Drug-free performance enhancement: Capitalising on cyclists' capacity to respond to placebos

Chris Beedie
Professor of Applied Sport & Exercise Science
Canterbury Christ Church University
Canterbury, Kent, UK
chris.beedie@canterbury.ac.uk

Before I begin: People without whom this presentation would not have been possible

- Phil Hurst (University of Birmingham)
- Dr. Abby Foad (Canterbury Christ Church University)
- Dr. Damian Coleman (Canterbury Christ Church University)
- Professor Andy Lane (University of Wolverhampton)
- Professor Fabrizio Benedetti (University of Turin)
- Professor Jack Raglin (Indiana University)
- Professor Emma Cohen (Oxford University)

Overview of this talk

- Placebo effects in cycling research
  - Via formation of implicit expectations by cyclists
  - Via communication of explicit expectations by experts
- Placebo responders versus non-responders
- Creating a placebo responder
  - Using needles and drugs to elicit a conditioned placebo response on performance
  - Using words and placebos to elicit a conditioned placebo response on performance
- Ethics & professional practice
- The cycling context as a placebo-rich environment

The placebo effect

- A positive psychobiological response to an environmental cue
- Placebo effect associated with drugs
- Constitute up to 75% of some drug effects (100% of some CAM)
- Experienced to a wide range of cues, not simply drugs
- Most data indicate a role for expectation or conditioning
- Consistent neurophysiological mechanisms have been identified using numerous methods

How placebo effect researchers work

How placebo effect researchers work

# How placebo effect researchers work

How placebo effect researchers work

Evidence for placebo effects in cycling performance

- **Beedie et al. Placebo effects of caffeine on cycling performance. *Med. Sci. Sport. Ex. 2006***
- Participants informed one each of
  - Placebo
  - Low dose caffeine (4.5 mg/kg)
  - High dose caffeine (9.0 mg/kg)
- Placebo administered in each condition
  - Believed placebo -1.5%
  - Believed low dose caffeine +1.5%
  - Believed high dose caffeine +3.0%
- Dose response effect of placebo?
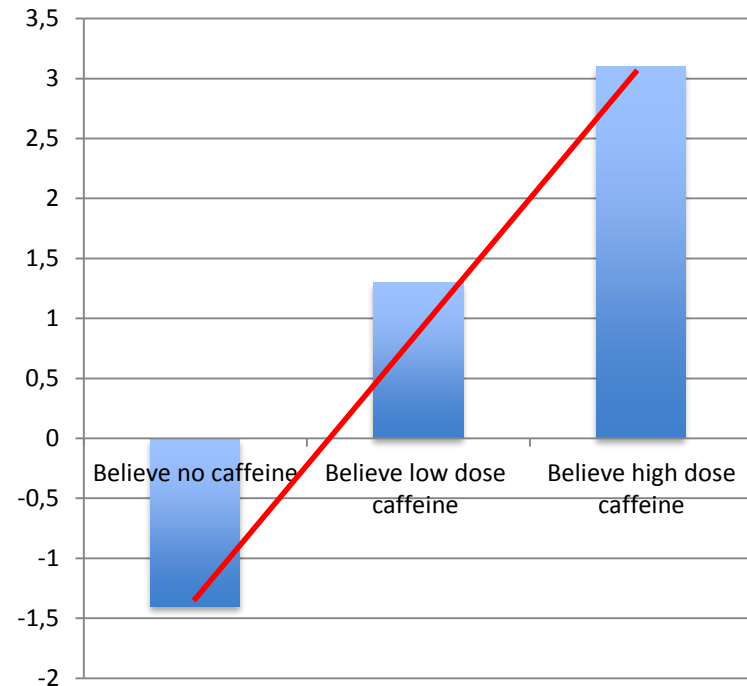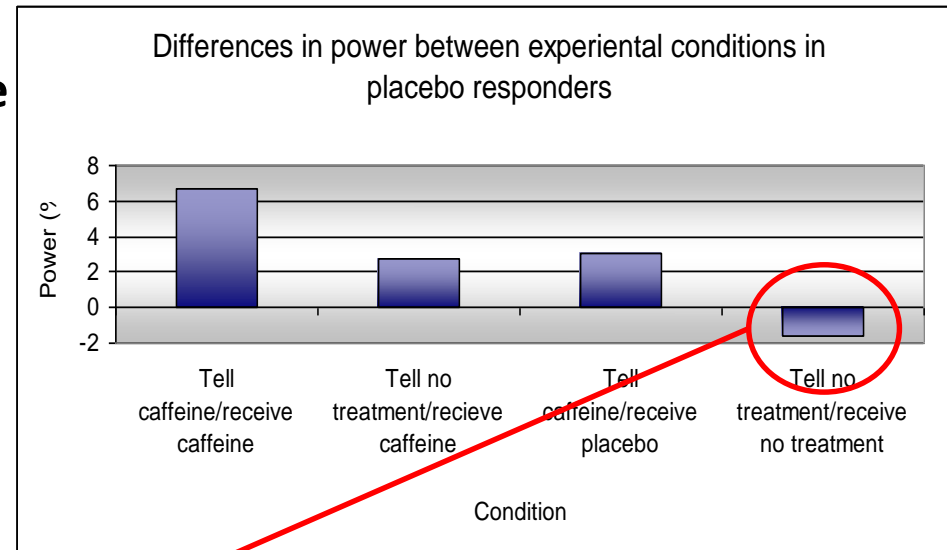
Cyclist set up their own *implicit* expectations

- We informed cyclists that they would receive treatments randomly assigned (repeated-measures design)
- After T1:
  - "What do you think you had today"?
  - They all answered "It felt as hard as baseline, so placebo....."
- After T2:
  - "What do you think you had today"?
  - All but one answered "Felt easier, but not too easy, so low dose caffeine..."
- Prior to T3
  - All but one participant was *expecting* high dose caffeine...
- Greater implicit expectation of effect related to greater effect
- **Dose response effect was for *expectation*, not placebo**

Message 1: Cyclists' implicit expectation of an effect can enhance performance

Evidence for *explicit* expectation in placebo effects on cycling performance

- **Foad et al. Psychological & pharmacological effects of caffeine on 40km cycling performance.** *Med. Sci. Sport. Ex. 2008*
- Cyclists informed/given
  - Caffeine/caffeine (C/C)
  - Caffeine/placebo (C/P)
  - No-treatment/caffeine (P/C)
  - No-treatment/no-treatment (P/P)
- Findings
  - (C/C) +6.0%
  - (C/P) +3.0%
  - (P/C) +2.5%
  - (P/P) -1.5%

Differences in power between experiental conditions in placebo responders

Power (%)

8
6
4
2
0
-2

Tell caffeine/receive caffeine

Tell no treatment/recieve caffeine

Tell caffeine/receive placebo

Tell no treatment/receive no treatment

Condition

Message 2: Providing cyclists with an explicit expectation of an effect can enhance performance
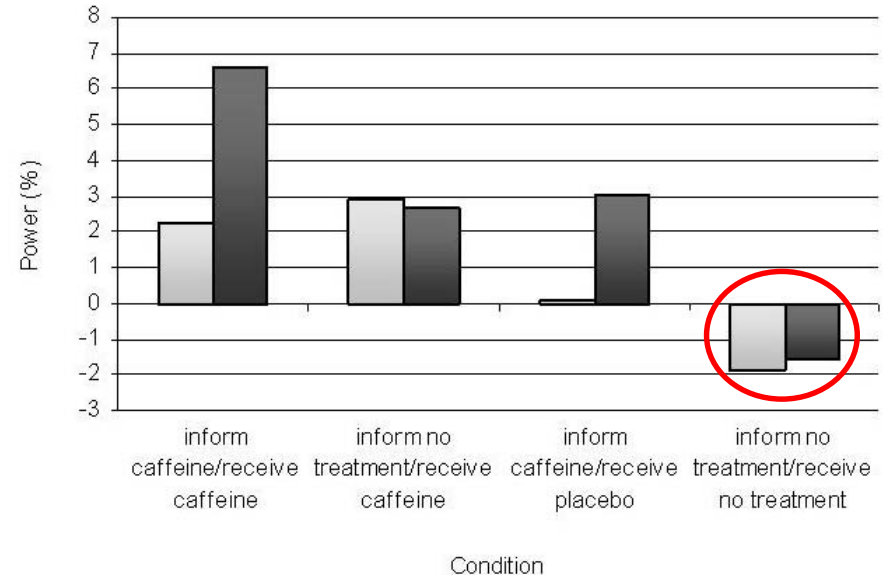
# Message 3: Negative expectations can also disrupt performance

But some cyclists appeared to respond to expectation, whilst others did not…?

- **Beedie et al. Identification of placebo responsive athletes in 40-km cycling performance. *J. Sport. Sci. Med. 2008***

- Responders and non-responders both performed below baseline when they correctly believed they had received no caffeine

But some cyclists appeared to respond to expectation, whilst others did not…?

- **Beedie et al. Identification of placebo responsive athletes in 40-km cycling performance. *J. Sport. Sci. Med. 2008***

- Placebo responders responded better to real caffeine than did placebo non responders
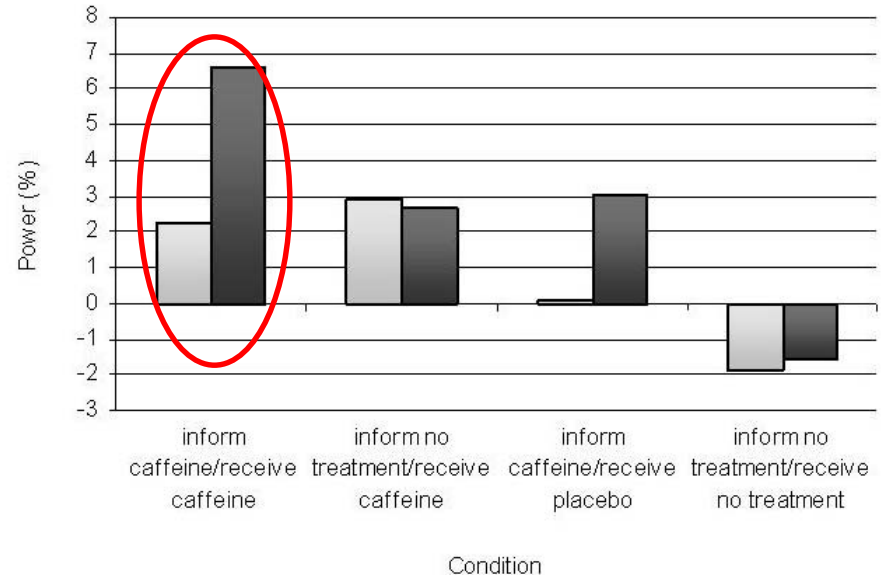
# Message 4: Placebo responsive cyclists experienced greater positive effects of caffeine

EXPECTATION

The question I'm asked more than any other:

Is it possible to create a placebo responsive athlete?

Can we 'create' a placebo responder? Conditioned effects of morphine in a muscle task

- **Benedetti et al. Opioid-mediated placebo responses boost pain endurance and physical performance: is it doping in sport competitions? *J. Neurosci. 2007***
- Hand grip task. Repeated injections of morphine in training phase
- Replacement of morphine with injection of placebo on the day of competition
- Opioid-mediated increase of pain endurance and physical performance observed
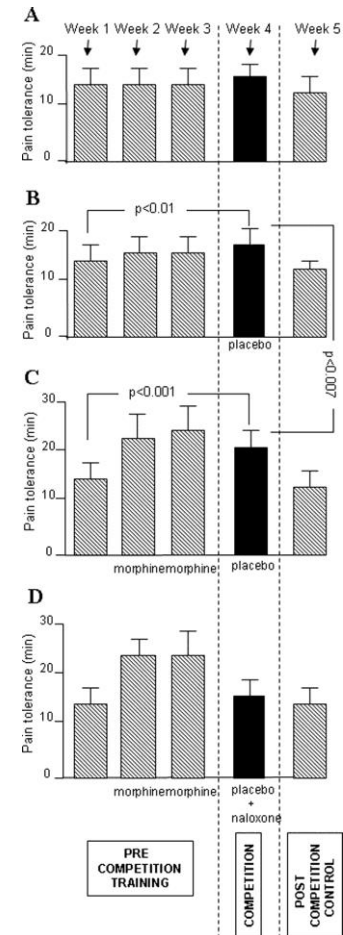
Can we 'create' a placebo responder? Conditioned effects of morphine in a muscle task
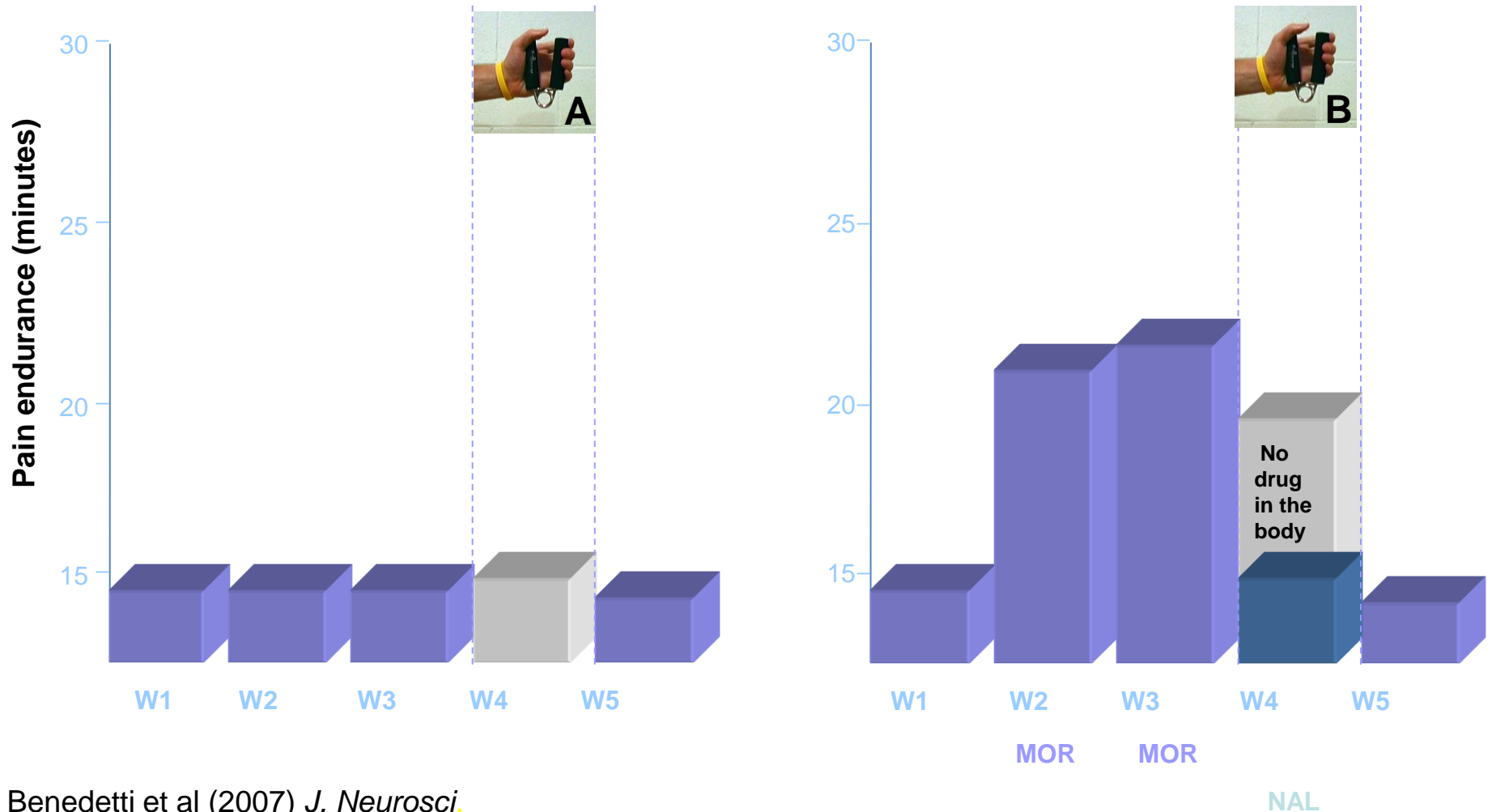
Benedetti et al (2007) *J. Neurosci.*

Message 5: Learning of a drug effect on performance is possible

But...........

- Despite suggesting that the 'athlete' would not be doping on the day of competition...
  - The study used a drug
  - The study used injections
  - The process is unethical and banned in sport

So, can we learn a drug effect using no drugs and no injections?

So, can we learn a placebo effect using no drugs and no injections?

- **Pollo et al. The top-down influence of ergogenic placebos on muscle work and fatigue. *Eur. J. Neurosci. 2008***
- Experiment 1
    - Following baseline, placebo caffeine was administered with verbal expectation of enhanced performance (leg extension).
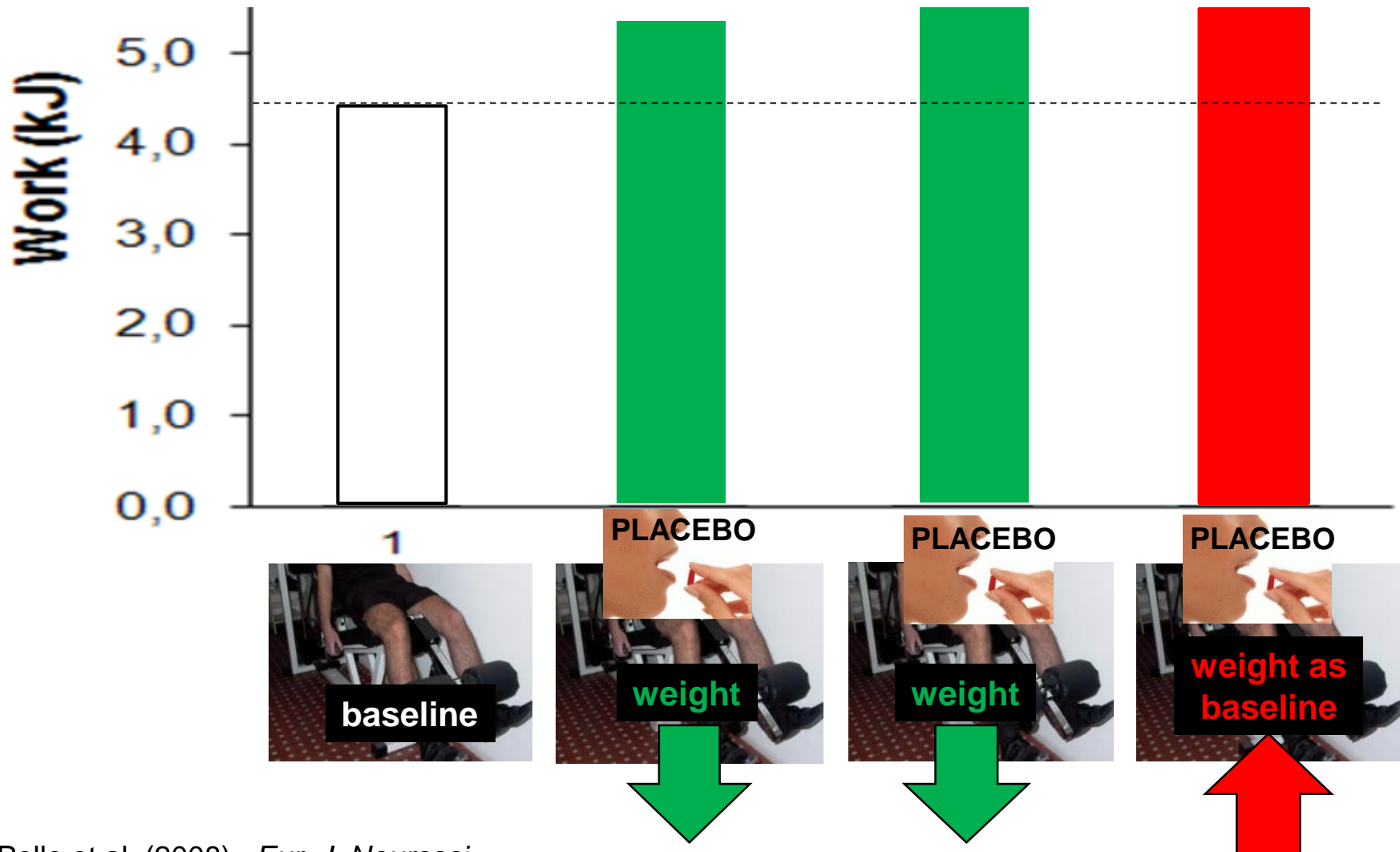   - Resulted in increased performance.

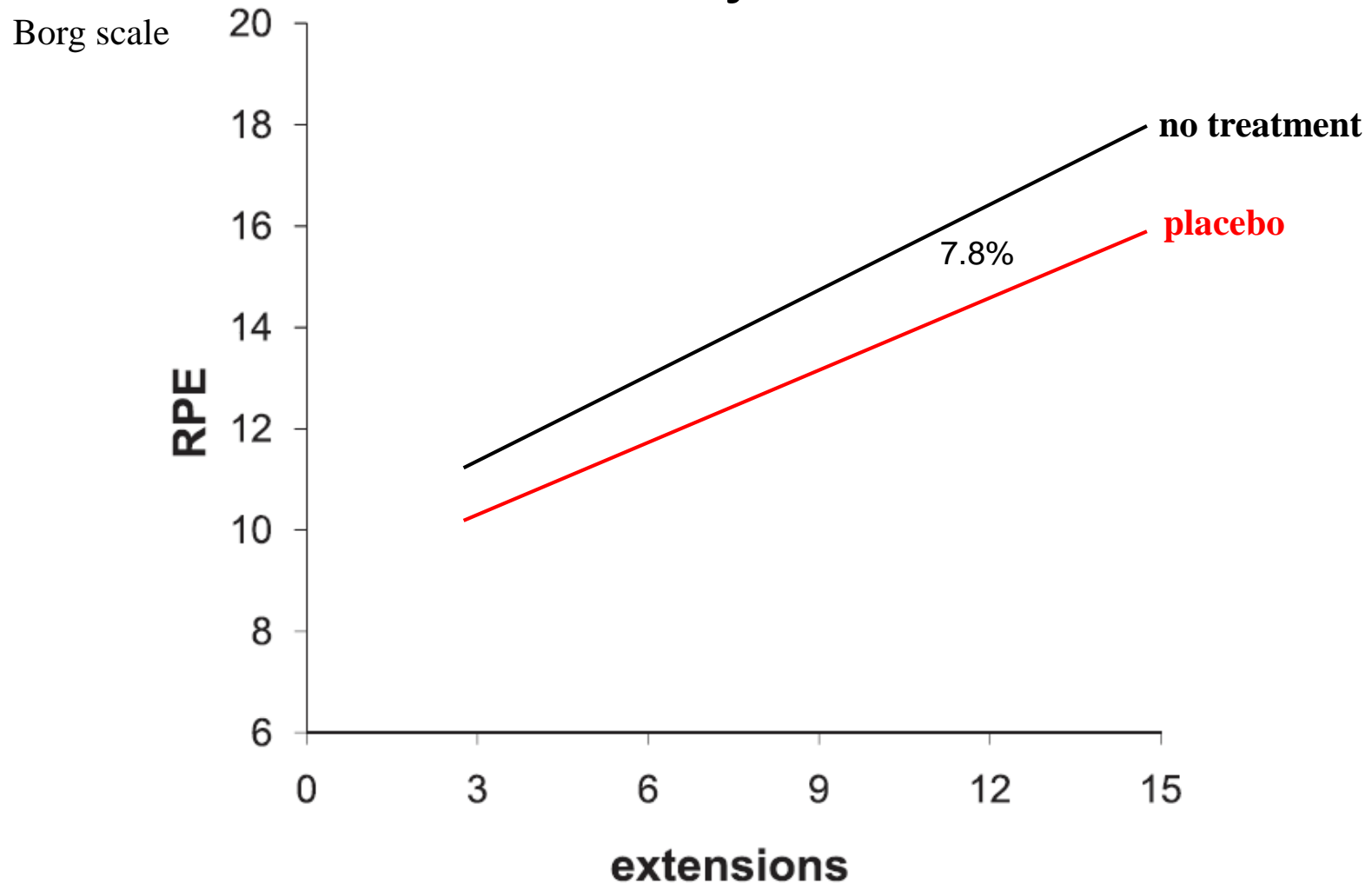# So, can we learn a placebo effect using no drugs and no injections?

- **Pollo et al. The top-down influence of ergogenic placebos on muscle work and fatigue.** *Eur. J. Neurosci. 2008*

- Experiment 2
  - Following baseline, placebo caffeine administered prior to two weight-training sessions (leg extension).
  - Resistance was reduced deceptively to set up expectation that the 'caffeine' was ergogenic.
  - In a final trial, the load was restored to the original weight.

So, can we learn a placebo effect using no drugs and no injections?

Pollo et al. (2008)   *Eur. J. Neurosci.*

So, can we learn a placebo effect using no drugs and no injections?

Borg scale


Pollo et al. (2008)   *Eur. J. Neurosci.*

So, can we learn a placebo effect using no drugs and no injections?

- **Pollo et al. The top-down influence of ergogenic placebos on muscle work and fatigue. *Eur. J. Neurosci. 2008***
- Results
  - Significant increase in muscle work and decrease in perceived muscle fatigue.
  - Greater effects observed following conditioning than earlier expectation-only treatment
 - Underscores the role of *learning* in increasing muscle performance with placebos.

LEARNING

Message 6: Learning of a placebo effect on performance is possible.
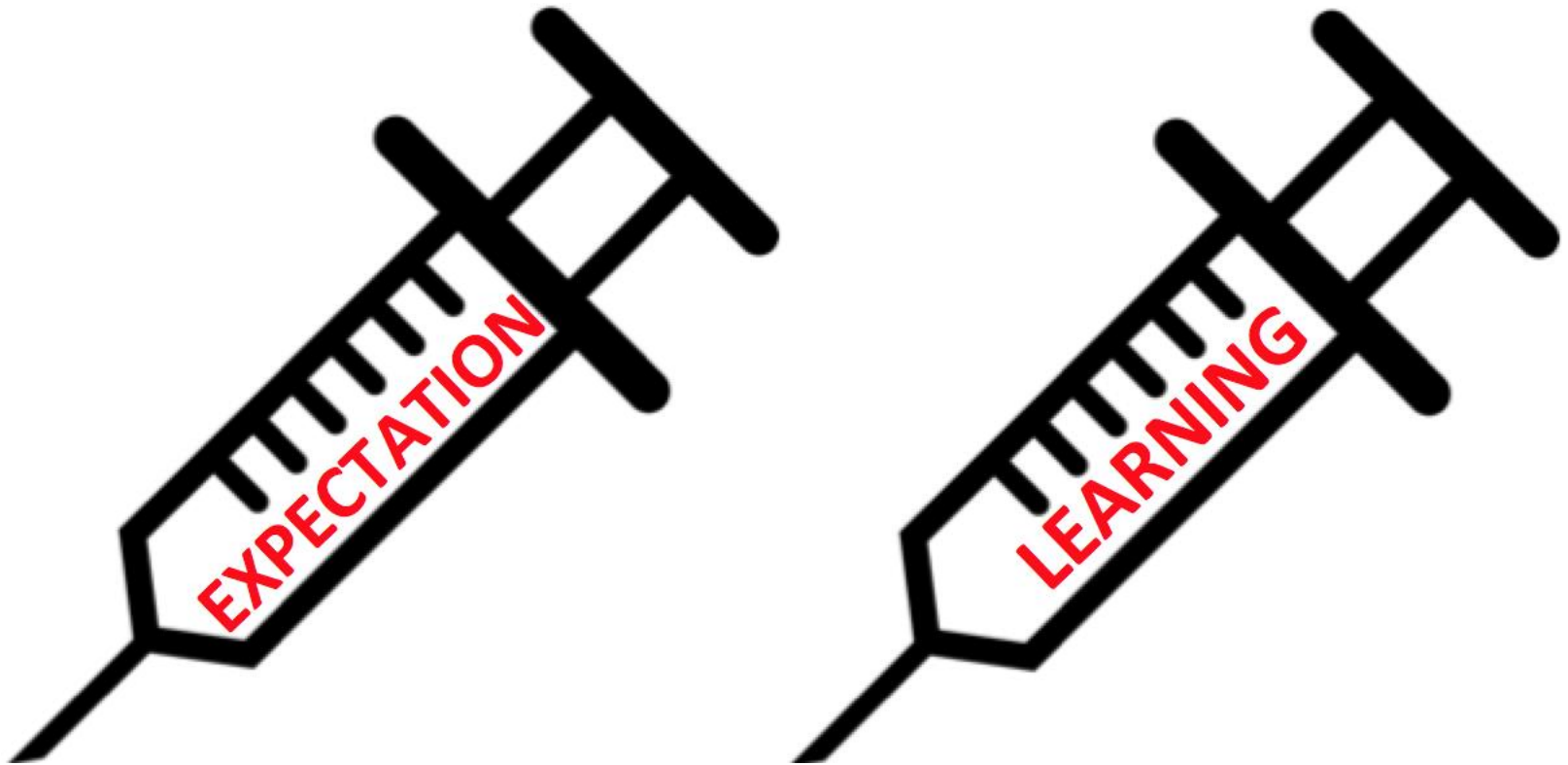
So, if we were to conduct our 2005-2008 studies again….?

- We would have used Pollo's (2008) placebo acquisition protocol ahead of cycling performance trials

- Hypothesis 1: We would have seen a greater total number of placebo responders

- Hypothesis 2: We would have observed larger mean effects in CC and CP
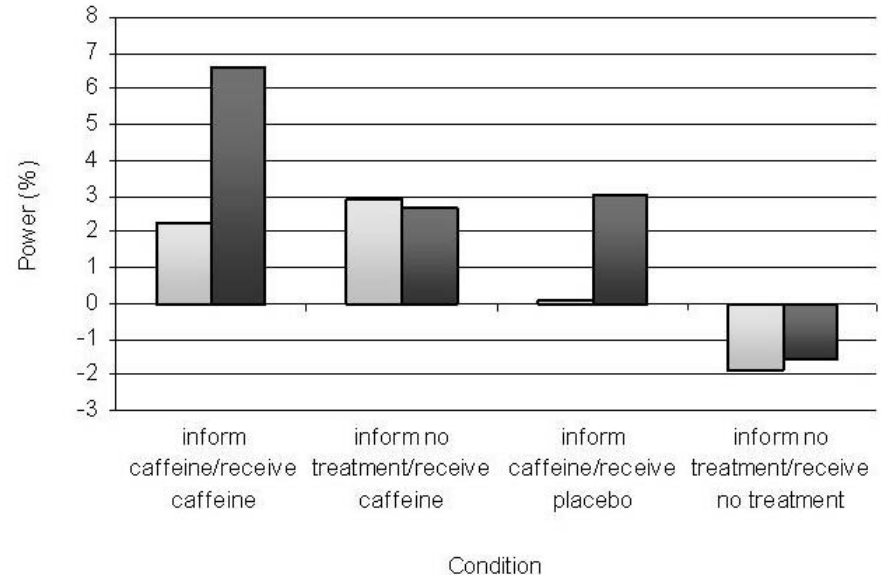
Ethics

- To routinely use deception with cyclists is unprofessional and unethical
- However these studies demonstrate the potential positive AND negative performance effects of
  - Explicit verbal information
  - Implicit expectations
  - Conditioned/learned responses
- Stability of effects over time is questionable

Professional practice

- If expectations influence outcomes, it is important that:
  - You understand the expectations of your athletes
  - You are able to modify these where appropriate

Relevance? In cycling there are many opportunities to enhance expectation & learning

Equipment

Social context

Supplements & food

Training

Lab data

Performance feedback

Summary

- Cyclists' implicit expectation of an effect can enhance performance

- Providing cyclists with an explicit expectation of an effect can enhance performance

- Cyclists negative expectations of an effect can disrupt performance

- Placebo responsive cyclists experienced greater positive effects of caffeine

- Learning of a drug effect on performance is possible

- Learning of a placebo effect on performance is possible

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