University of Essex

The Physiological Society

A sporting chance: The 5 rings of success

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University of Essex

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ASE annual conference

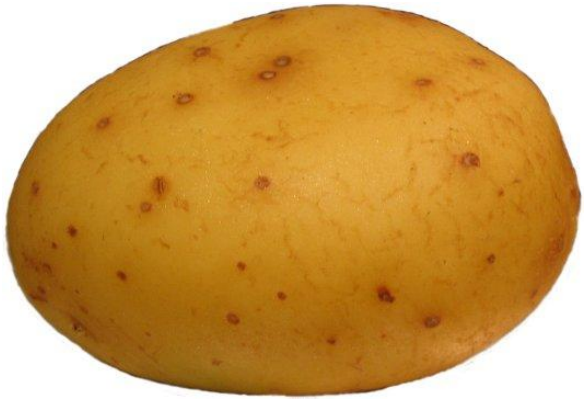
BPS BRITISH PHARMACOLOGICAL SOCIETY
Today's science, tomorrow's medicines

Biochemical Society
Advancing Molecular Bioscience

The Olympics
is coming…

But what makes
an Olympian

Why is someone a couch potato?



And another a double gold winning Olympian?
-like Kelly Holmes

The Mind/Brain

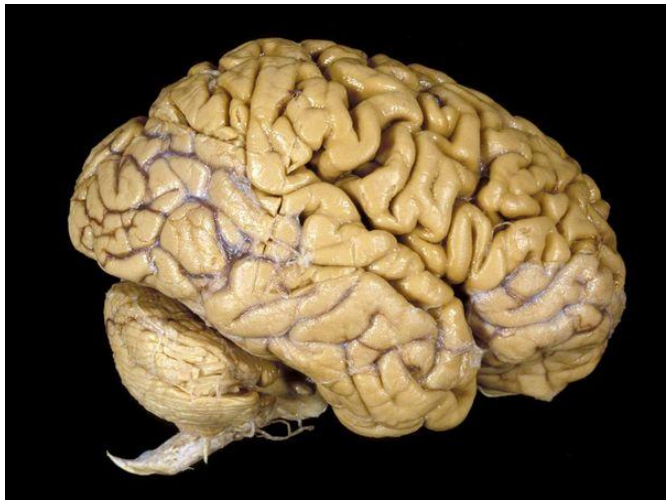
The X Factor

The Body

Training

Fuel and ergogenics

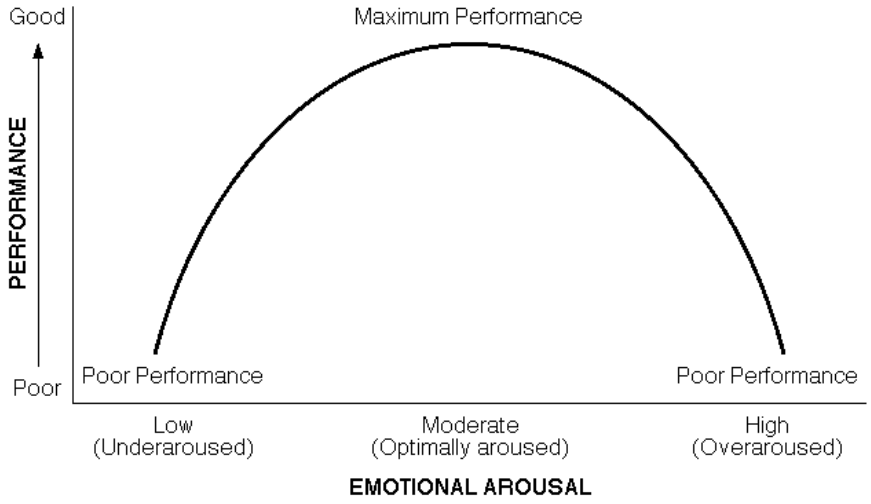
The Body



Which sports involve the brain?

The mind: arousal

Let's start at the start!



- Cognitive anxiety vs physiological arousal

- Competition seen as challenge or a threat
- Is the athlete a Crowd pleaser?

The mind: the use of music

- Music can help increase/decrease arousal

Different sports stars are believed to listen to different types of music- not always what you would expect

The mind: getting it wrong!

On your marks…..

Reaction time

1. Gun sound
2. ear
3. brain
4. processing
5. muscle contraction

False start:

If respond quicker than 100ms

The brain: controlling the body

Gymnastics

Feedback from receptors: position of body in space to alter response of muscles

Modern pentathlon

Combined event, shoot and run

Shoot accurately need to:

control breathing and even heart rate

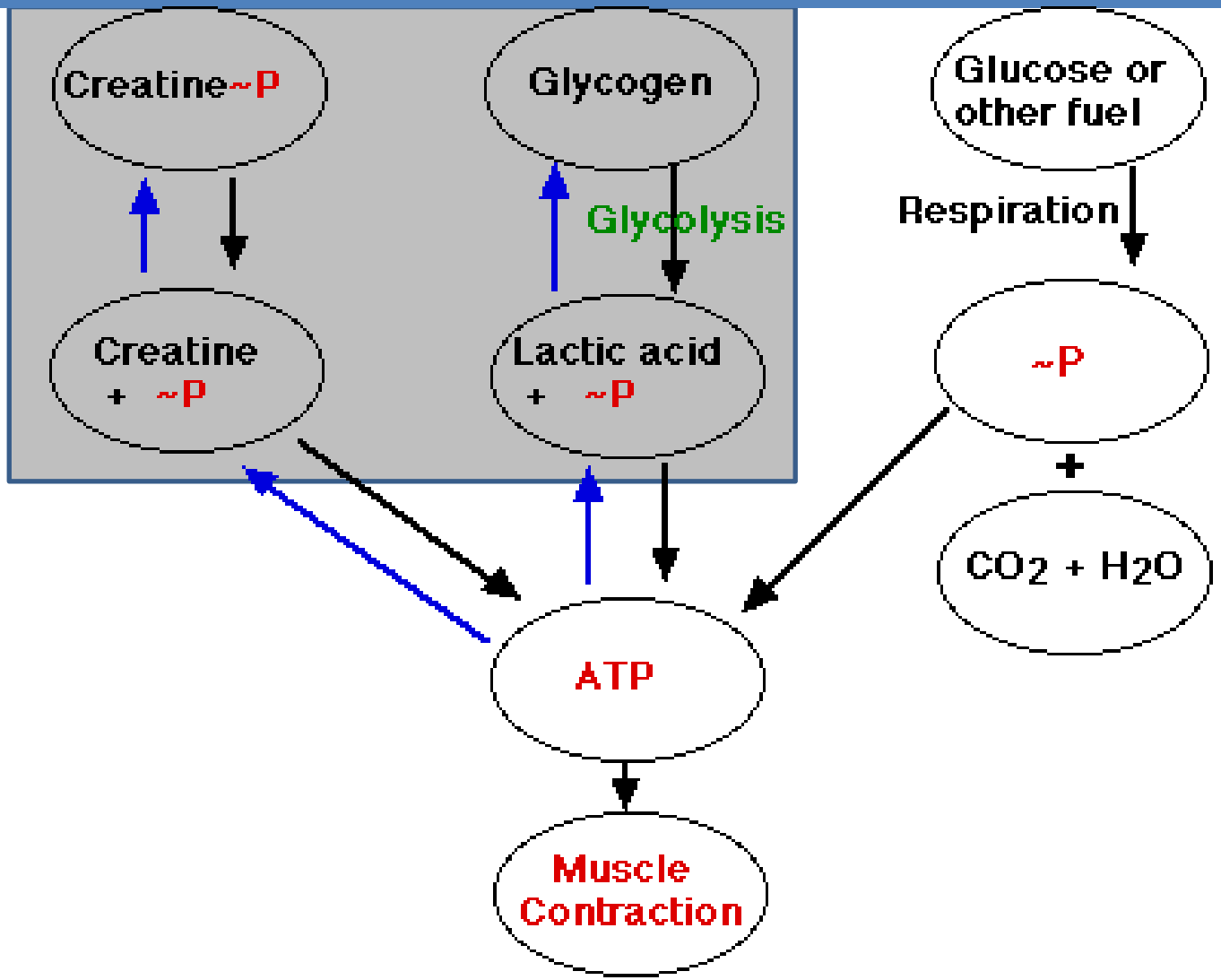
The Body

The body: all systems go

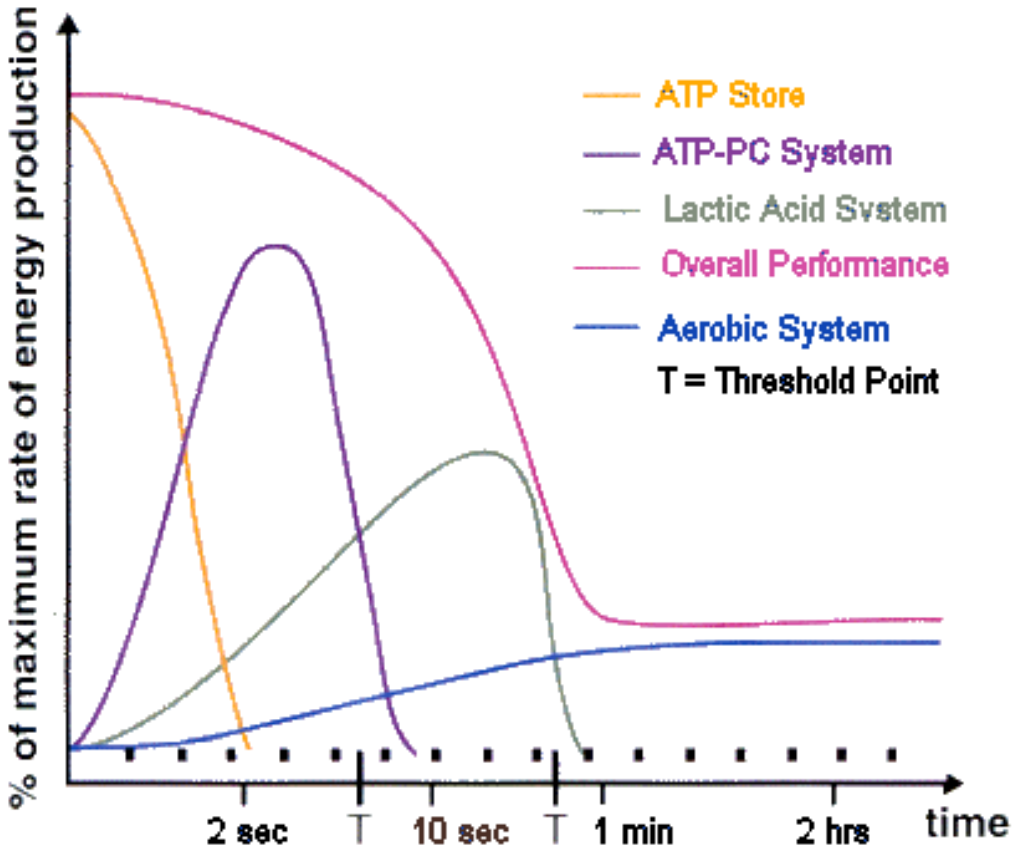
Physiology of the body

- Cardiovascular
- Respiratory
- Nervous
- Gastrointestinal
- Urinary

The body: energy supply

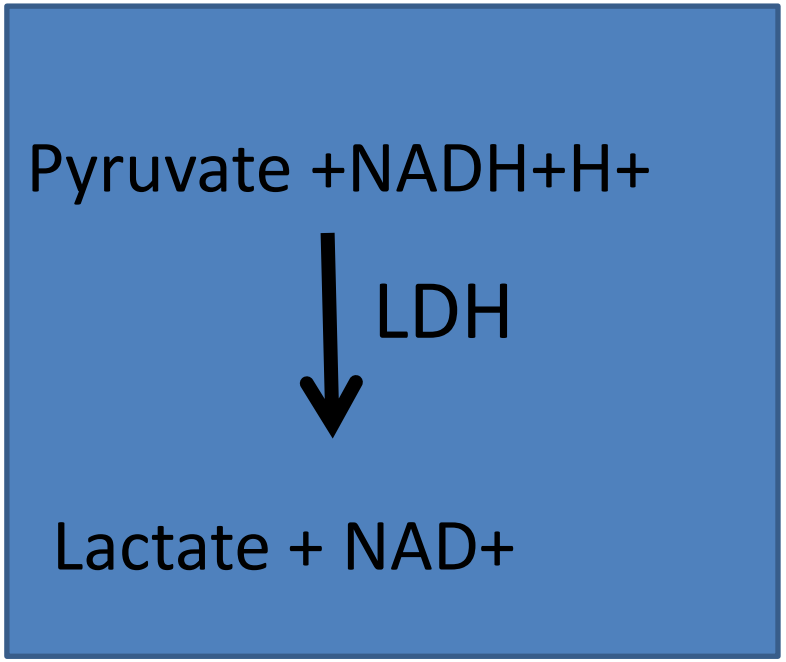


The body: energy supply



The body: lactate friend or foe?

Anaerobic metabolism

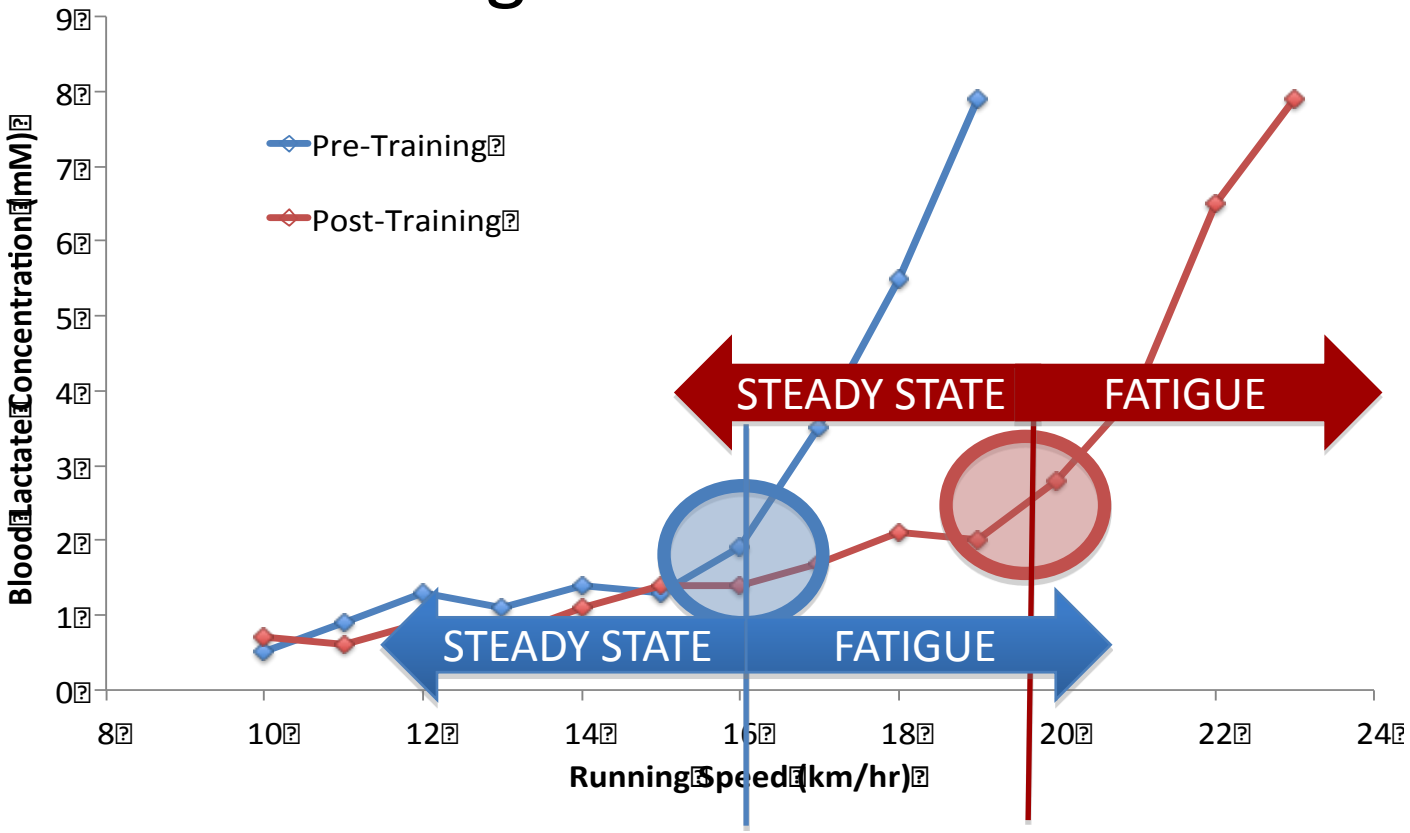


Lactate allows ATP to be made (energy currency)
And unloads H+ from NAD preventing a traffic jam
BUT creates acidity

The body: Lactate Threshold

Lactate threshold: lactate accumulation when production> clearance

Training can shift lactate threshold



The body: Lactate clearance

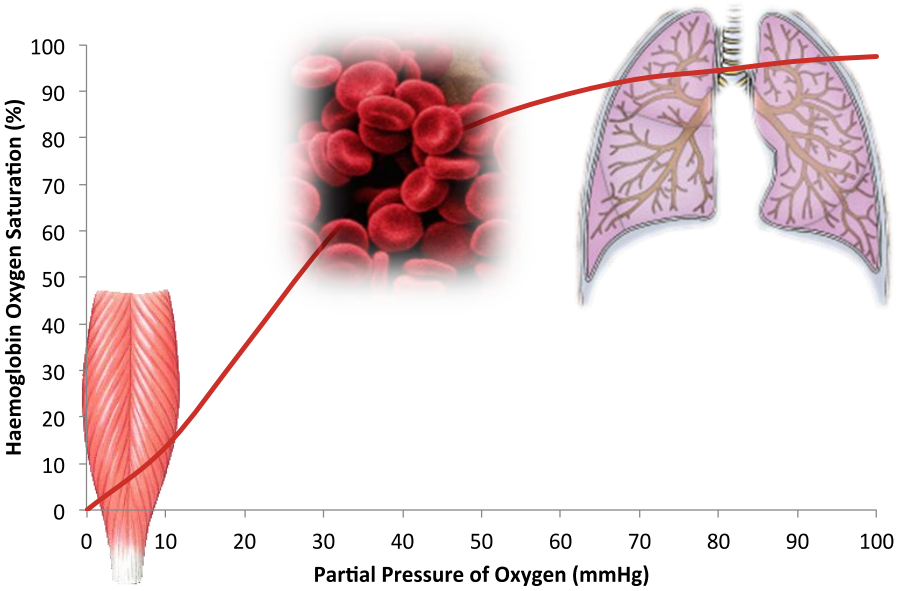
Lactate + sodium bicarbonate → Sodium lactate +carbonic acid → Sodium lactate + Carbon dioxide + water

Fast removal required in:

Short burst intermittent sports:

- Hockey
- Football
- Rugby
- Squash

The body: aerobic respiration



The journey of oxygen

Oxygen used in muscles to transform energy= aerobic respiration

Training

Training: the body

Training increases VO_2 max- an indicator of fitness is dependent on:

- air into lungs (not much change in functional capacity)
- blood collecting air from lungs (potential increase RBC concentration, blood volume increase)
- heart pumping blood (size and force contraction increases)
- blood capillary network around muscles (increase numbers with training, rerouting of blood)
- uptake of oxygen from the blood into muscle tissue (increased efficiency with training)
- Mitochondria (increased numbers with training but also determined by your Mother!!)

Training: improving oxygen uptake

Train high: hard work as less partial pressure of oxygen but you increase EPO production leading to increases in red blood cells

Train low- sleep high.

Better tolerance than exercising

BUT takes longer for adaptations

Training: practice makes perfect?

- Andy Murray: reaction- shots without thinking
- Amy Williams: precise body moves-life and death
- Jonny Wilkinson: over and over again
- Daley Thomson: train harder than anyone else

Practice needs to be perfect
to gain the edge

Training: too much?

↓ performance

Overtraining can lead to:

Decreased immune function

Altered heart function and control

Changes in mood

Increased injury rate

Measure by:

Mood

Cortisol

Blood count

Sleep

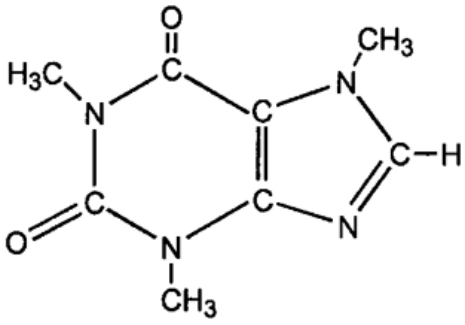
Fuel and ergogenics

Fuel and ergogenic aids

The right fuel is really important: Also need to get timing right

BUT what about other things: like caffeine, beetroot juice, supplements

Ergogenic aids: caffeine



Caffeine

1000 articles about caffeine and exercise:

Improves endurance performance???

100 mg of caffeine in small cup of coffee

Require 3mg per kg body weight 2-3 hours pre-performance

Side effects

Ergogenic aids: beetroot juice

- Infancy- only 9 articles about beetroot and exercise (Mainly from Prof Jones Exeter)
- Improves endurance performance
- Acute dose beetroot 2.8% improvement time trials
- Six day dose 16% longer
- Works via nitrate

Ergogenic aids: the use of music

Music- may help especially in training (Karageorghis, Brunel)

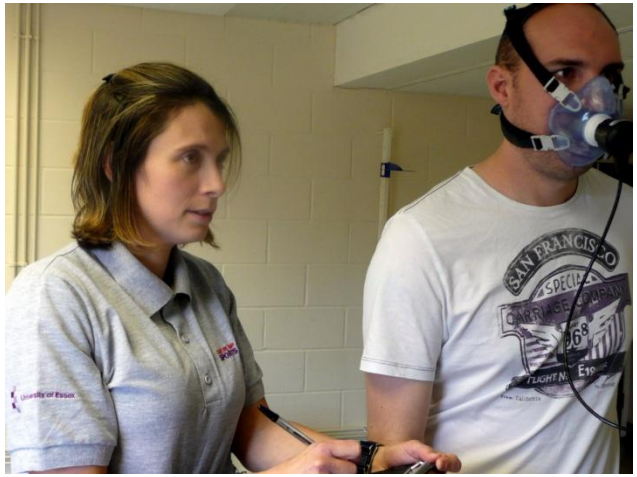
The X Factor

The X-factor: Recovery Therapies

Recovery is really important:

- Get quality sleep –learn and recover
- Massage therapy -200 articles but no clear evidence
- Ice therapy- very popular but no clear evidence

The X-factor: The support team



A good support team is required

The X-factor: choose your parents

Your mitochondria comes from your mum!!

Mind over body?

The ultimate challenge: Ironman Triathlon
http://www.youtube.com/watch?v=MTn1v5TGK_w

140 miles of exhaustion: swim, cycle, run

Chrissy Wellington (Great Britain) set women's course record for Hawaii 2009

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Inspired???

- The Physiological Society's competition
  - The science of sport: how to win gold
  - www.understanding-life.org
- Wellcome Trust Physiology experiment kits for schools
  - www.getinthezone.org.uk
- Wellcome Trust Big Picture publication

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Thanks to:

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