Does Physical Activity Have a Role in Reducing Obesity?

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AUGUST 17, 2009

Comeback Kids: Clinton Brings Them Home

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The White House's Race to Stop A Flu Pandemic

TIME

The Myth About Exercise

Of course it's good for you, but it won't make you lose weight. Why it's what you eat that really counts.

BY JOHN CLOUD

www.time.com

Published by Oxford University Press on behalf of the International Epidemiological Association

International Journal of Epidemiology 2013;42:1831–1836
doi:10.1093/ije/dyt159

DEBATE–PHYSICAL ACTIVITY AND OBESITY RISK

Physical activity does not influence obesity risk: time to clarify the public health message

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Accepted 16 July 2013

Introduction

Over the past 3 decades the obesity epidemic has spread inexorably across societies in all parts of the globe. Unfortunately our understanding of the key factors driving body weight upward – and thereby the public health interventions required to reverse this trend – has advanced much more slowly. Since the 1980s innumerable studies have catalogued the descriptive characteristics of this epidemic and detailed maps of obesity prevalence and the associated disease burden have been produced.[1–3] Until recently, however, discourse about the underlying aetiology of this quintessential modern epidemic has been confined primarily to commentaries on bad dietary habits and low levels of physical activity, suggesting a failure both to restrict energy intake and to maintain high levels of energy expenditure.[4] On closer scrutiny, the empirical data have been insufficient to support either element of the aetiological pathway characterized in those terms, nor is that formulation justified on theory alone. Virchow laid the foundation for our understanding of all human epidemics with the assertion that 'mass disease means society is out of joint'.[5] Recent work by nutrition scientists and economists has led to the formulation of an increasingly sophisticated explanatory model of this latest scourge – based on solid data – which is firmly rooted in traditional public health theory: 'Changes in the global food system, including reductions in the time-cost of food, seem to be the major drivers of the rise of the global obesity epidemic during the past 3–4 decades'.[6] Although recognizing the secondary, or 'conditional', role of 'dietary habits', this model clearly states that individual choice has not been the primary factor leading to the worldwide rise in long-term positive energy balance.

Within this new phase of aetiological thinking, however, there has continued to be less clarity about the role of 'low levels of physical activity'.[7] In this commentary we challenge the theoretical basis for considering reduced energy expenditure in activity as a cause of the obesity epidemic and summarize the empirical data to support that contention. From both perspectives – physiological theory as well as observational data and trials as set out below – energy expenditure in activity appears to be playing no role in either causing or moderating the obesity epidemic, suggesting that current guidelines need to be reformulated.

Long-term secular trends in activity are not consistent with the dynamics of the obesity epidemic

Over the past century and a half, mechanization has markedly reduced the requirement for hard physical labour and physically active transportation. Estimates of a decline in energy expenditure assumed to accompany increased mechanization are indirect, however, since no objective measurements span this time frame. Nonetheless, these trends away from high levels of physical activity cannot explain the increases in relative weight that have occurred during the latter half of the 20th century, as the 'labour-saving culture' was fully in place by the 1960s-70s.[8] A recent econometric analysis of calorie intake in the USA demonstrated a slow relative decline through the 1950s, which is presumed to reflect parallel decreases in expenditure since the US population as a whole remained relatively weight stable.[9] To use a term borrowed from Swinburn *et al.*, an 'energy balance flipping point' appears to have been reached in the mid-1960s; following dramatic changes in the food supply, energy intake increased along with a parallel increase in body mass[6] (Figure 1). In the decades following this 'flipping point', energy intake crept slowly upward, while expenditure remained stable,

Changes in physical activity happened decades ago: Food is now driving increase in weight

Energy Intake vs Energy Expenditure: No Contest

Activity	Duration (min)	Cost (kcal)	Efficiency (kcal/min)
Large burger	3	560	186.7
70% VO2 Max	60	560	9.3
40% VO2 Max	45	280	6.2

The Energy Balance System

Inherited Factors

- **Efficiency**
- **Adaptive thermogenesis**
- **Food preferences**

Environmental Factors

- **Food environment**
- **Physical activity environment**

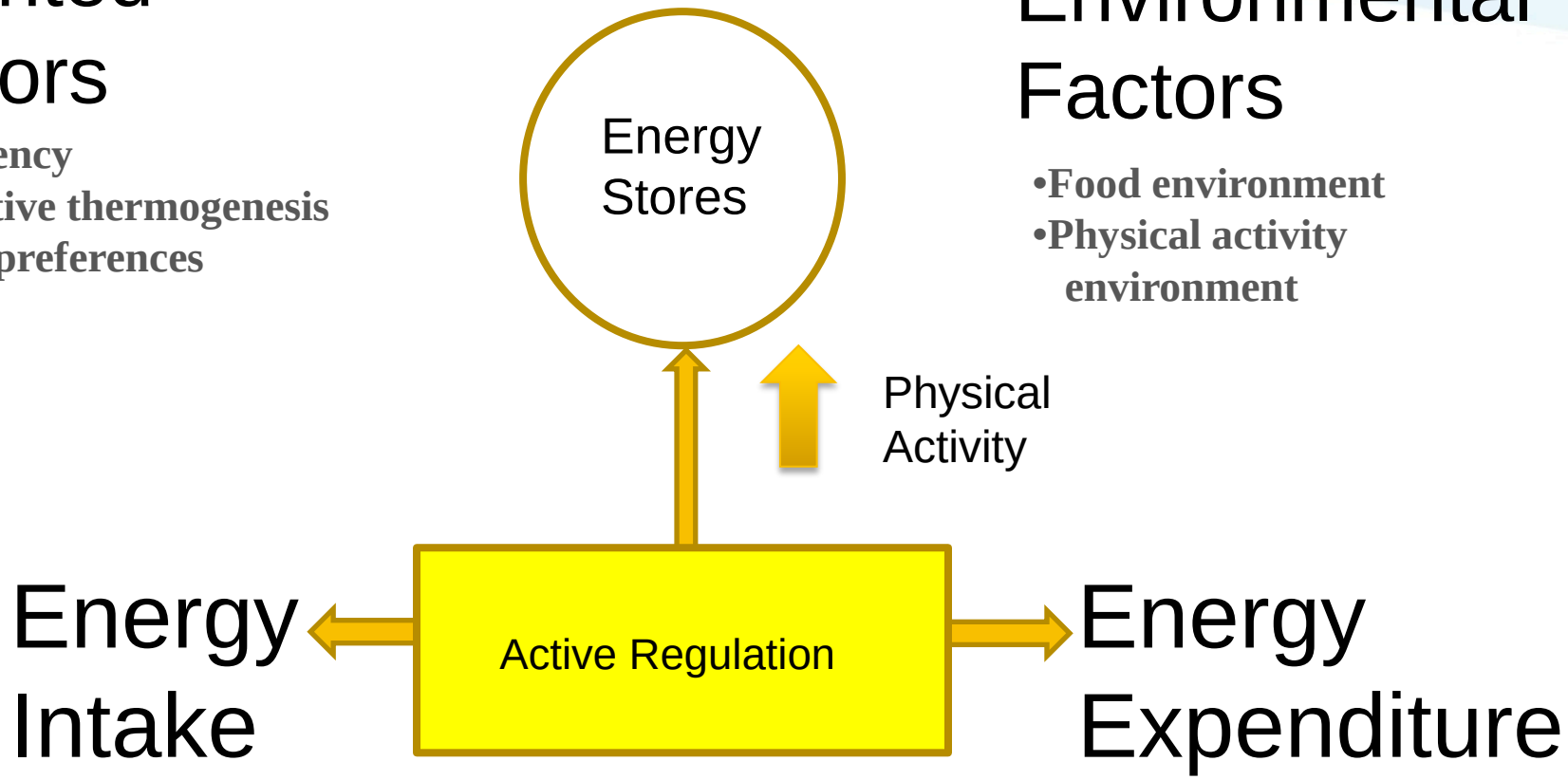

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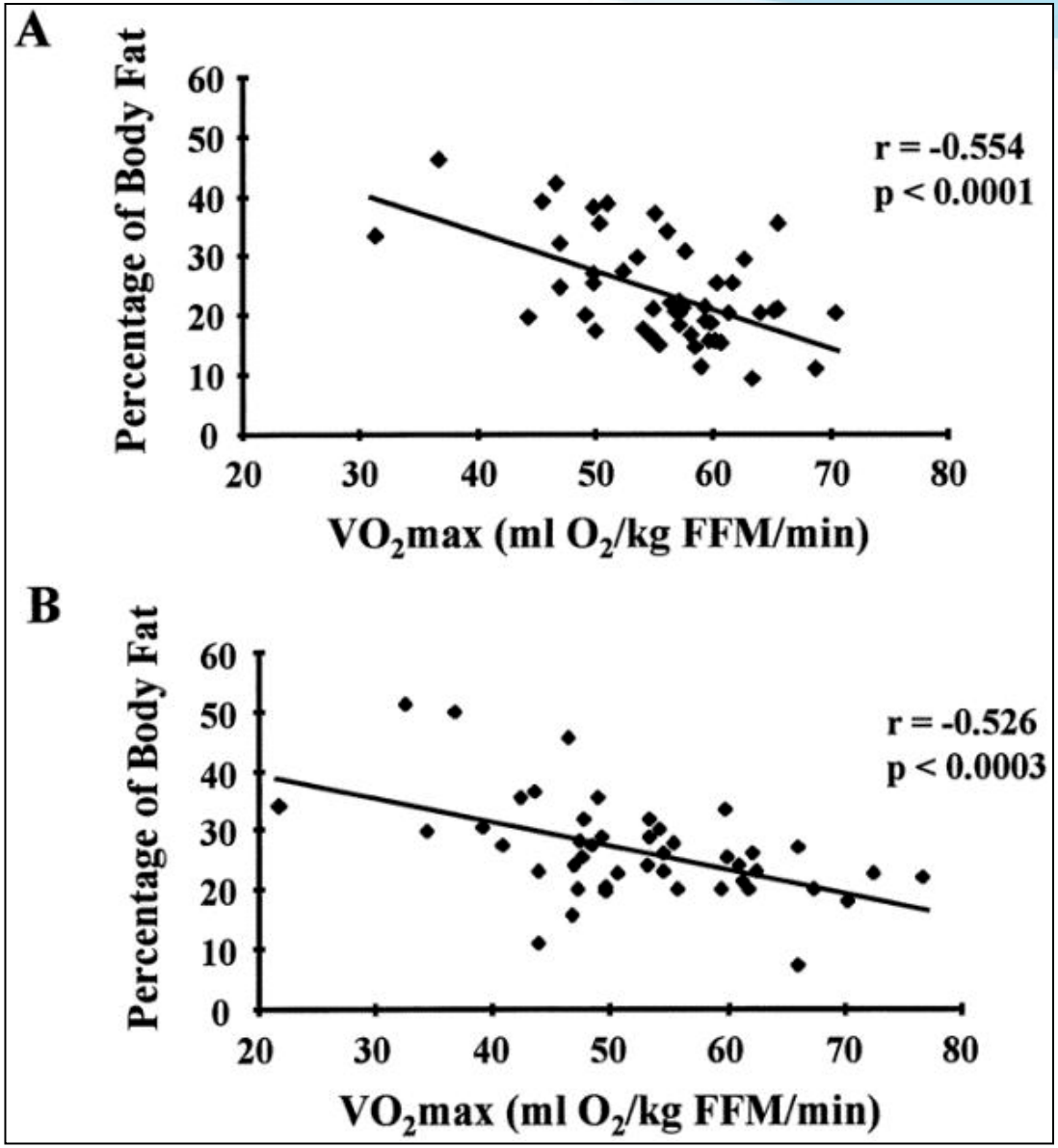
Figure 1



Effects of aerobic fitness on fat oxidation and body fatness.
KRIKETOS, ADAMANDIA; SHARP, TERESA; SEAGLE, HELEN; PETERS, JOHN; HILL, JAMES

Medicine & Science in Sports & Exercise. 32(4):805-811, April 2000.

Figure 1 Relationships between level of aerobic fitness ([latin capital V with dot above]O2max) and percentage of body fat in 49 males subjects (A) and 45 female subjects (B).

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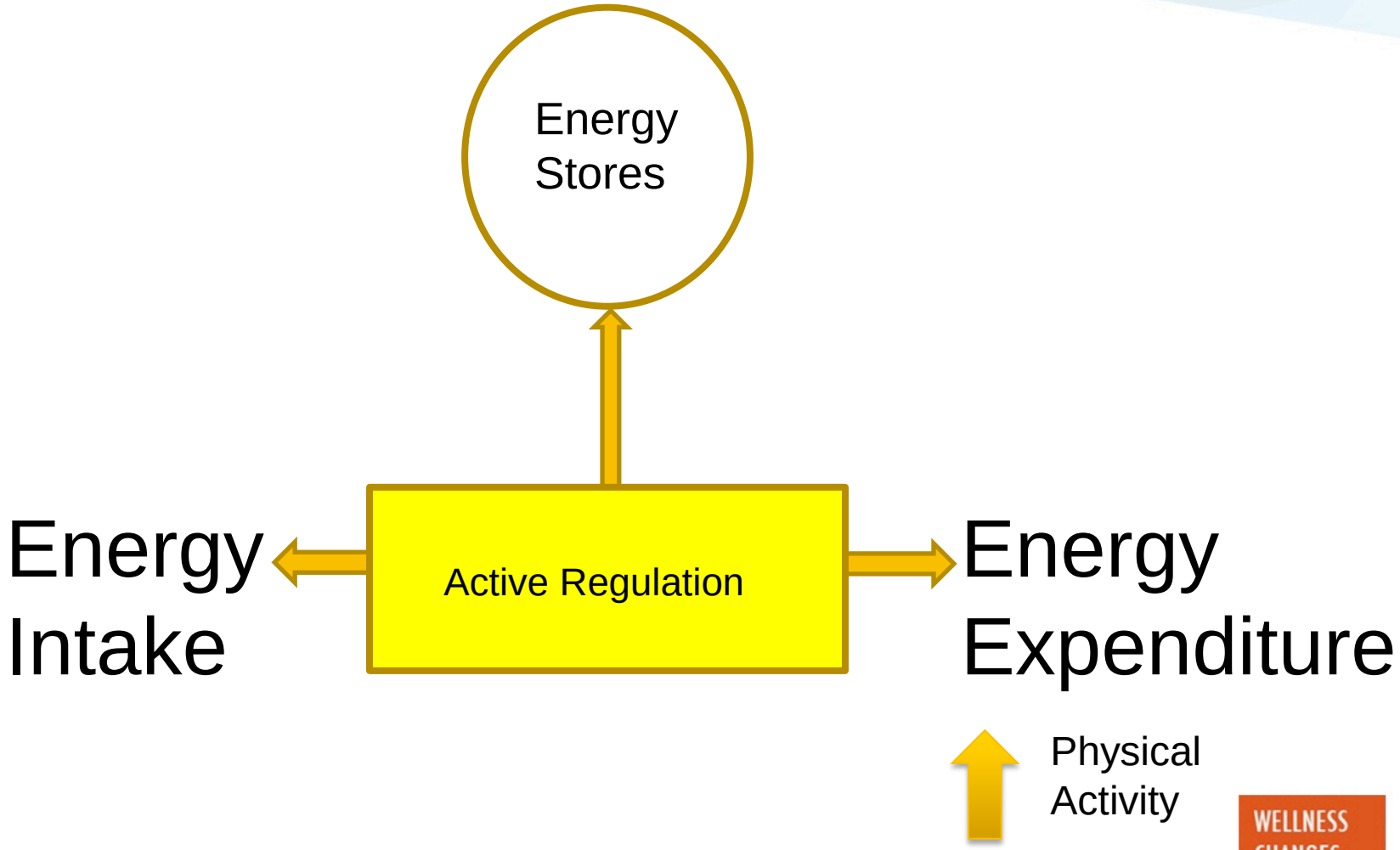
The Energy Balance System



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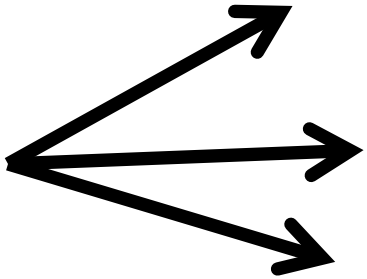
What happens to body weight when physical activity is increased?

Increase Physical Activity



Body weight increases

Body weight does not change

Body weight decreases

Other physical activity
Food Intake

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Systematic Review: Washburn et al. Clinical Obesity, 2014

No reductions in non-exercise physical activity/energy expenditure in response to prescribed physical activity/exercise training

- 100% of cross-sectional studies (n=4)
- 90% of short-term studies (n=10)
- 50% of non-randomized trials (n=10)
- 100% of RCTs (n=7)

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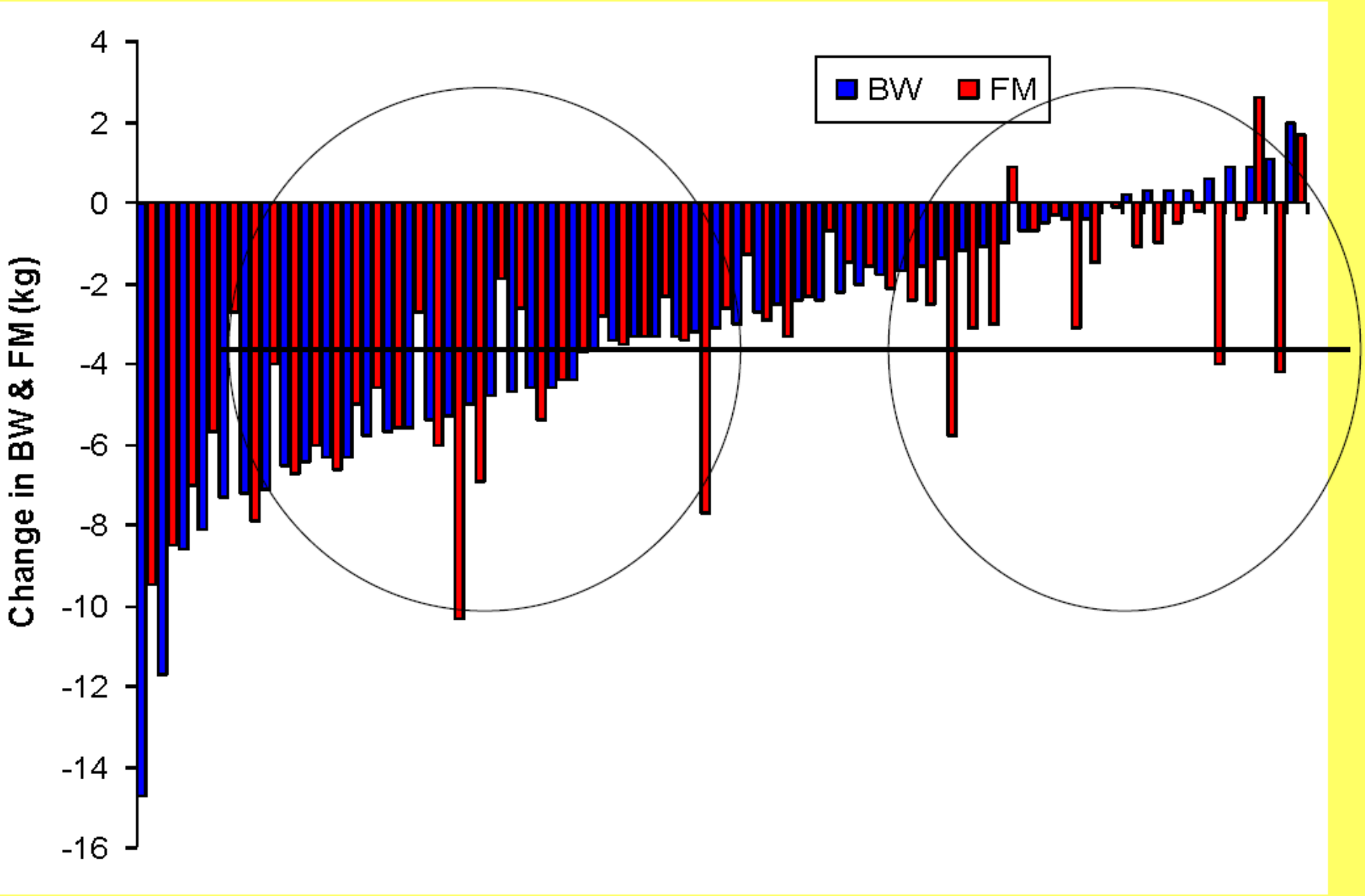
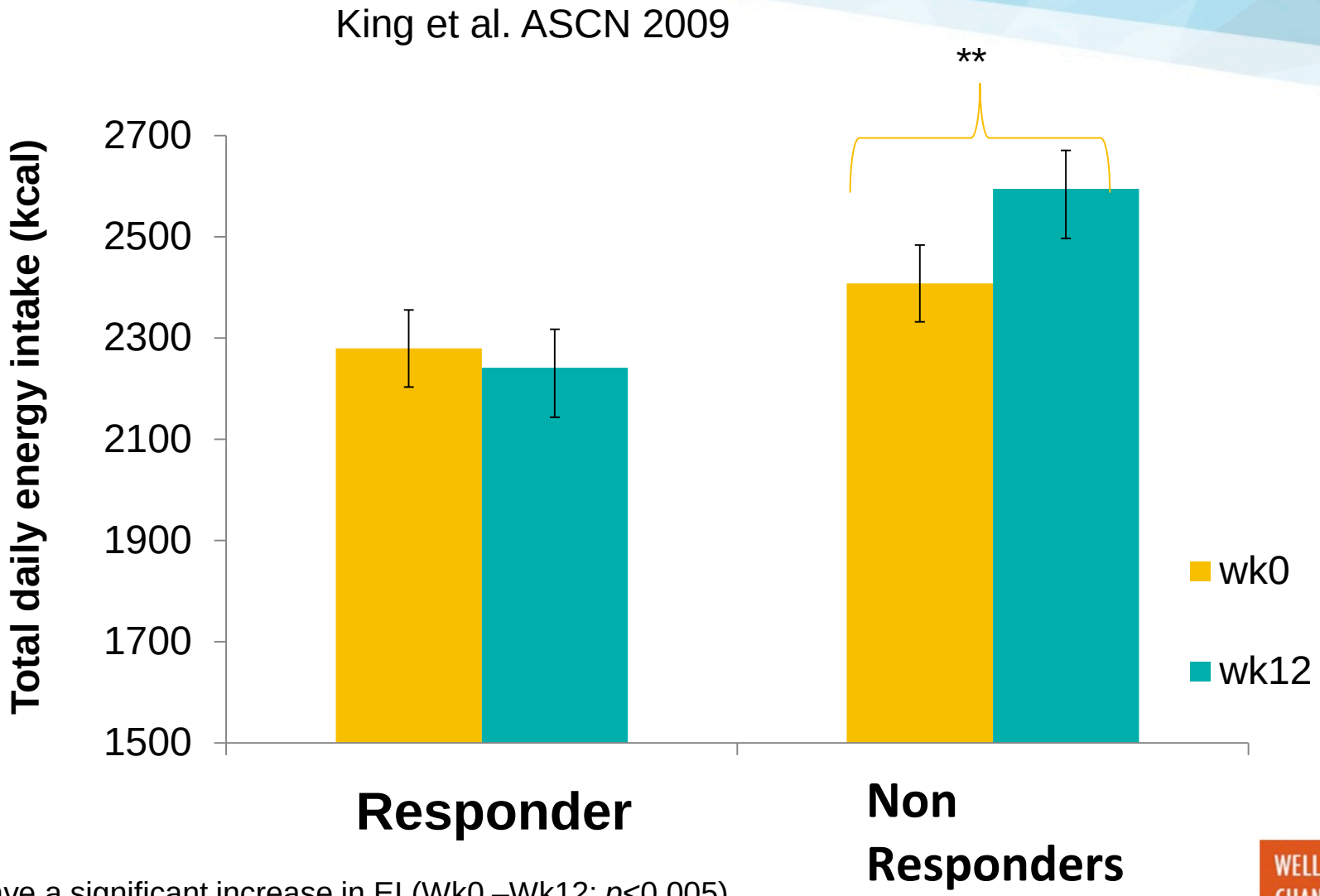
Acute exercise and subsequent energy intake. A meta-analysis
Matthew M. Schubert et al. Appetite 2012

Despite variability among studies, results suggest that exercise is effective for producing a short-term energy deficit and that individuals tend not to compensate for the energy expended during exercise in the immediate hours after exercise by altering food intake.

Individual Variation in Body Weight & Fat Mass after 12 Weeks of Exercise (*King et al, IJO 2008*)



Daily Energy Intake



* NR have a significant increase in EI (Wk0 –Wk12; $p<0.005$)

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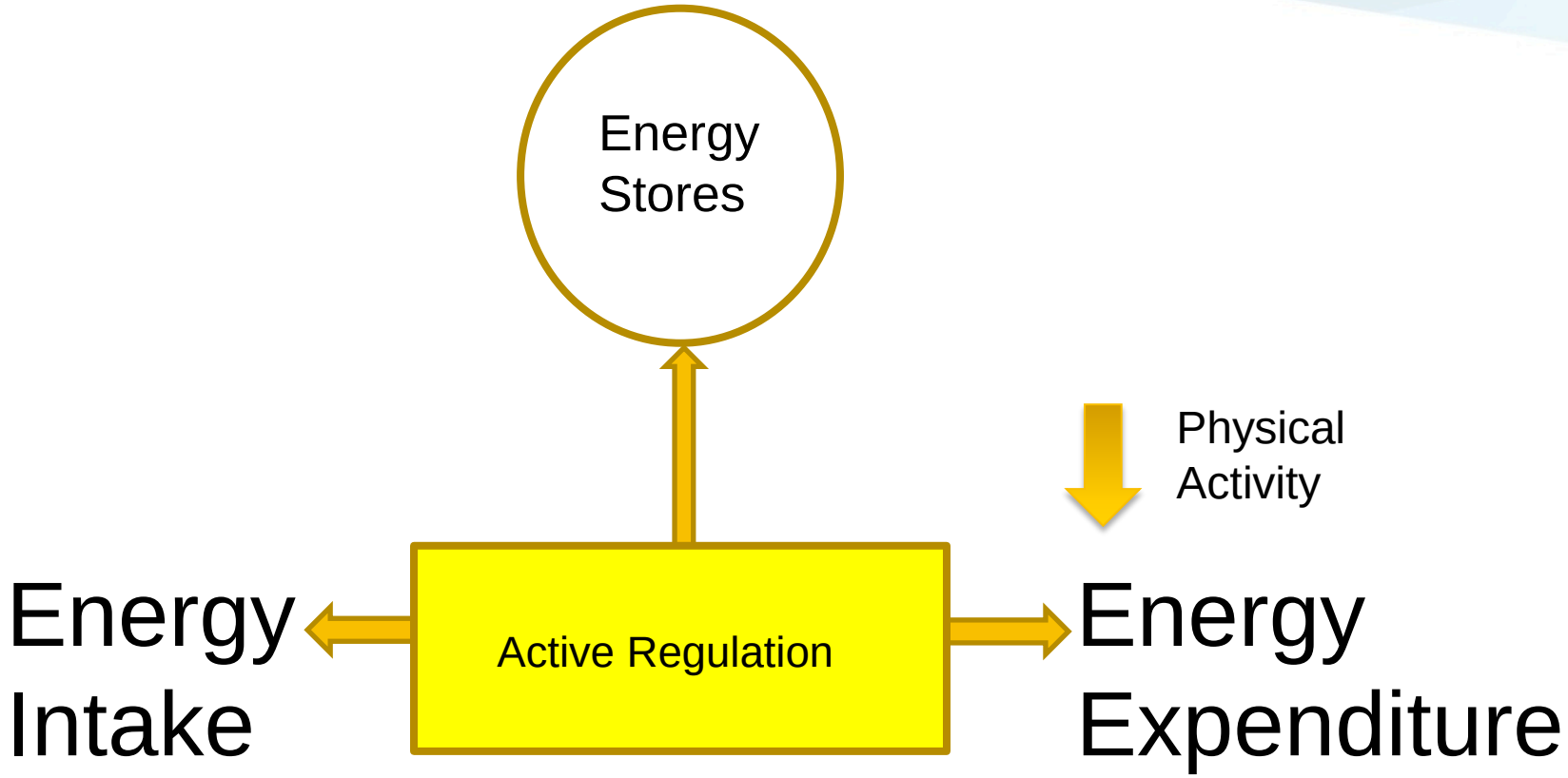
The Energy Balance System



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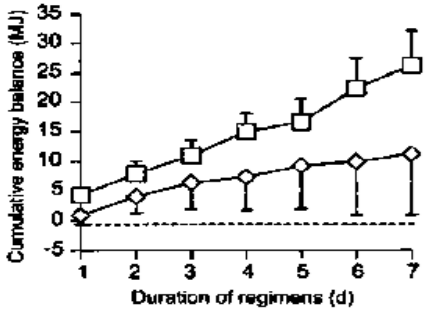
Does Decreasing Physical Activity Increase Energy Intake?

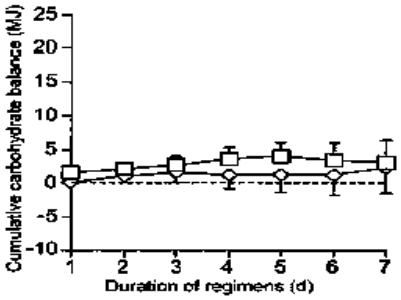
Stubbs et al 1997

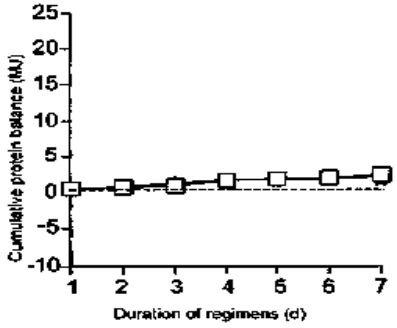
OUTCOME

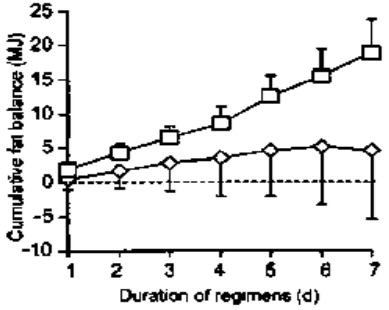
	ACTIVE	SEDENTARY
EE	12.8	9.8
EI	14.6	13.5

- Decrease in PA from 1.8 – 1.4 x RMR does not induce a marked compensatory decrease in EI
- Majority of excess energy stored as fat

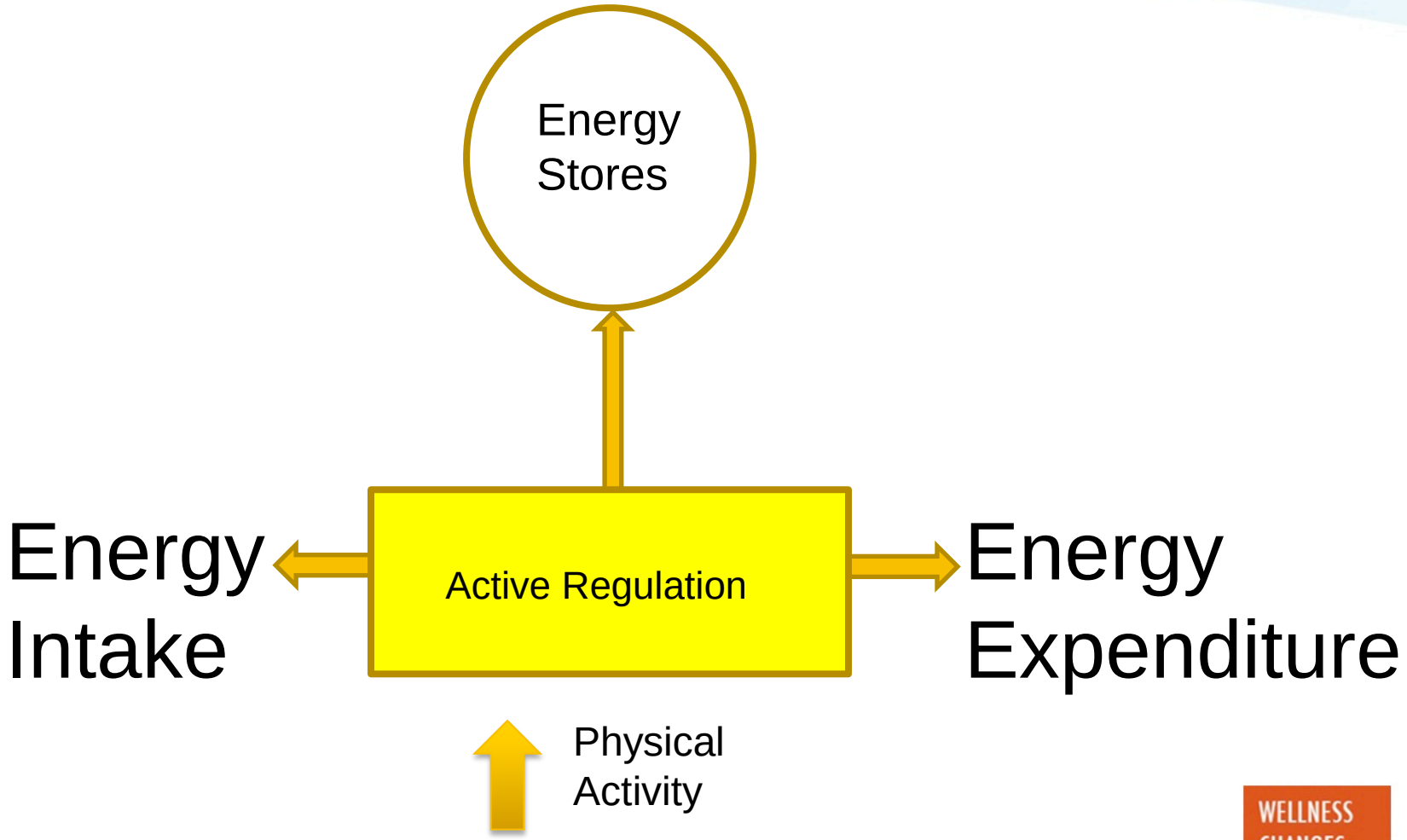








The Energy Balance System



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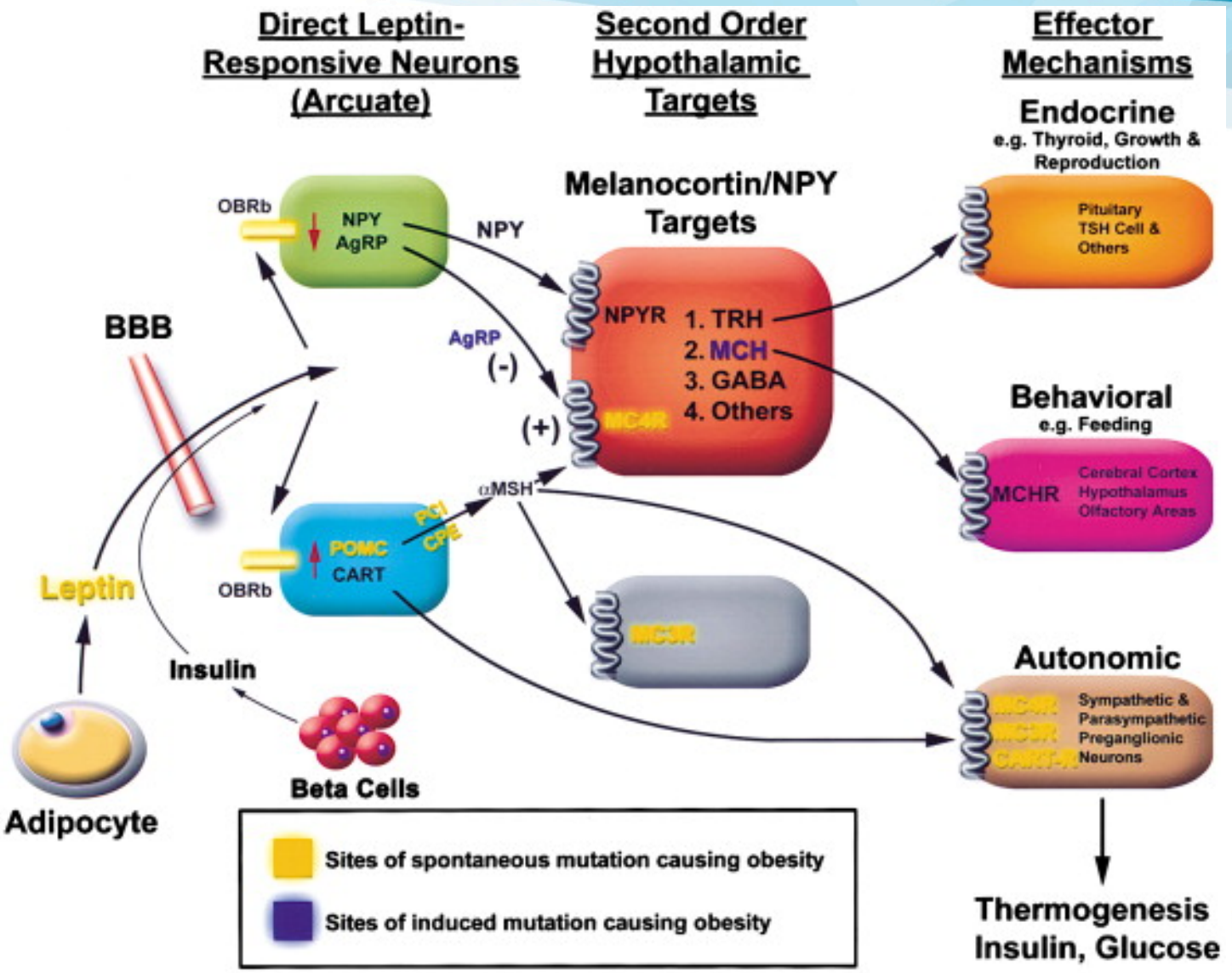
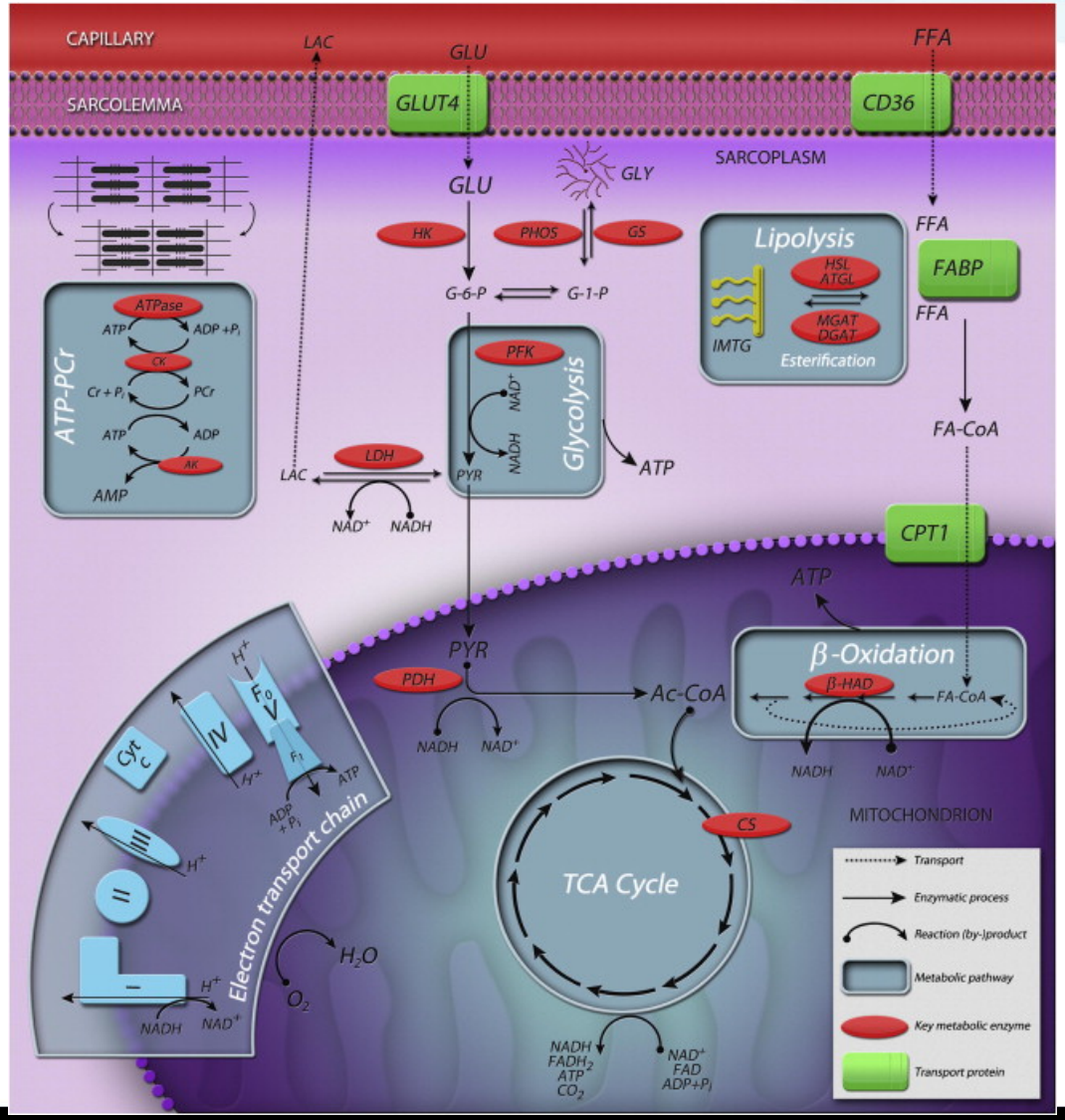


Spiegelman & Flier 2002

Skeletal Muscle Adaptations

Egan and Zierath 2013



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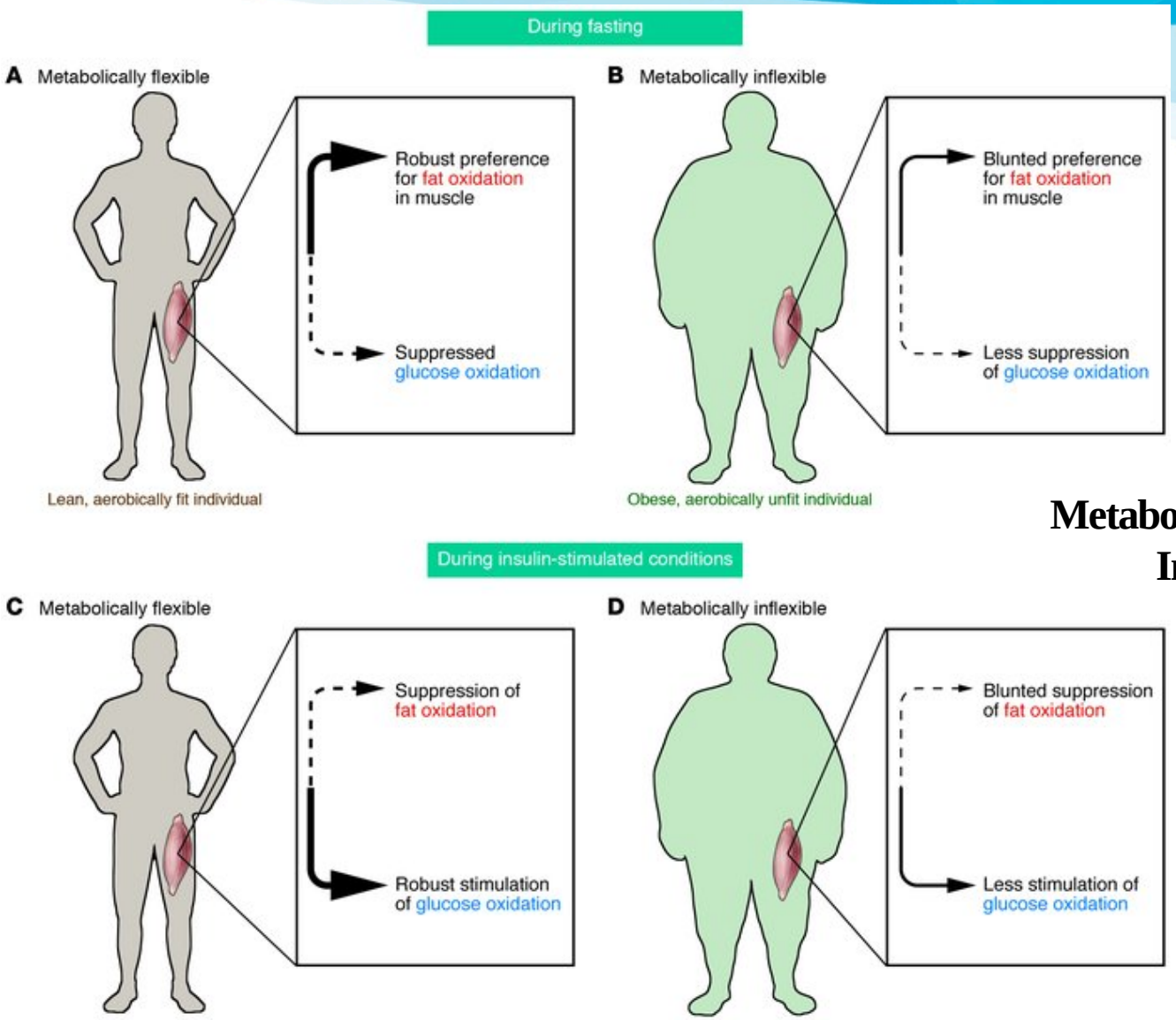
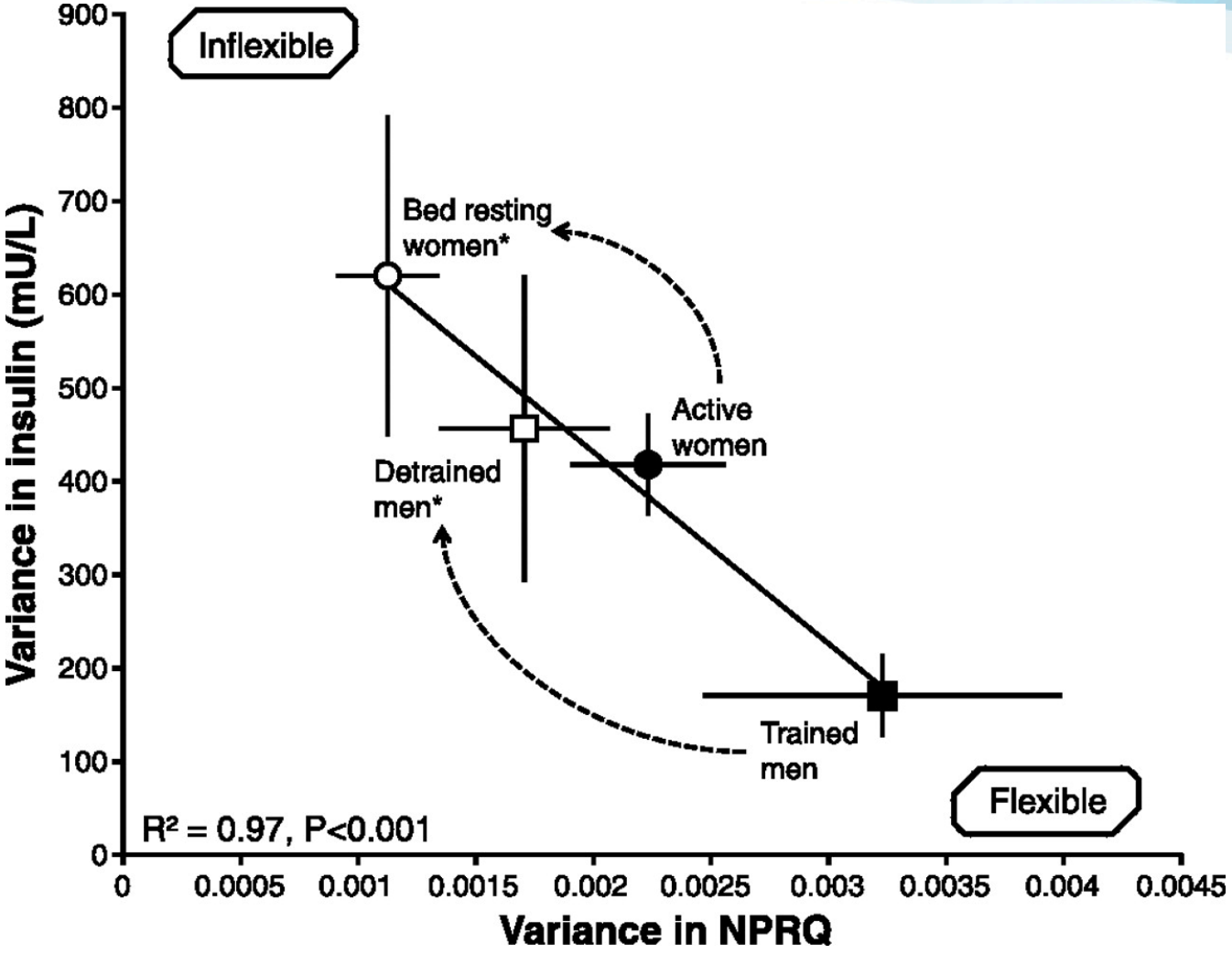
Metabolic Flexibility and Inflexibility



Kelley, D. E. (2005). Skeletal muscle fat oxidation: timing and flexibility are everything. *Journal of Clinical Investigation*, *115*(7), 1699-1702.

Physical activity predicts metabolic flexibility.



Bergouignan A et al. J Appl Physiol 2011;111:1201-1210

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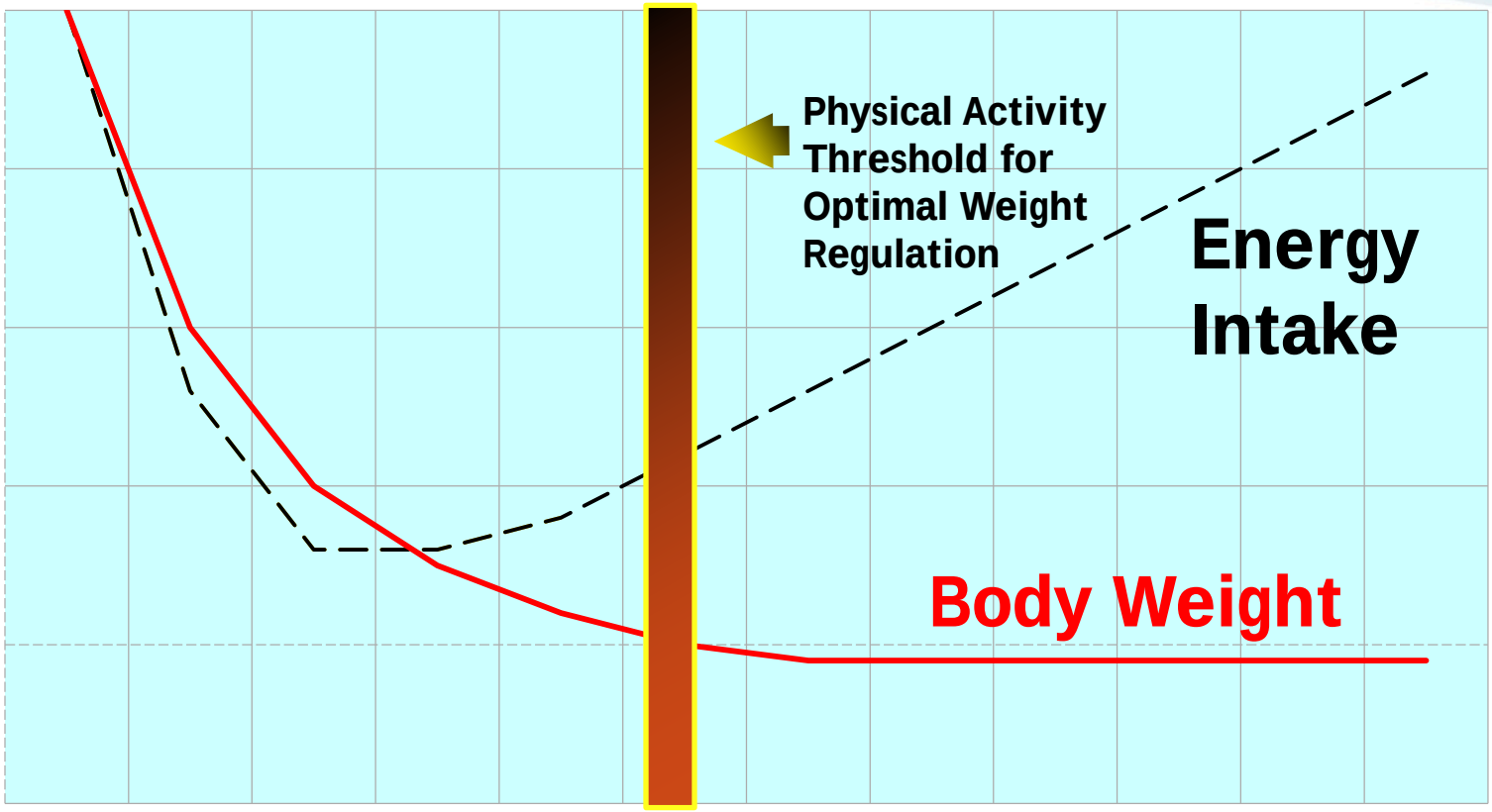
Our biology works best at high flux



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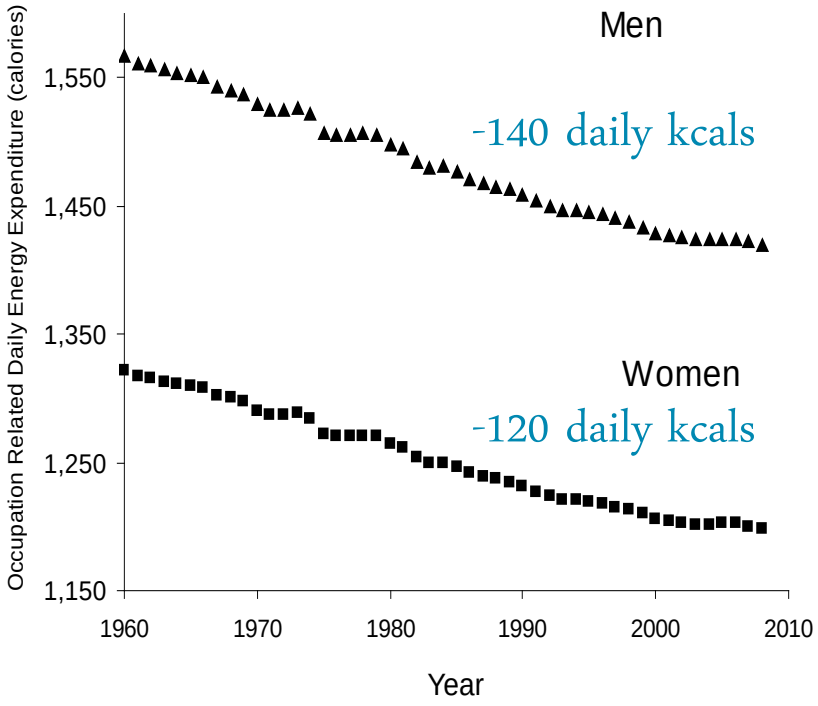
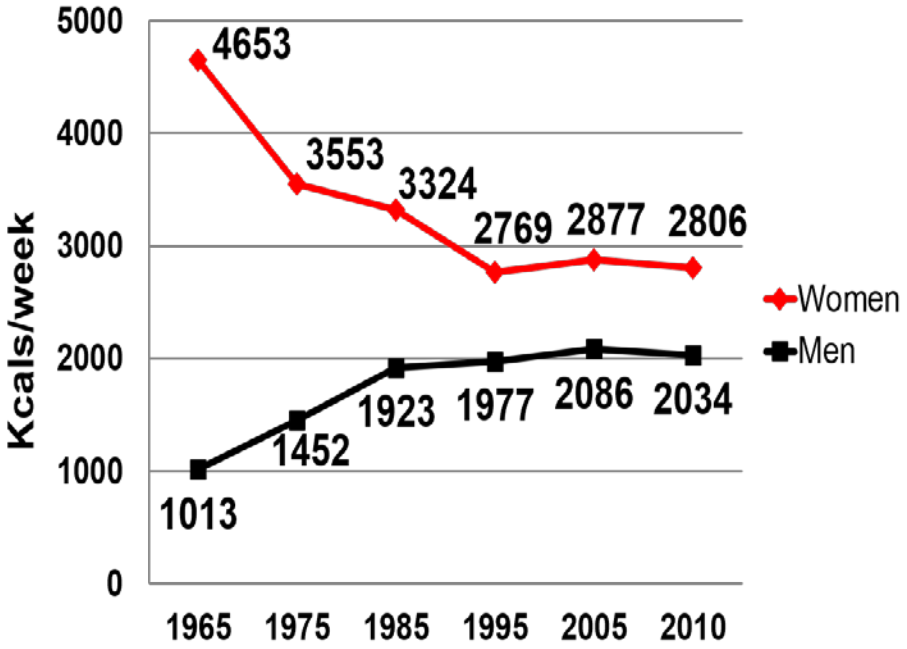
Can Reduced Physical Activity Facilitate Weight Gain?

Daily Occupational Caloric Expenditure



Trends in Housework Energy Expenditure (1965-2005)



Church et al, PLoS ONE, May 2011

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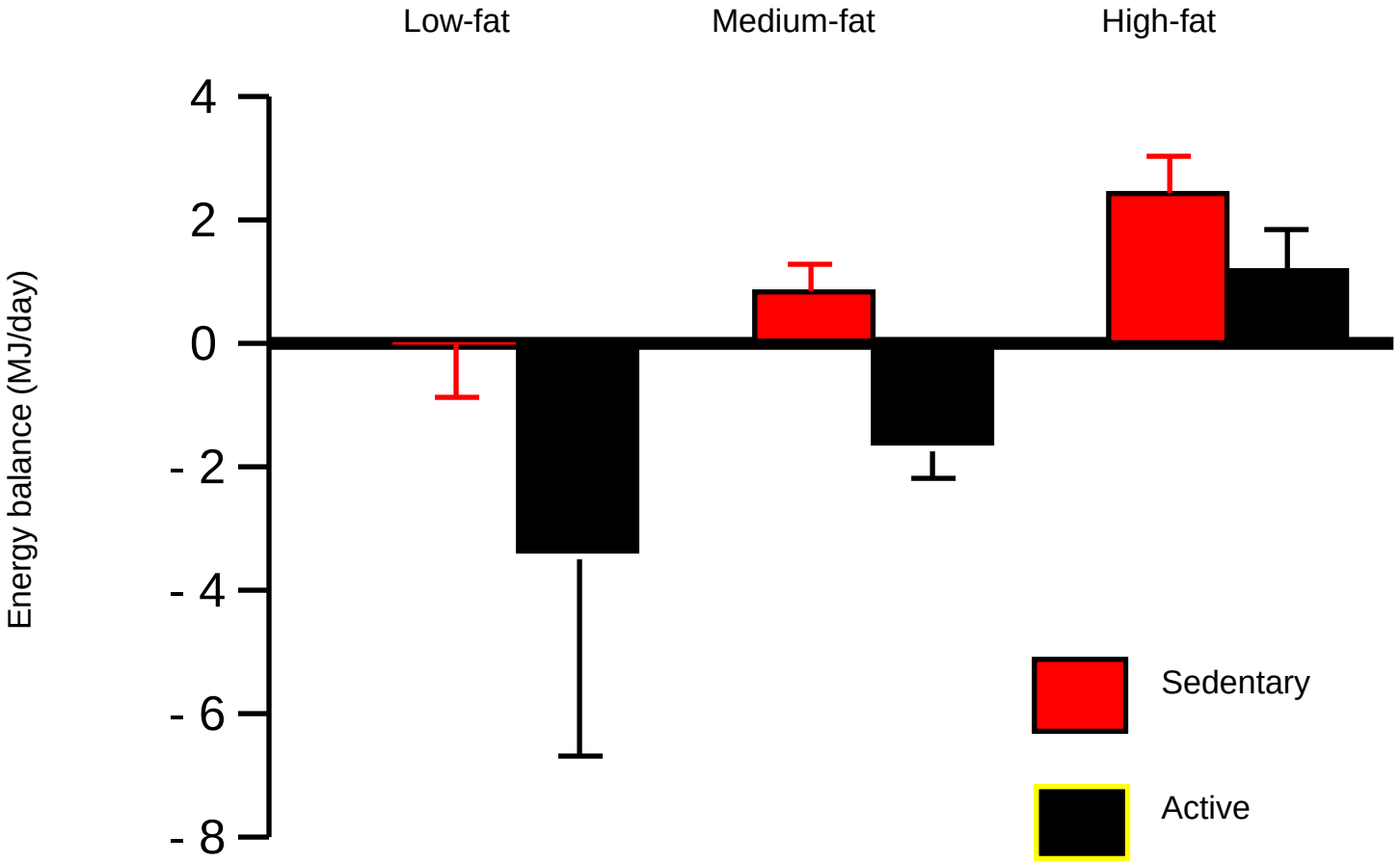
Can Physical Activity Prevent Weight



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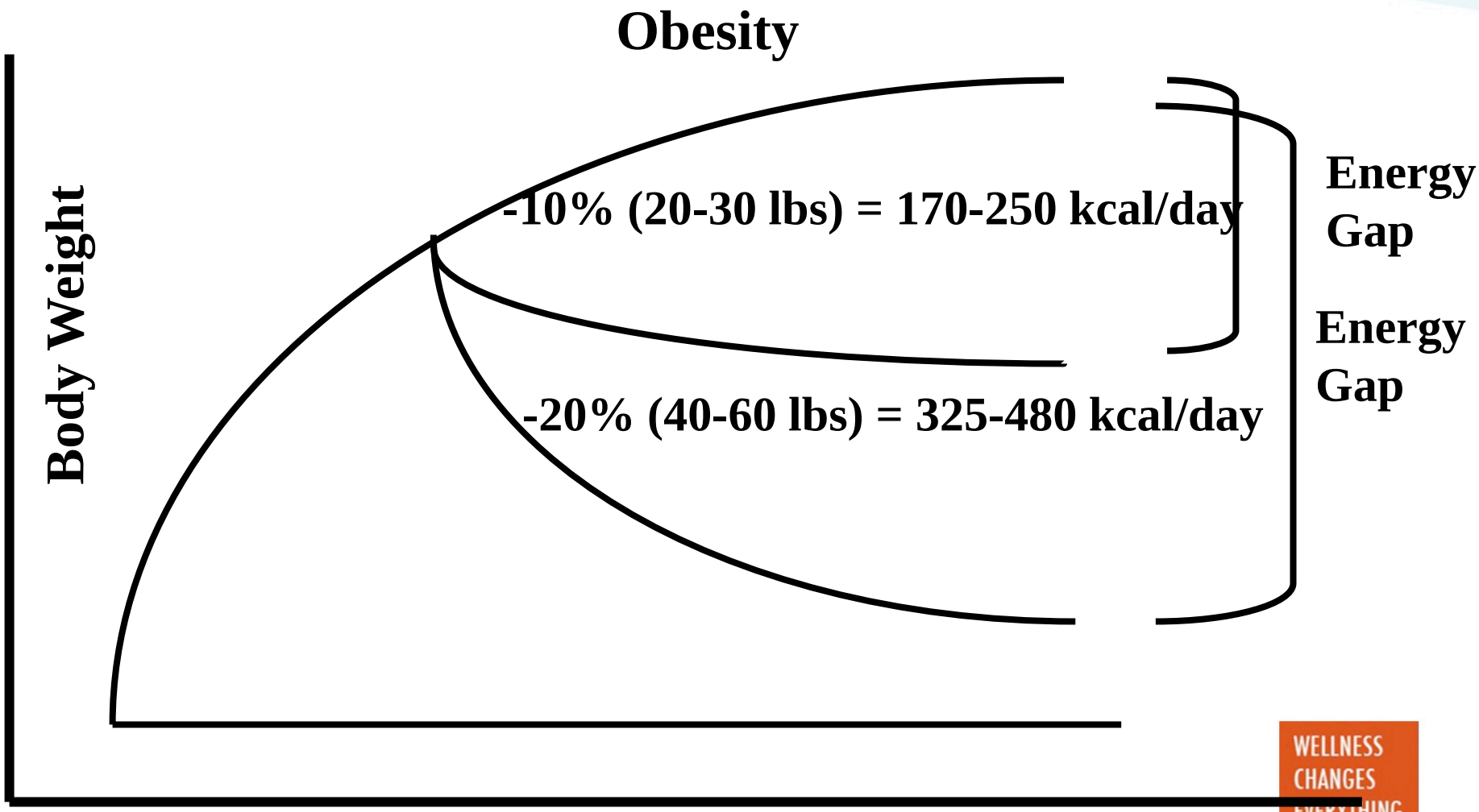
Research Article

Physical Activity Attenuates the Influence of FTO Variants on Obesity Risk: A Meta-Analysis of 218,166 Adults and 19,268 Children

Kilpeläinen TO, Qi L, Brage S, Sharp SJ, Sonestedt E, et al. PLoS Med 8:2011

The association of the *FTO* risk allele with the odds of obesity is attenuated by 27% in physically active adults, highlighting the importance of PA in particular in those genetically predisposed to obesity.

Can Physical Activity Help Treat Obesity?



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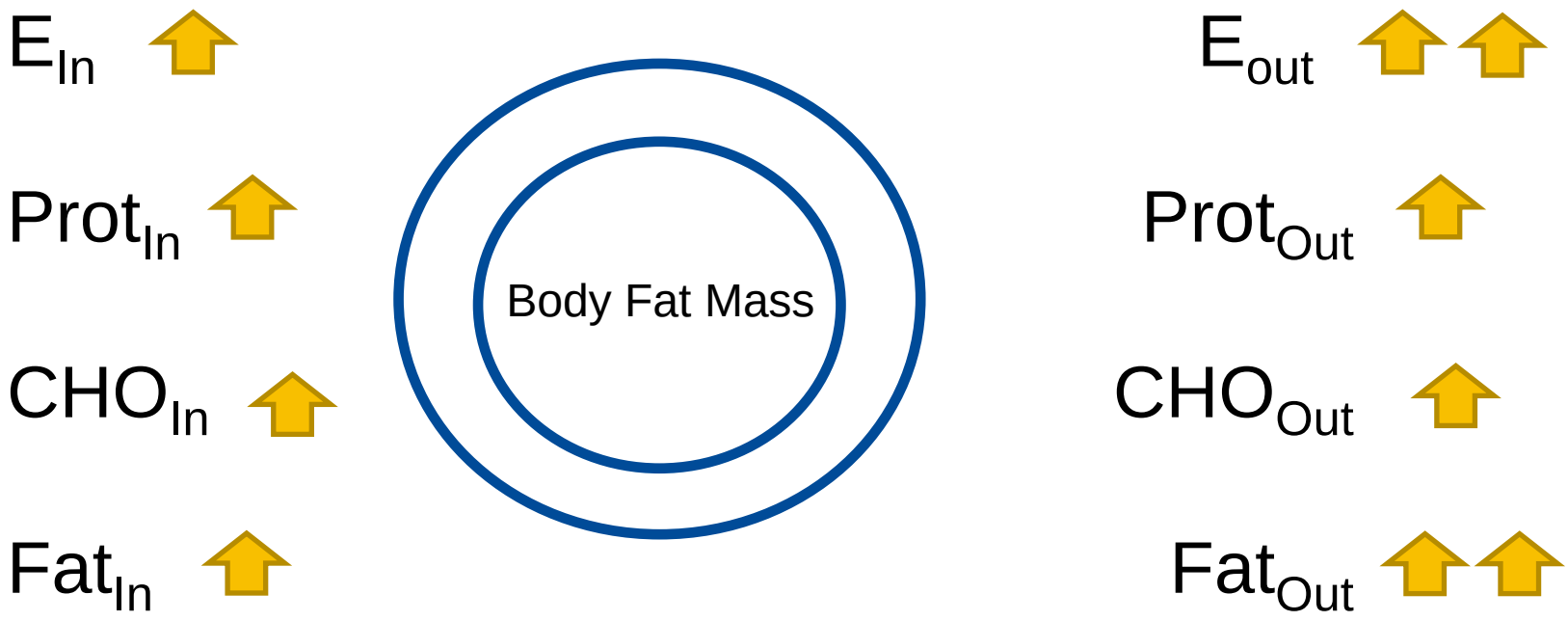
Should We Tell People to Exercise

+Physical Activity



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What Should we Tell People to Eat?

Is best diet for an active, fit person the same as for a sedentary, unfit person?

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CHANGES
EVERYTHING

Carbohydrate intake during the Tour de France

Garmin Riders at TdF:

Total Energy Intake: 6000-9000 Kcal/day

- **Carbohydrates: 75-80%**
- **About 1,000 g/day of CHO**
  - **400g simple sugars!**
- **4000 kcal/day of CHO**
  - **1600 Kcal/day Simple Sugars!**
  - **13-14g/kg/day!!**

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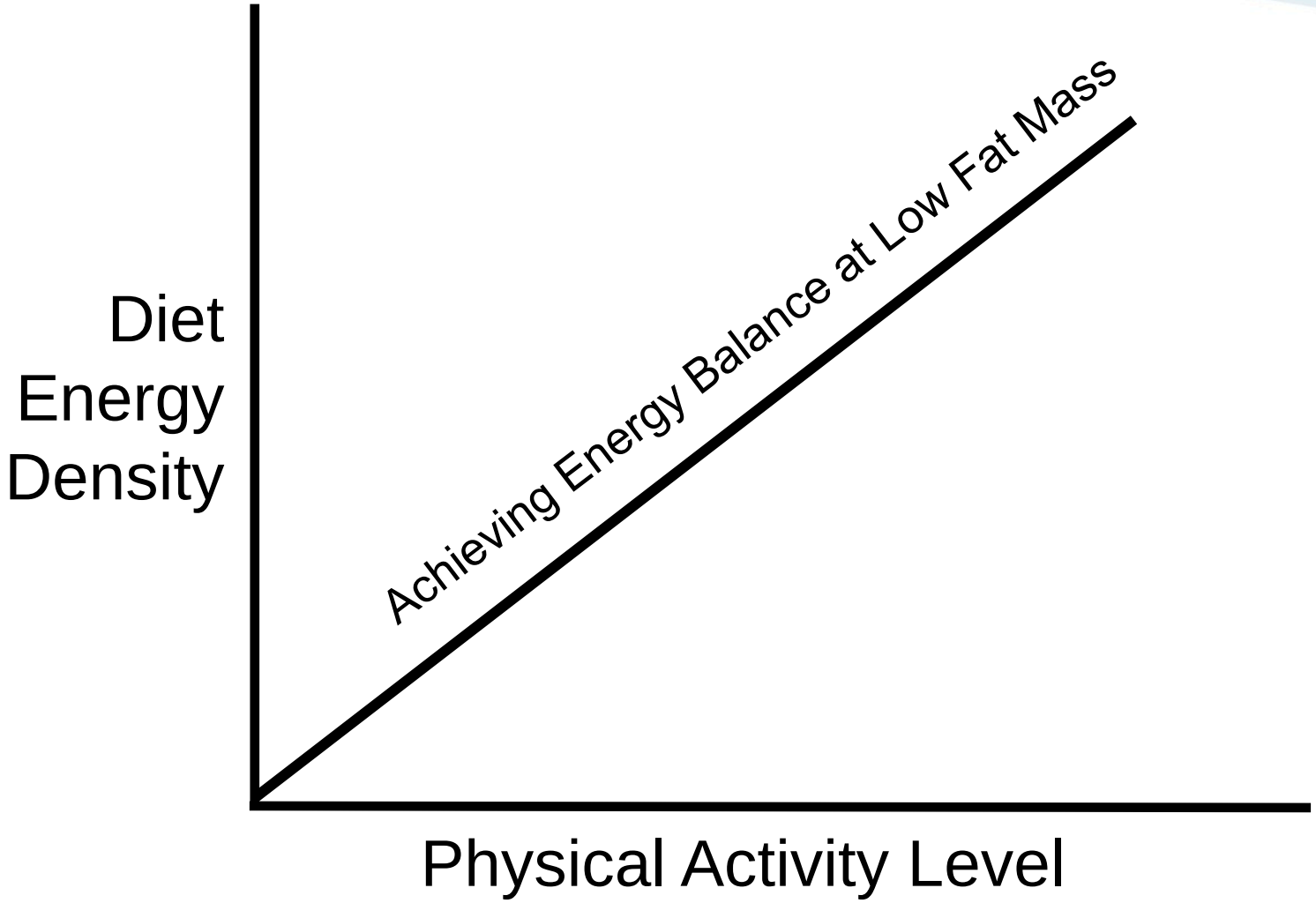
Optimum Diet Depends on Level of Physical Activity



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If we choose to focus on food alone what to we miss?

- Improved learning and cognitive function
- Improved cardiorespiratory fitness, chronic disease and mortality
- Improved mental state (e.g., reduced depression)
- Potentially higher productivity and economic growth
- National security

What is the one thing you could do to most improve human health?

Increase cardiometabolic fitness

How to Get People to Move?

Focus on environment
Change behavior - why

What if it became policy that:

1. In every workplace, employees get 30 minutes of physical activity every day on the clock?
2. In every school, students get 60 minutes of physical activity every day

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Conclusions

- Studies of energy balance suggest that changes in physical activity are directly related to changes in body weight in MOST people
- The biggest impact of physical activity may be in

WE CANNOT REVERSE THE OBESITY EPIDEMIC WITHOUT INCREASING PHYSICAL ACTIVITY IN THE POPULATION

- Increasing physical activity should be an effective way to prevent and treat obesity
- A big challenge remains in how to permanently increase physical activity

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THANK YOU

Our Team

Thanks to our fantastic faculty and staff