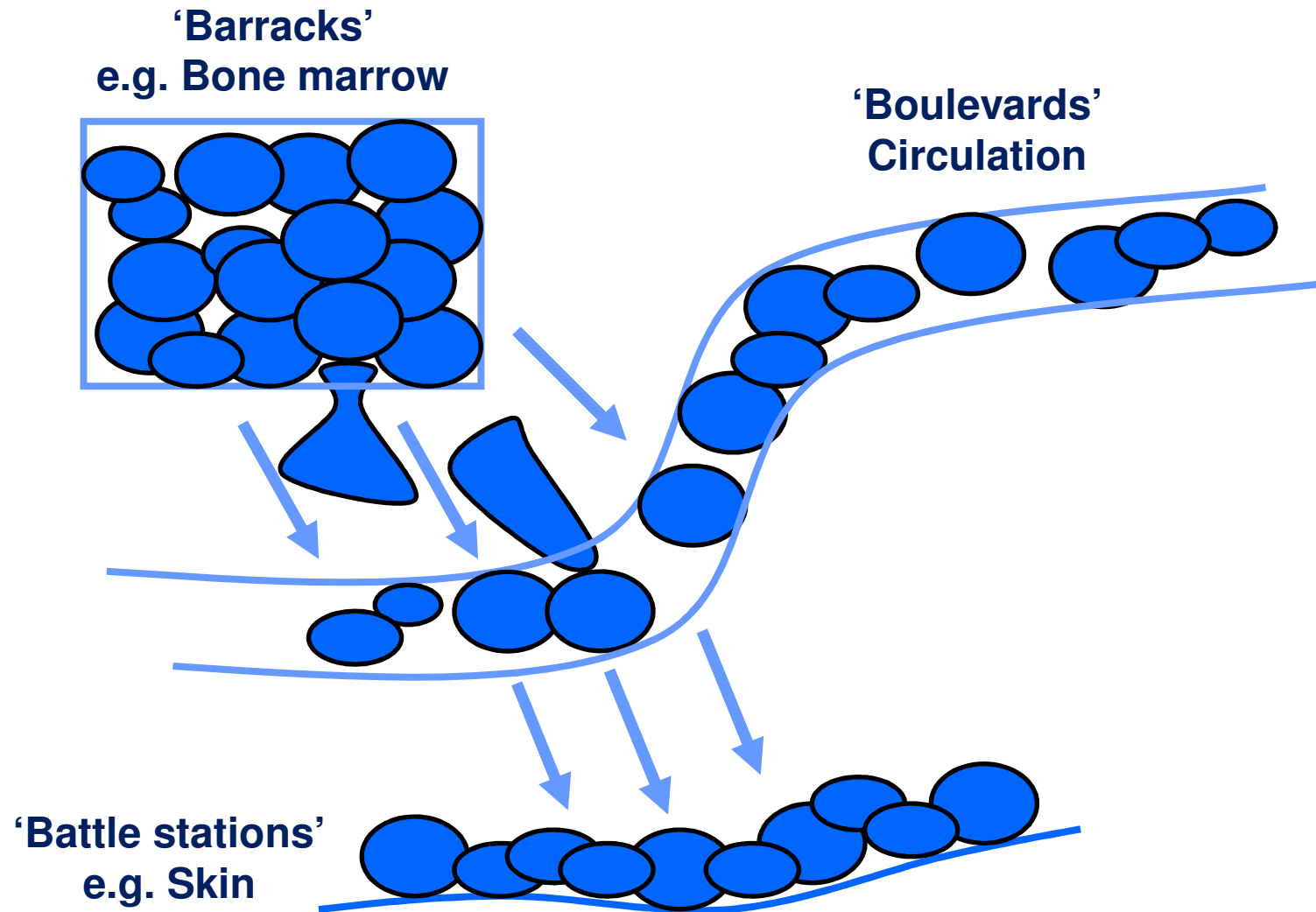
9 → 12

3	6	4	1	9	7	2	8	8	5
	9	10	5	10	16	9	10	16	13

Antibody response to vaccination



Proposed mechanism



Dhabhar & McEwen (1999)

Stress lymphocytosis



Dr Leila Anane



Dr Jos Bosch

Anane et al, 2009



What alien defence do you want on patrol?



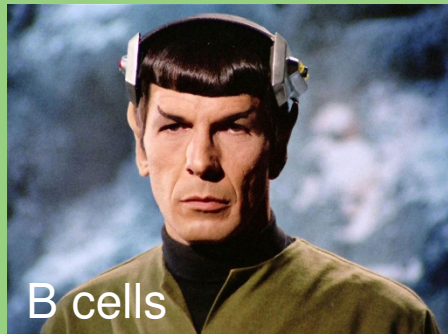
CD4 cells

Recognises only one type of alien. Can't kill them directly, but vital to coordinate effective response in the longer term; won't respond to other aliens.



Natural killer cells

Recognises ANY aliens. Effective at containing/killing them in the short term.



B cells

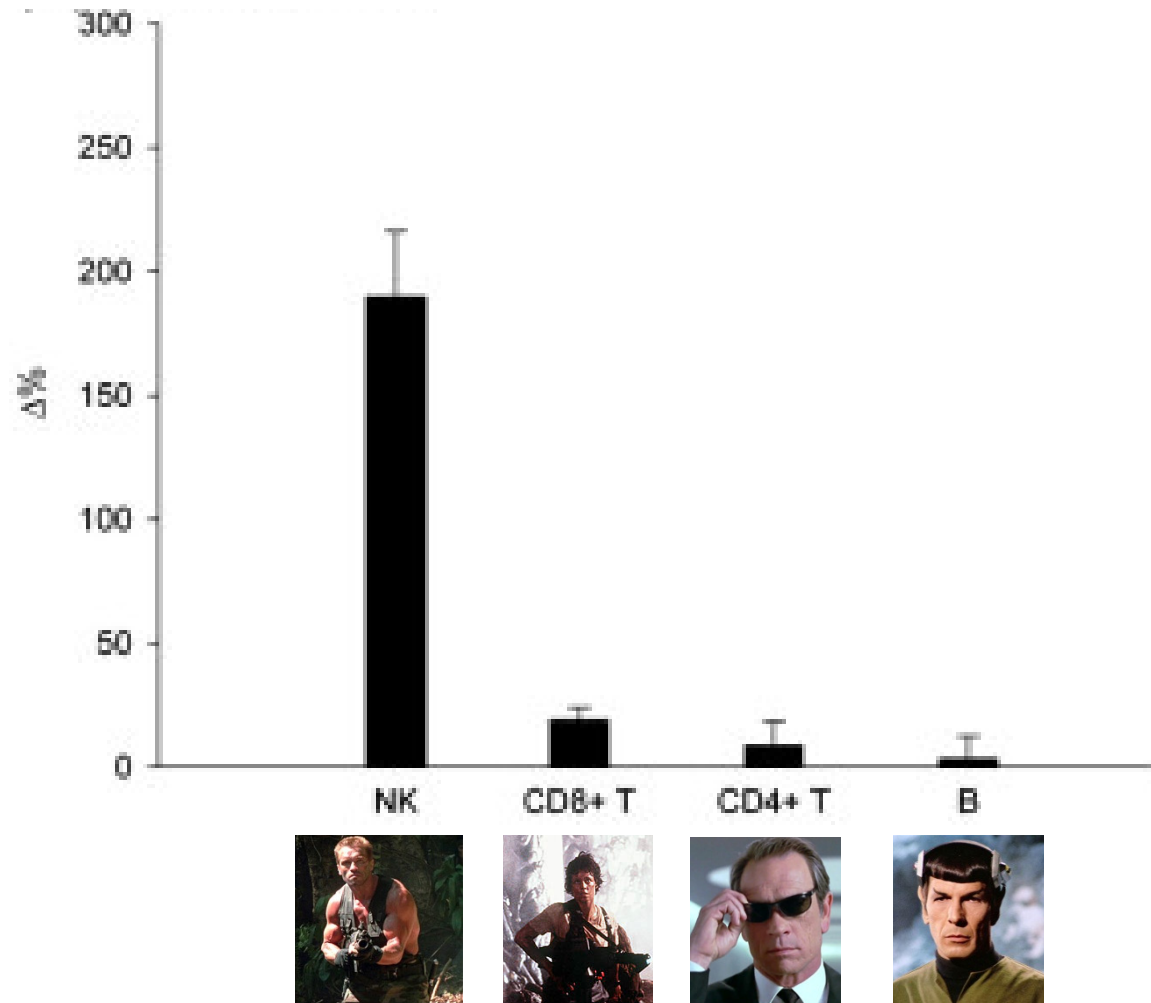
Recognises only one type of alien. Can't kill them directly, but produces tools to contain them and signal for support in the longer term; won't respond to other aliens.



CD8 cells

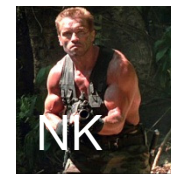
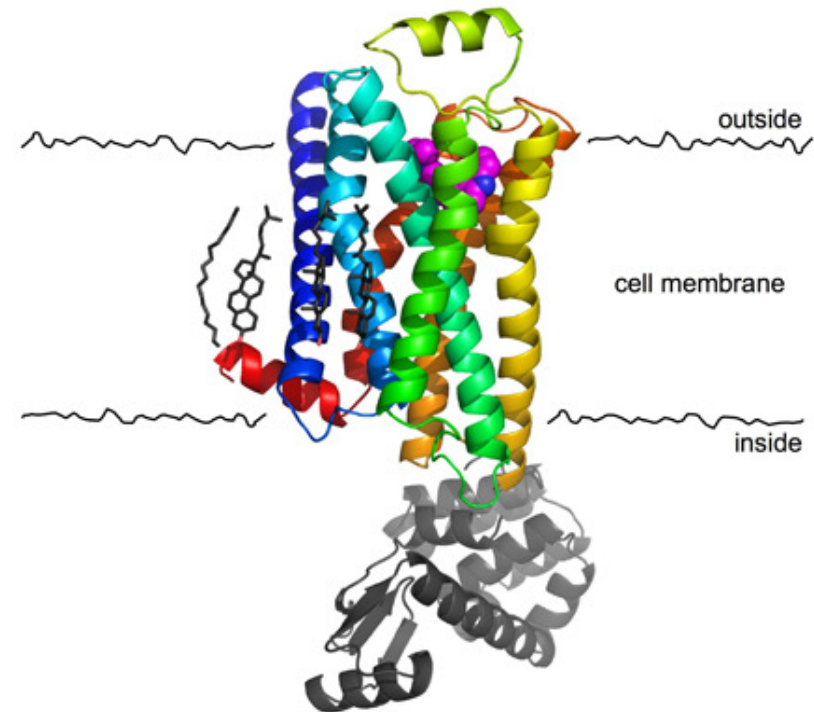
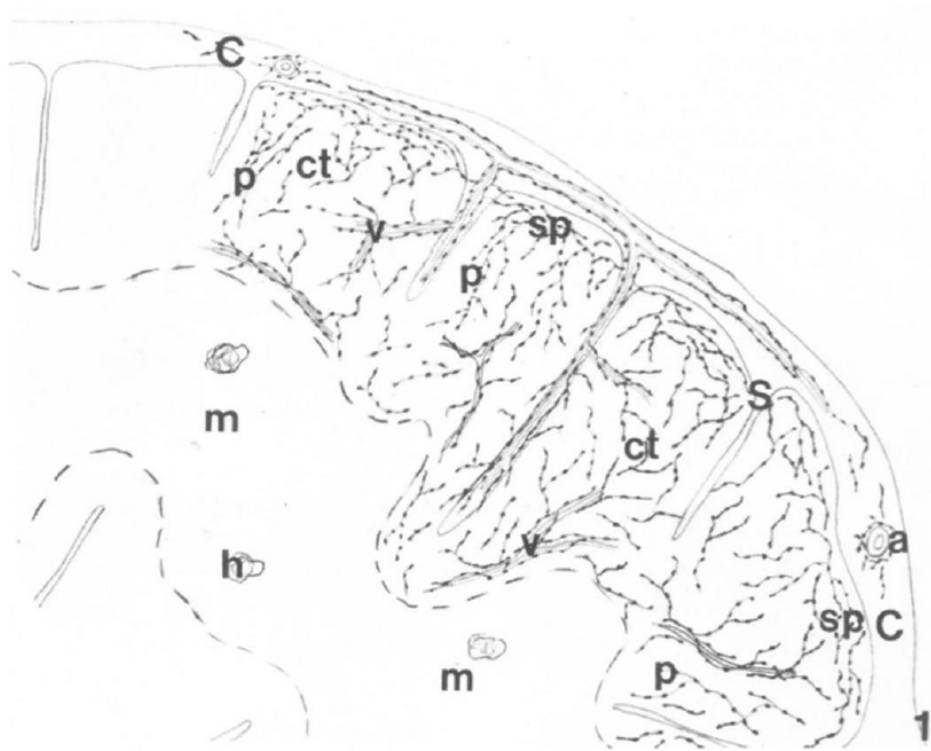
Recognises only one type of alien. Highly effective at killing; won't respond to other aliens.

Selective lymphocytosis



Anane et al, 2009

Highly coordinated adaptive response



+++



+++



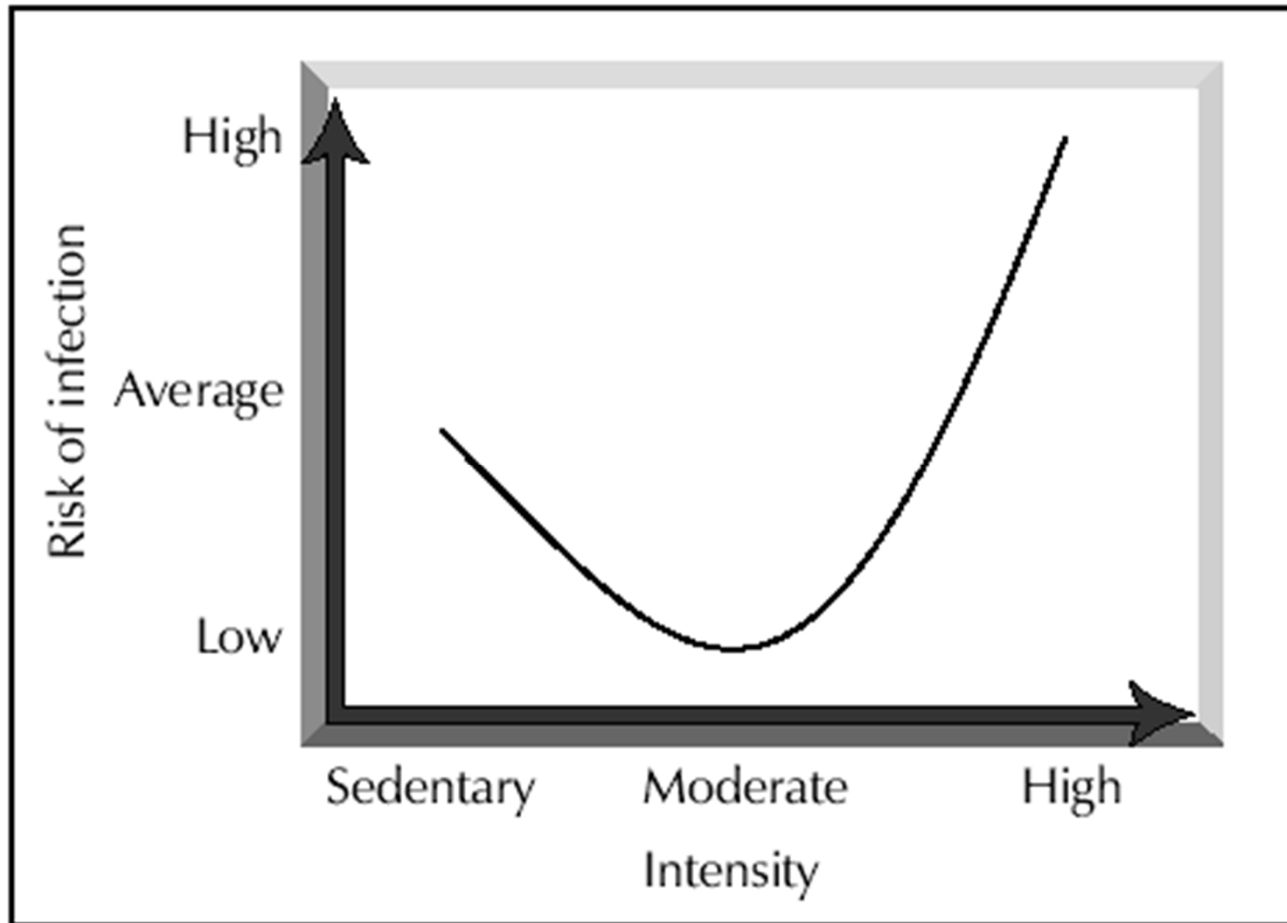
++



+

Felten et al, 1985

Surely exercise is good?



Overtraining

- Underperformance
- Altered mood
- Chronic fatigue
- Sleep disturbance
- Muscle weakness
- Sore/heavy muscles
- Reduced motivation
- Increased sleeping heart rate
- Loss of appetite
- Gastrointestinal disturbance
- Recurrent infection
- Slow wound healing



Immune
dysregulation
Symptom
or cause?

Symptoms of an infection

Overtraining

Underperformance

Altered mood

Chronic fatigue

Sleep disturbance

Muscle weakness

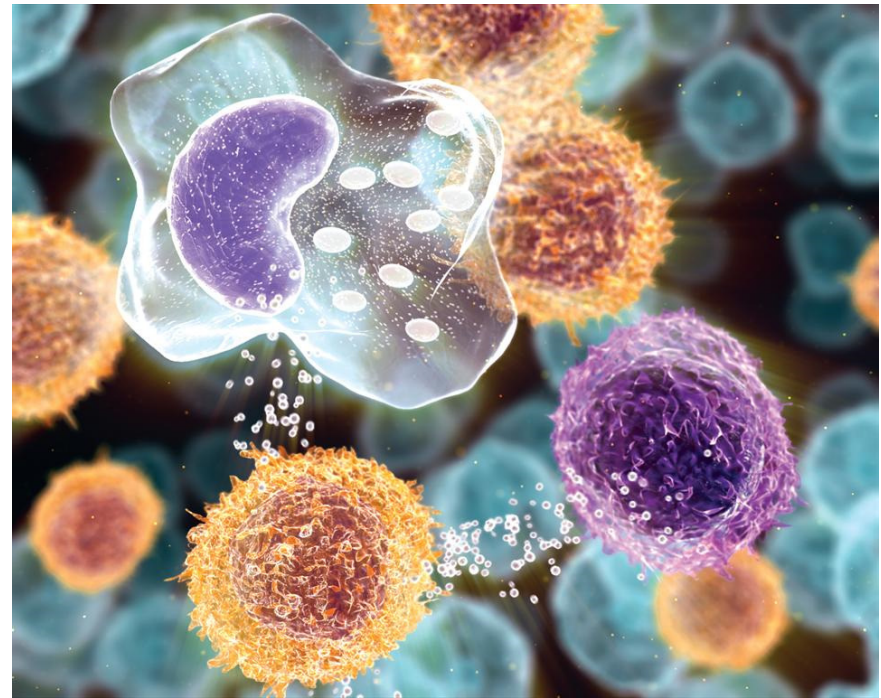
Sore/heavy muscles

Reduced motivation

Increased sleeping heart rate

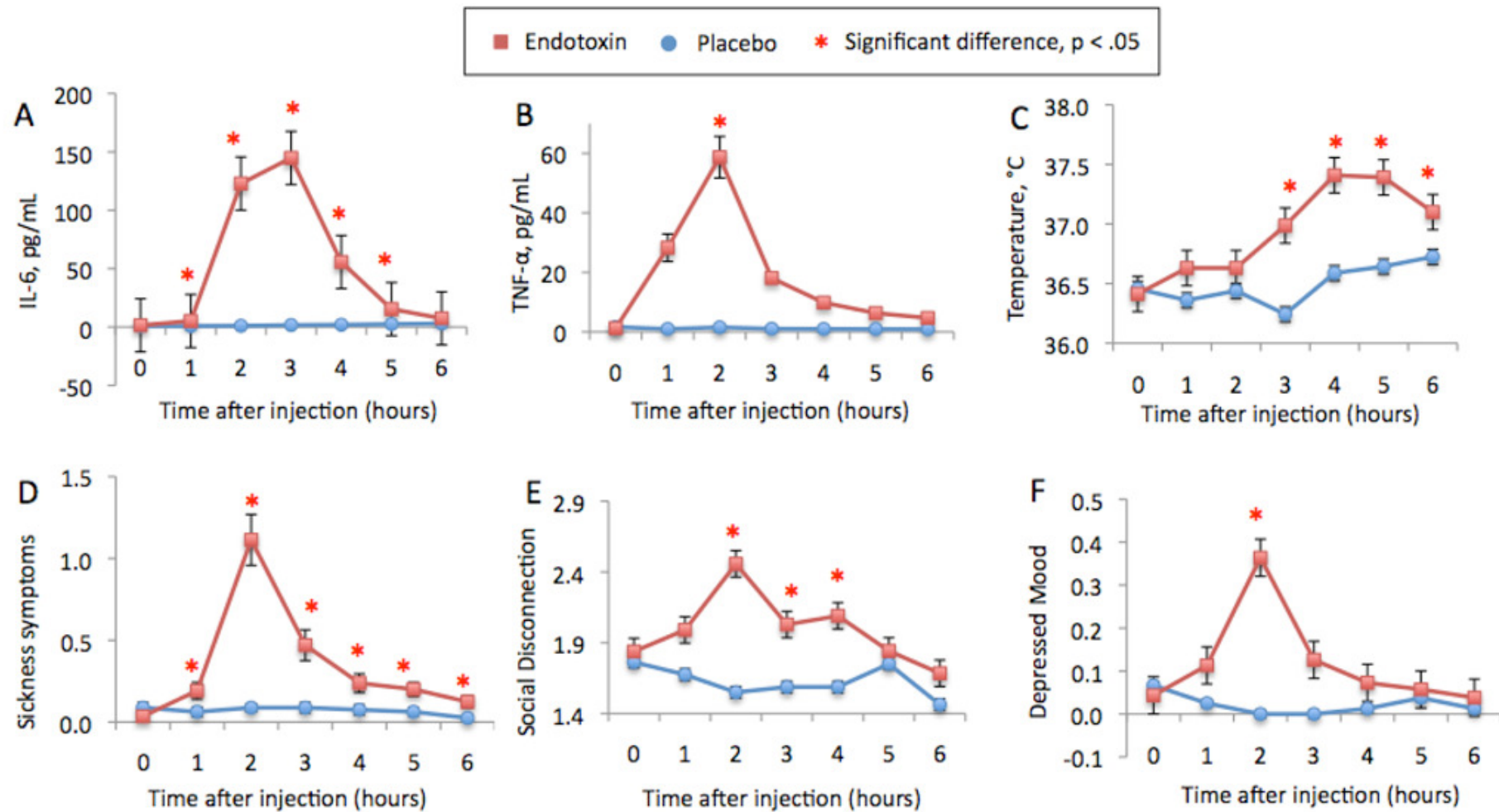
Loss of appetite

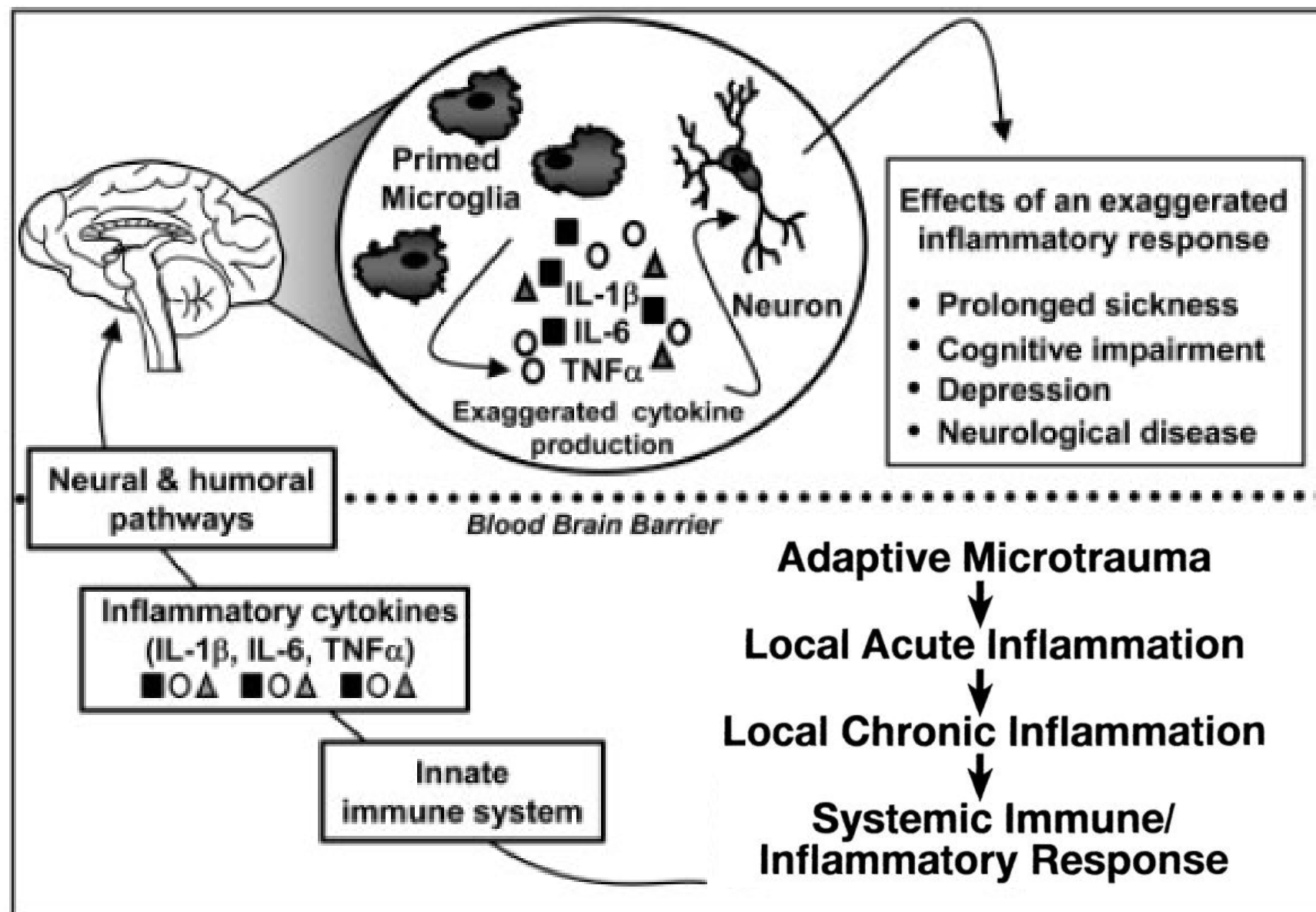
Gastrointestinal disturbance



Cytokines

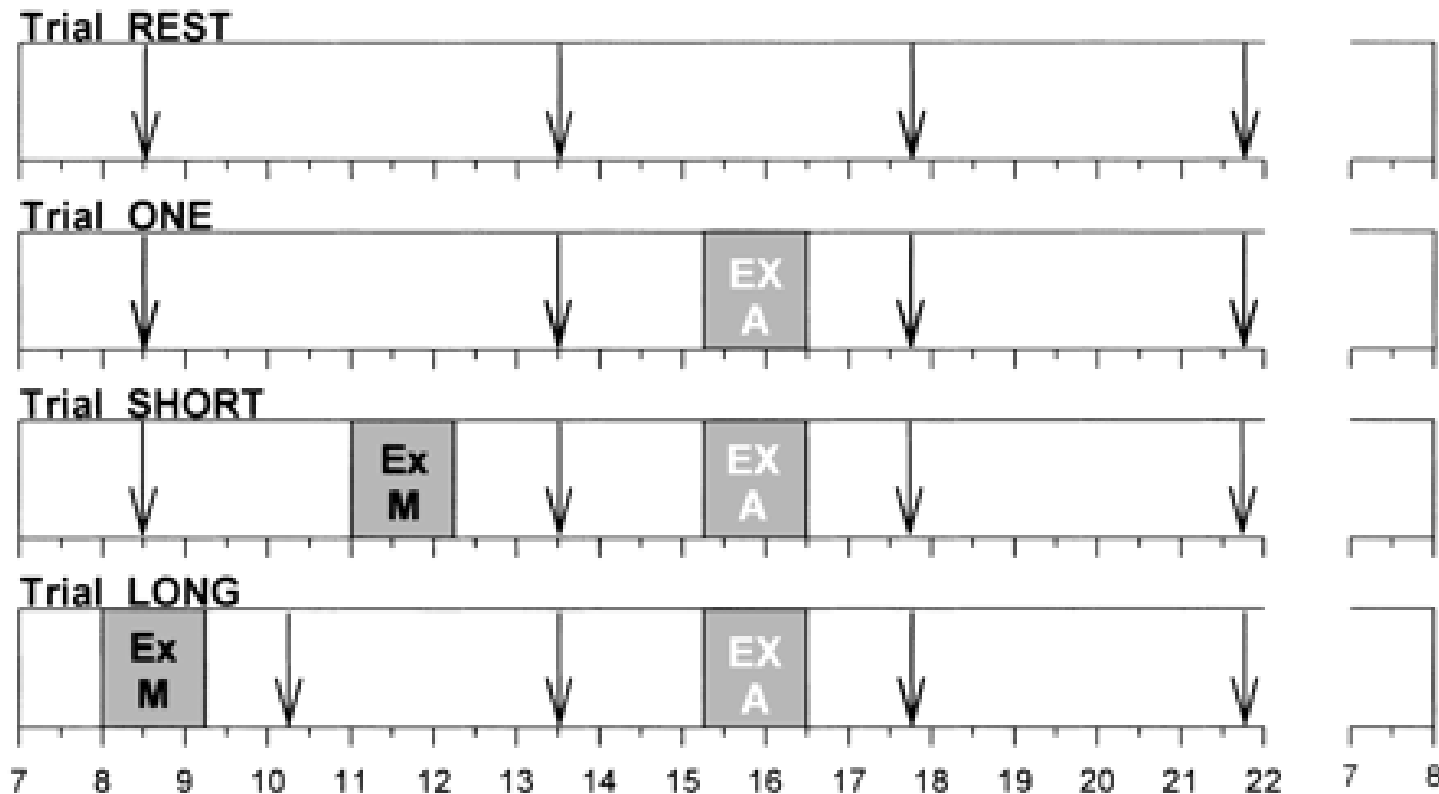
Immune effects on behaviour



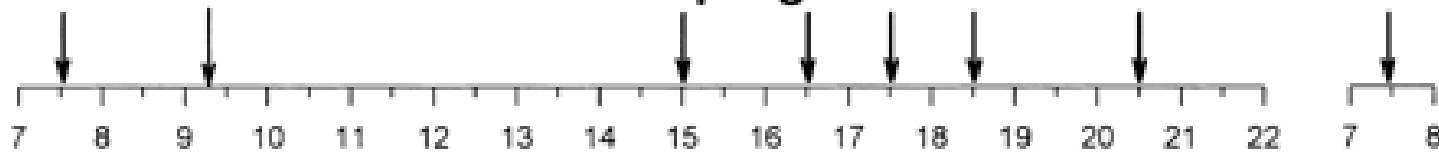


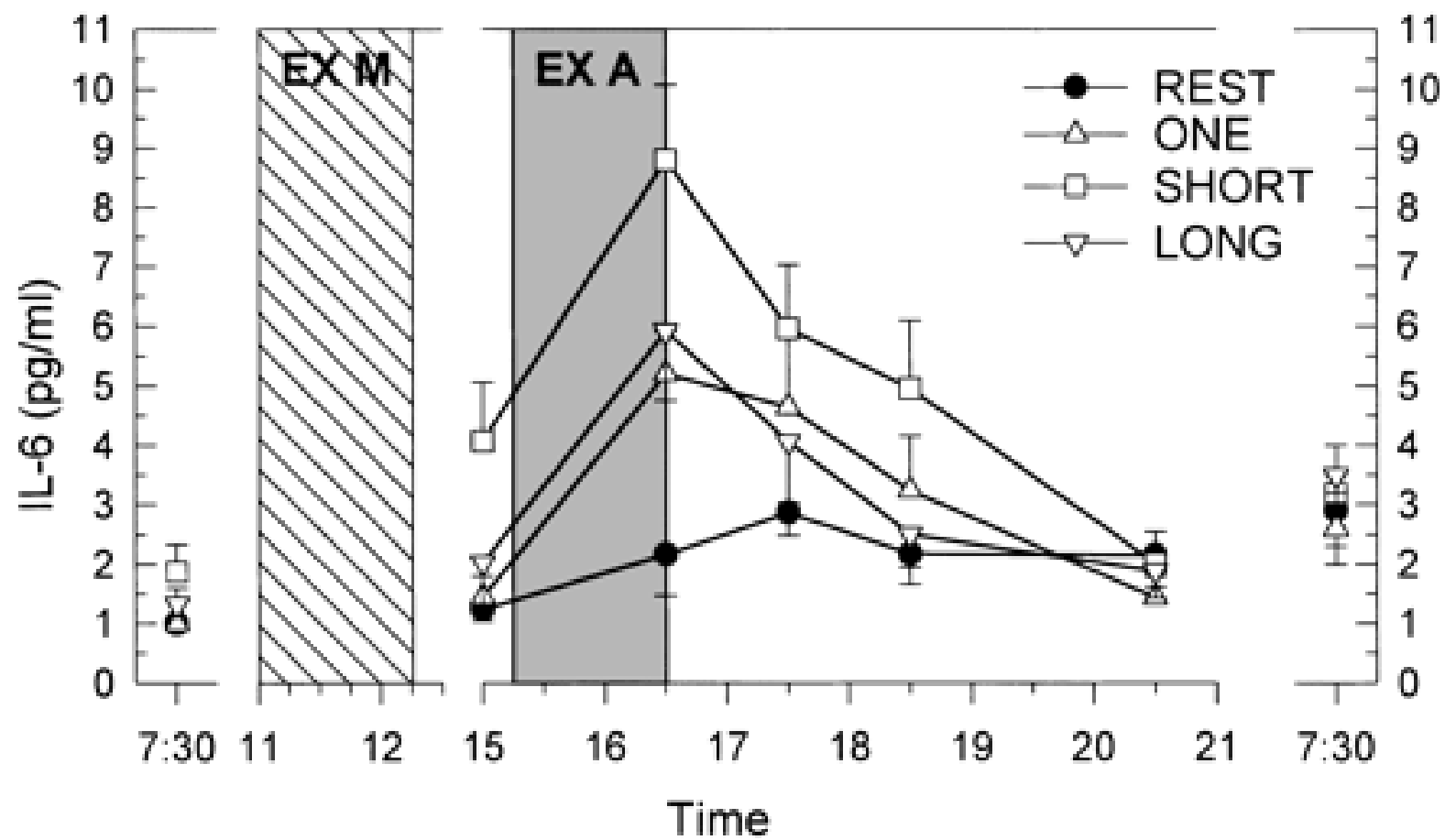
Adapted from Godbout et al 2005 and Smith, 2000

Exercise and meal schedule

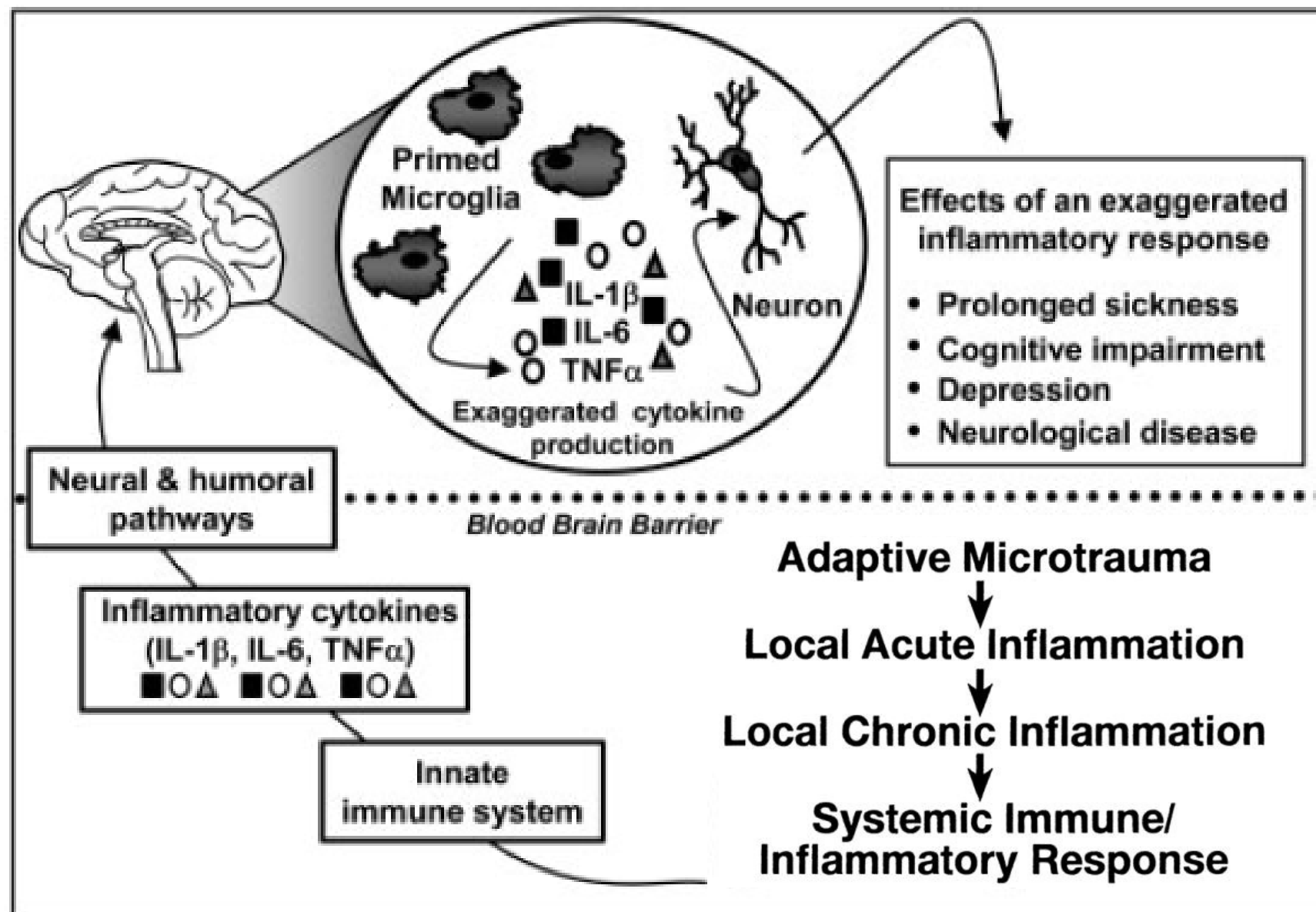


Blood sampling schedule





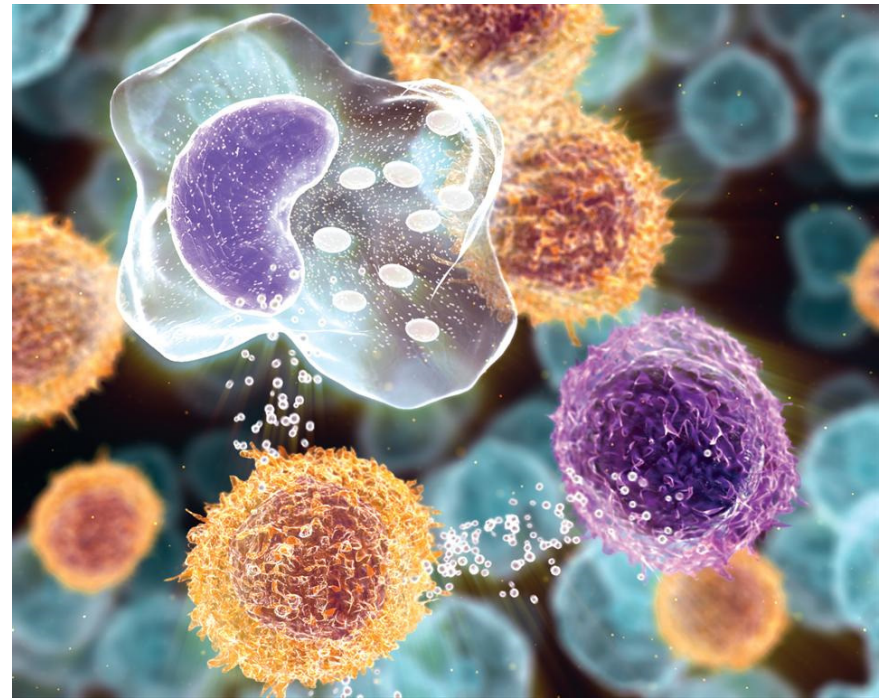
Ronson et al, 2002



Adapted from Godbout et al 2005 and Smith, 2000

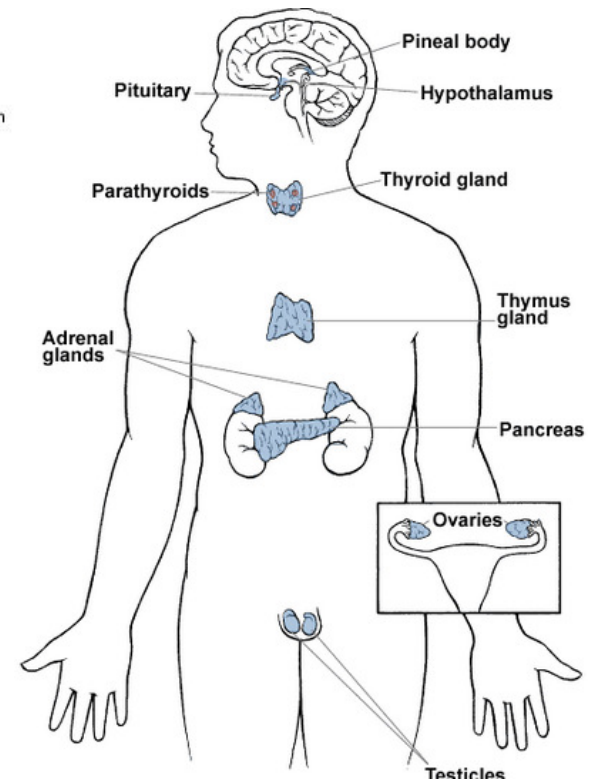
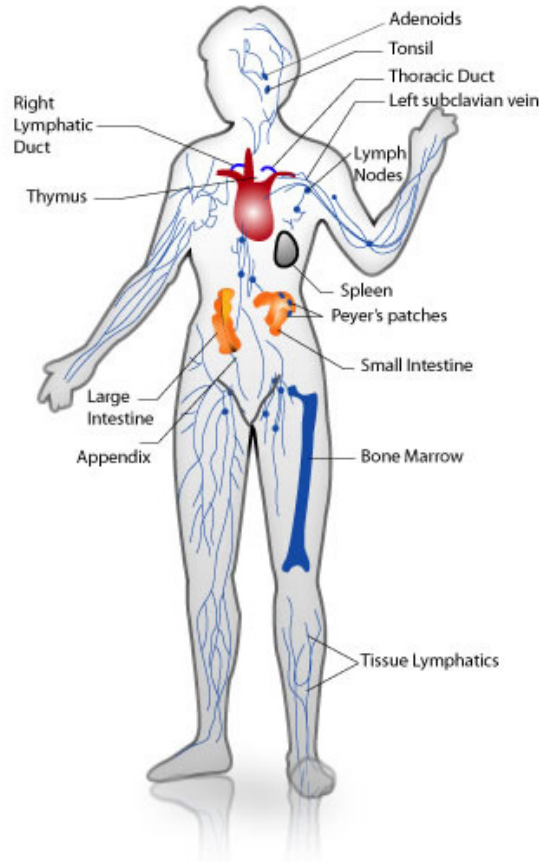
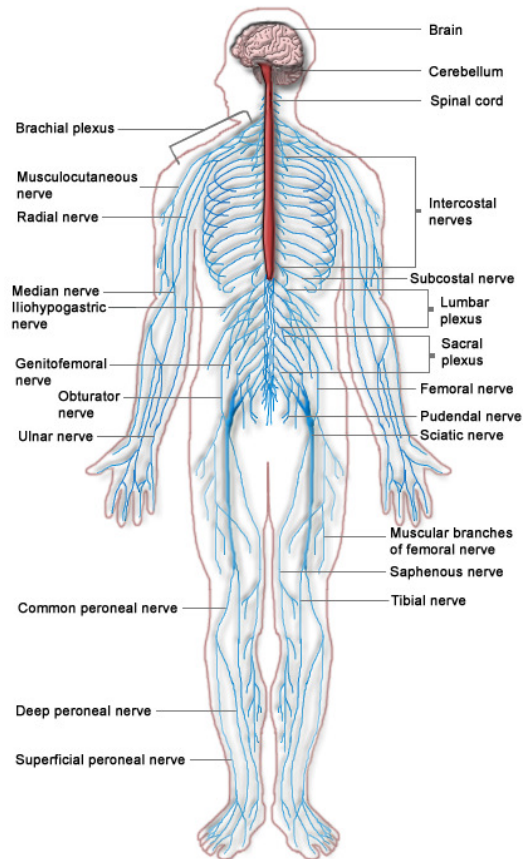
Common aetiology

Underperformance
Altered mood
Chronic fatigue
Sleep disturbance
Muscle weakness
Sore/heavy muscles
Reduced motivation
Increased sleeping heart rate
Loss of appetite
Gastrointestinal disturbance



Cytokines

Complexity and interaction



Stress is bad, Exercise is good

Are the effects on immunological health really that simple?

Dr Victoria Burns:
v.e.burns@bham.ac.uk
@drvikkiburns