

Ultramarathoners and the limits of human energy expenditure

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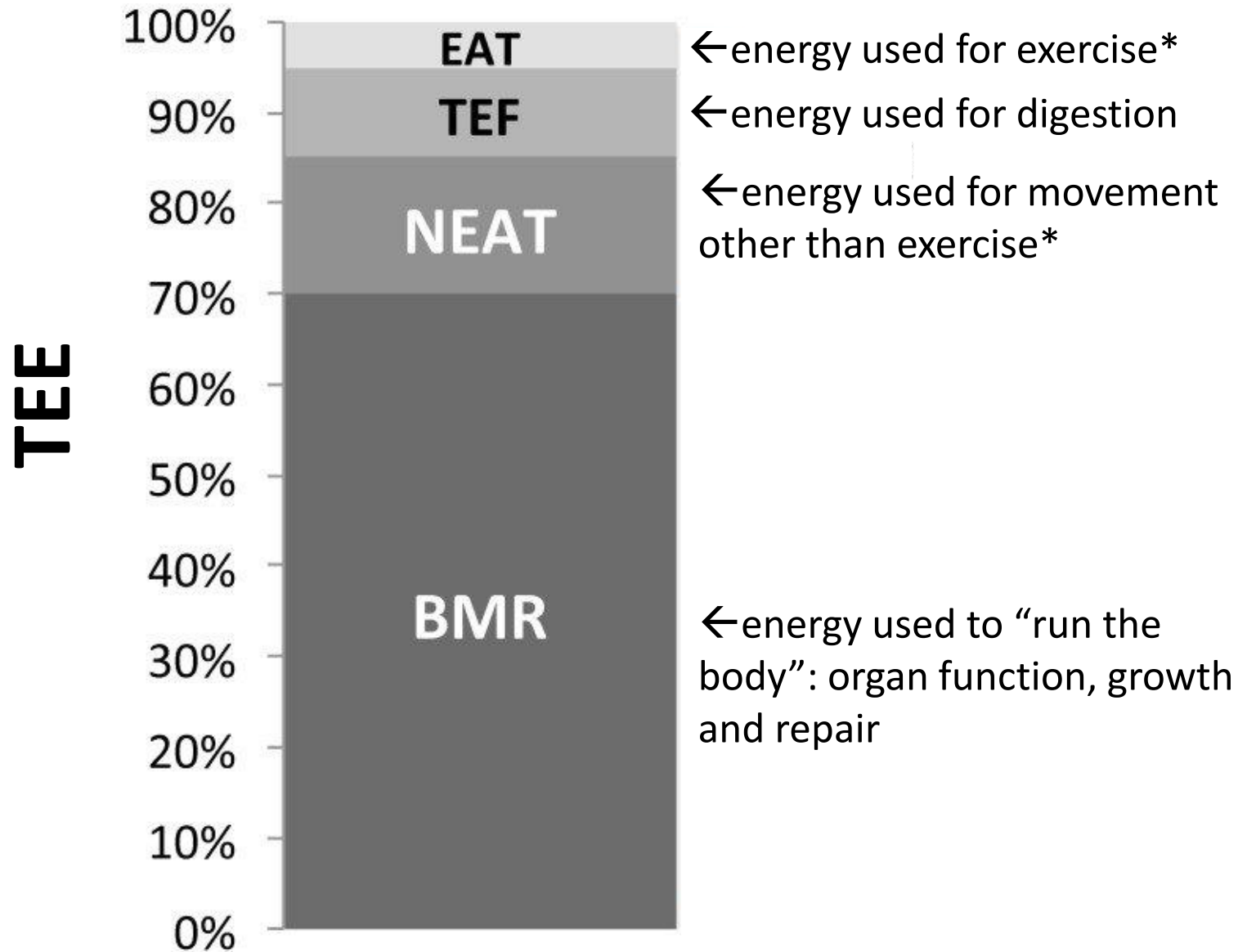
Biology of human energy expenditure

- Components of total energy expenditure
- Evolution of human energy expenditure
- Metabolic ceilings: How much energy can humans expend?

Ultra energetics project

- Objectives
- Methods
- Preliminary results
- Future directions

Components of Total Energy Expenditure (TEE)



*Activity Energy Expenditure

TEE / BMR = Metabolic Scope

Synonymous with PAL
(physical activity level)

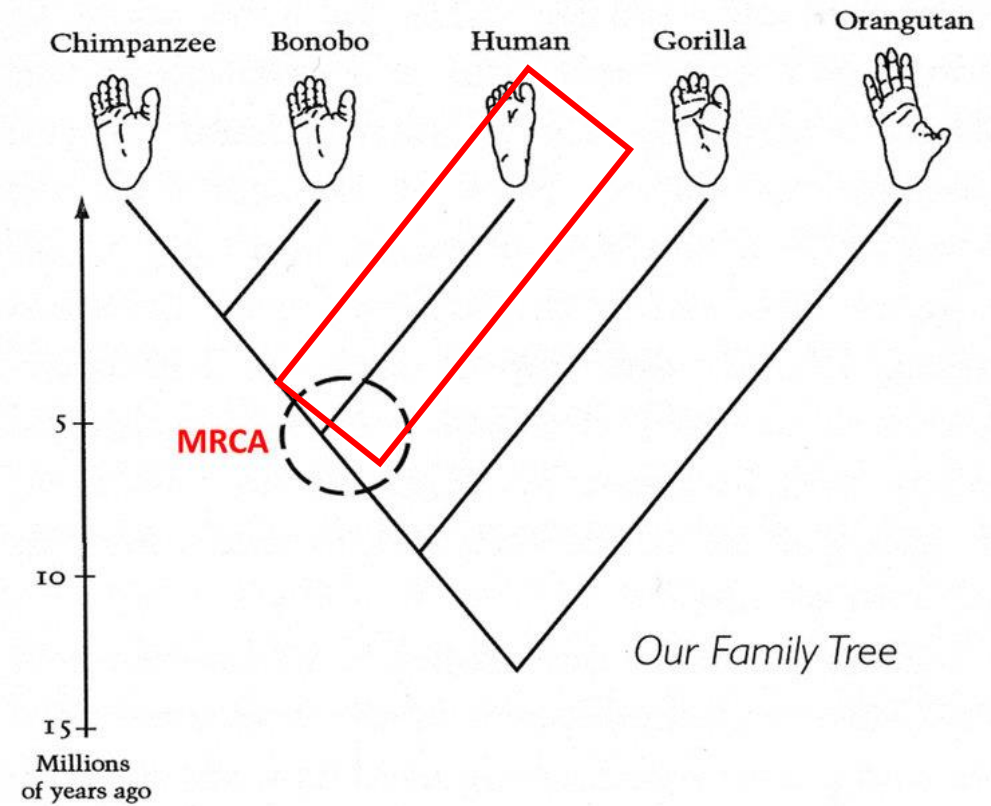
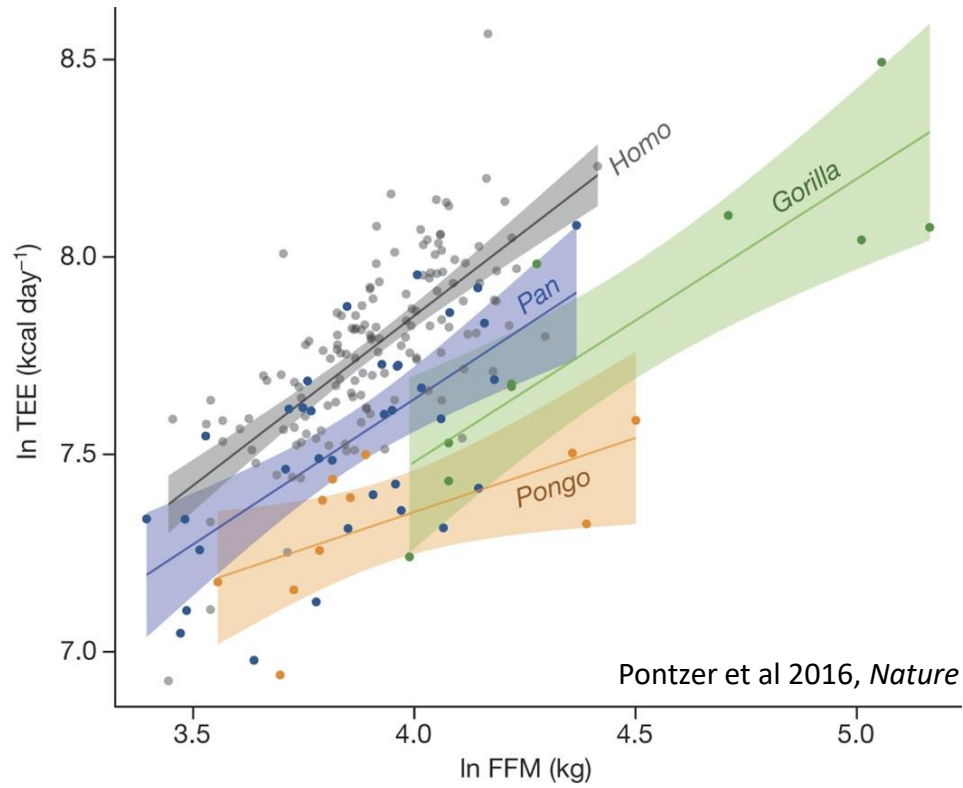
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High human TEE is derived



Evolutionary context of derived human TEE

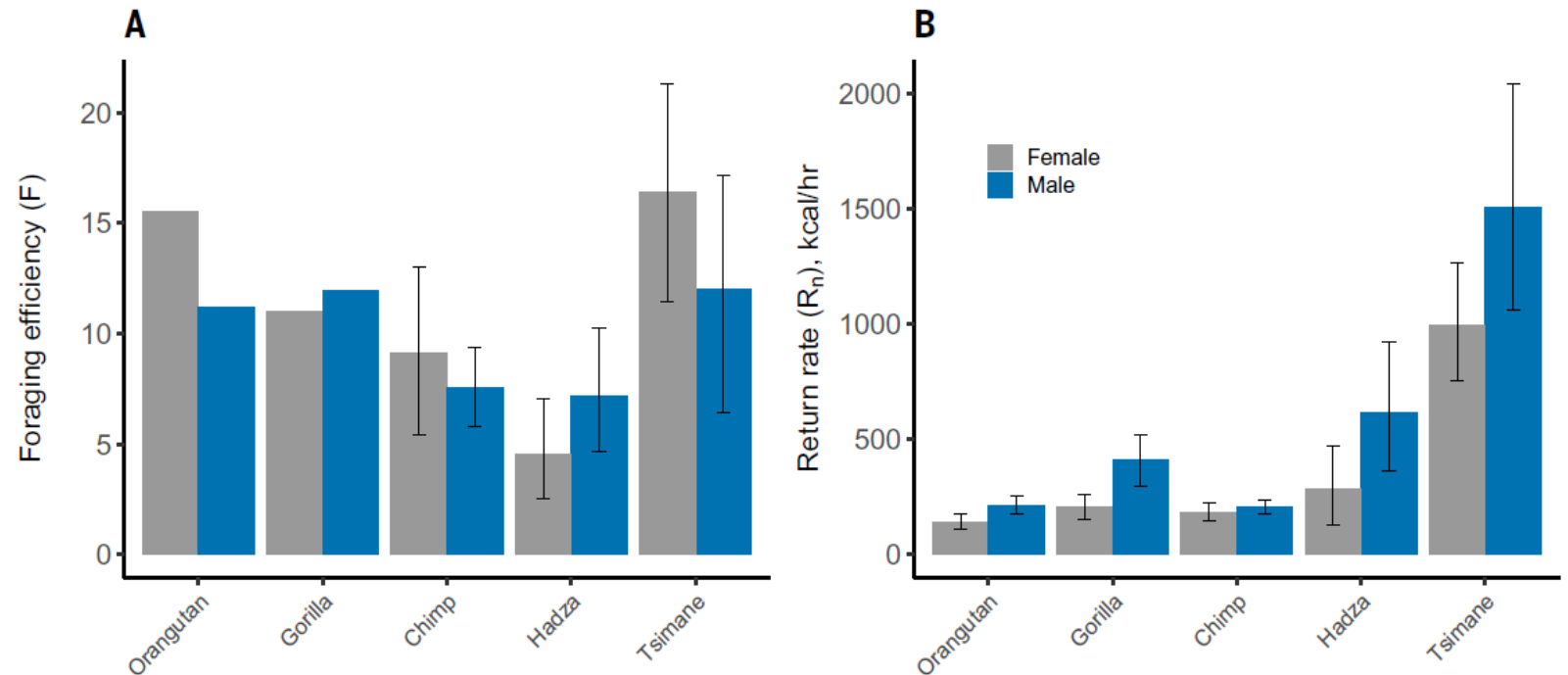
The human strategy:

- high metabolic rate, high physical activity, high reproductive rate
- yet slow childhood, long life, big brains

How we did it:

Increased energy acquisition per unit time.

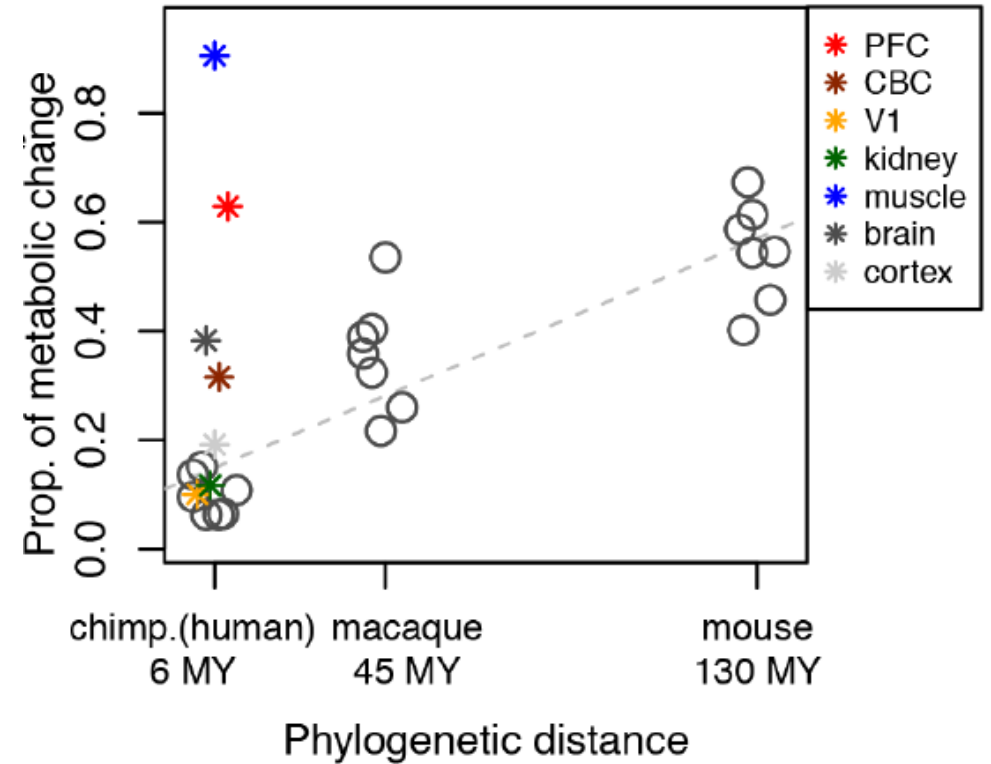
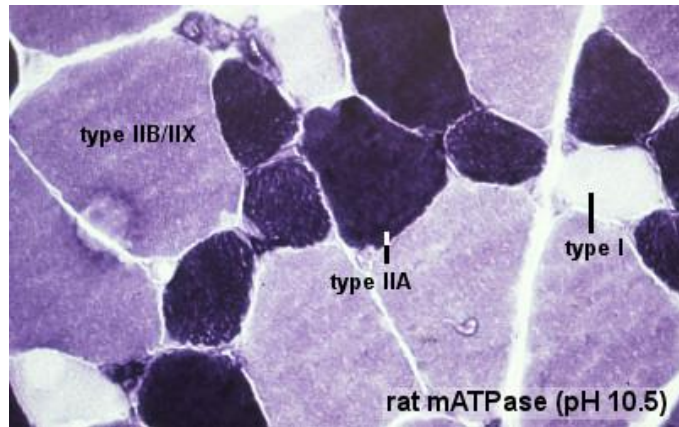
High energy cost, high energy return.



Kraft *et al.* 2021, *Science*

Evolutionary context of derived human TEE

High physical activity = selective pressure for high metabolic scope



High TEE is risky

- Increased adiposity as an energetic buffer
- Exercise capacities are “use it or lose it”; Match capacity to demand, energetic investment only when stimulated with physical activity

