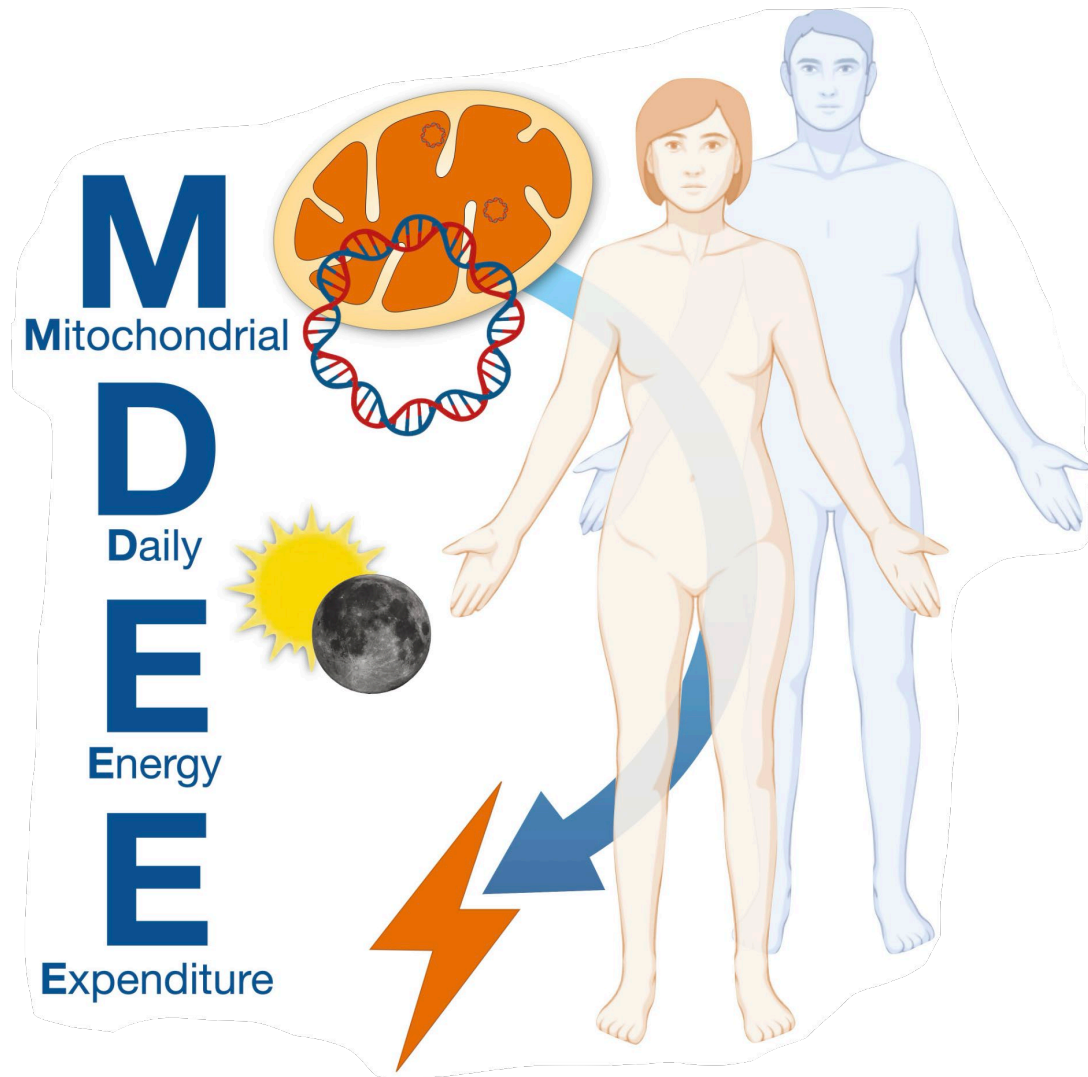


The Energetic Cost of Mitochondrial Disorders Across Day & Night

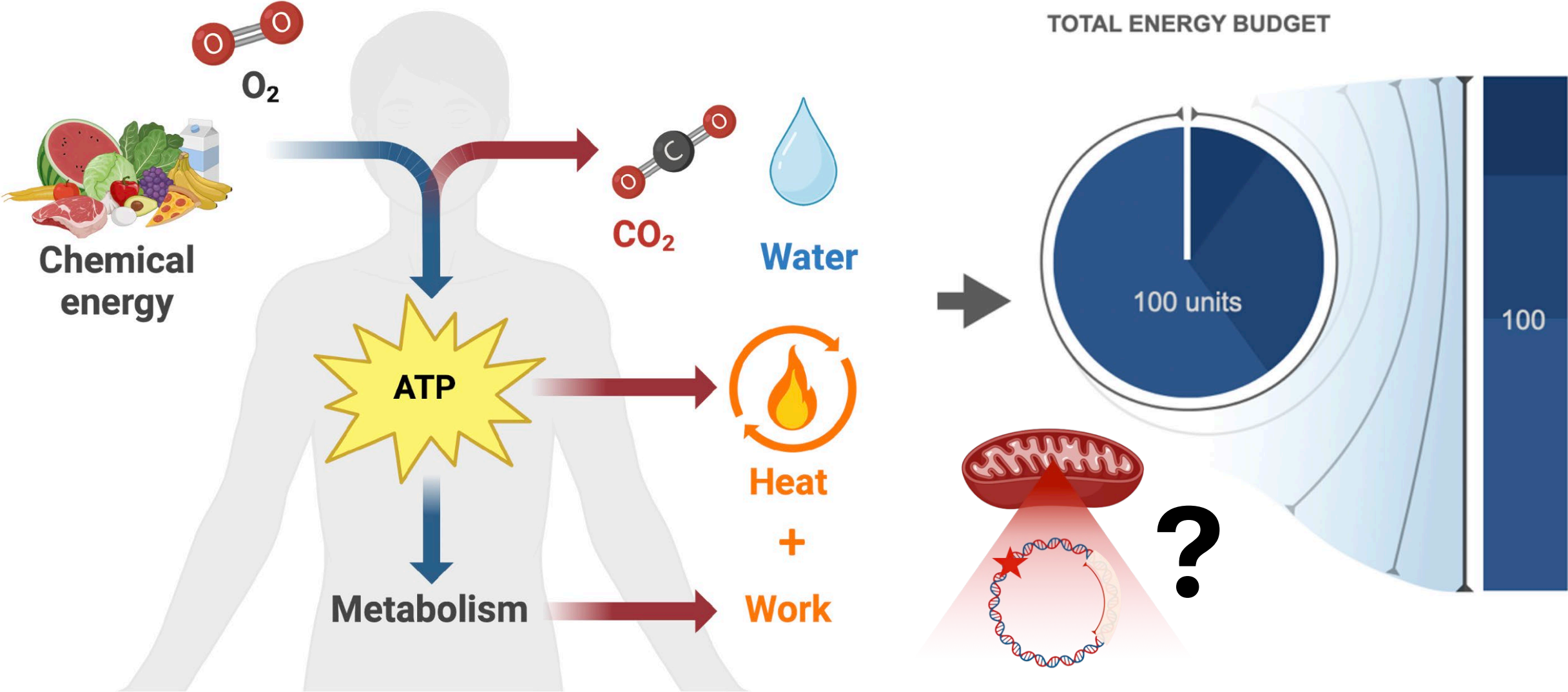
Evan Shaulson

MiSBIE Symposium

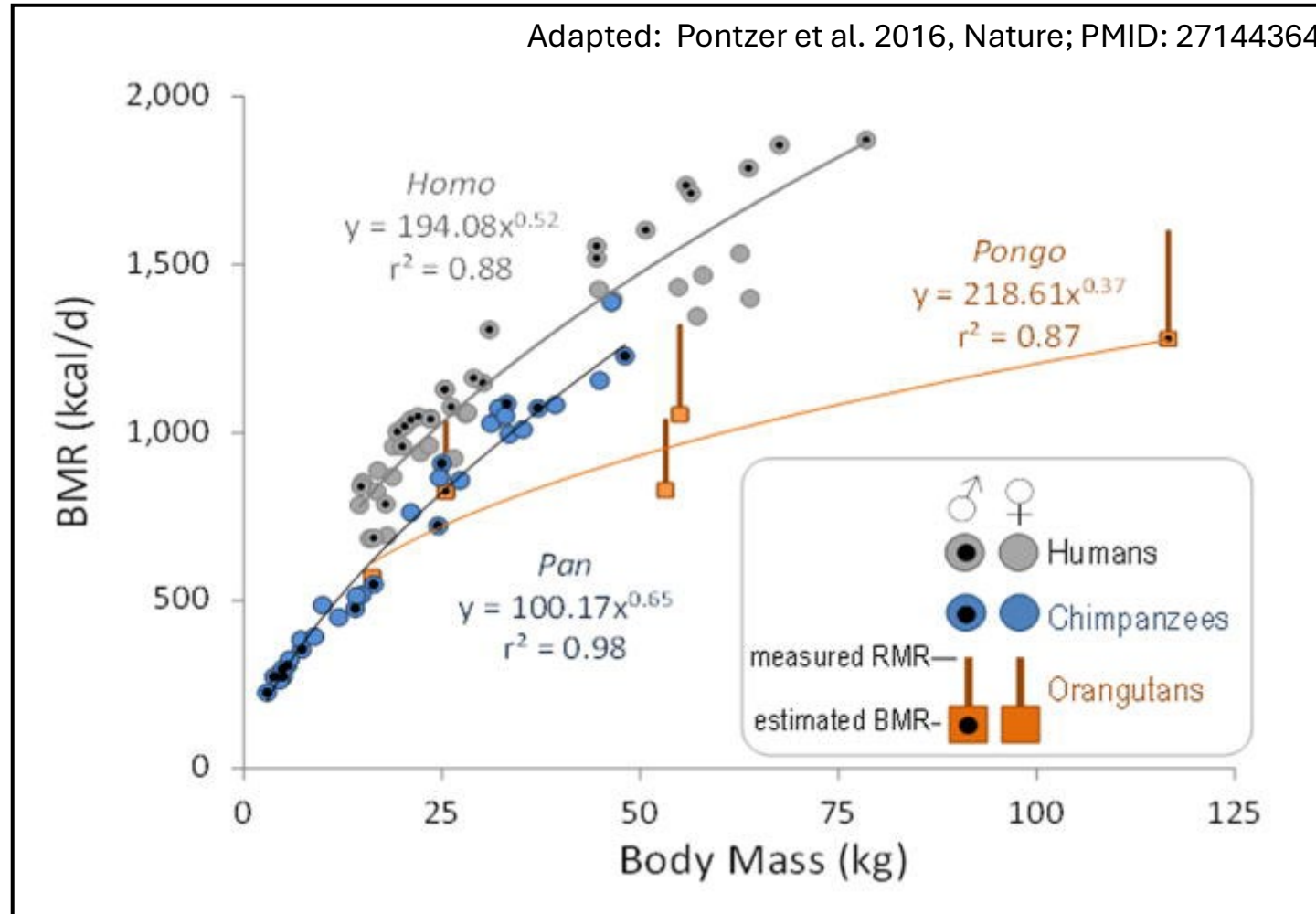
December 12th 2025



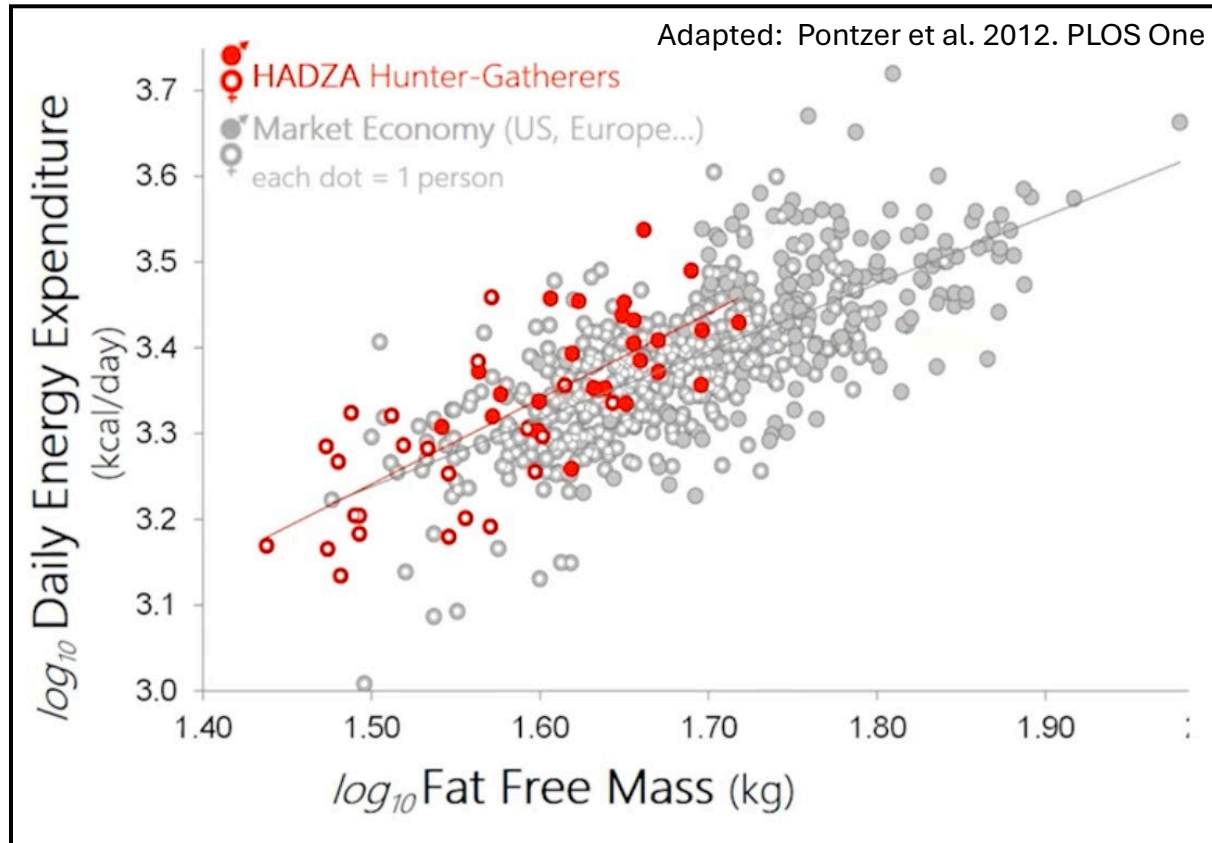
Everything must fit within the energy budget



Metabolic rate is an evolved trait



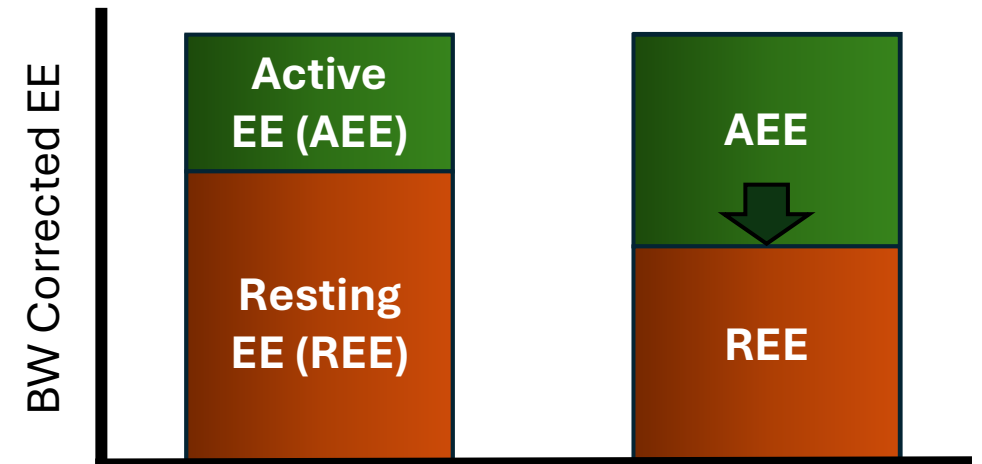
Metabolic rate is an evolved trait that is maintained within a narrow homeostatic range



Sedentary Population



Active Population

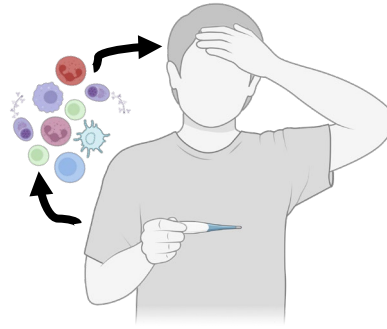




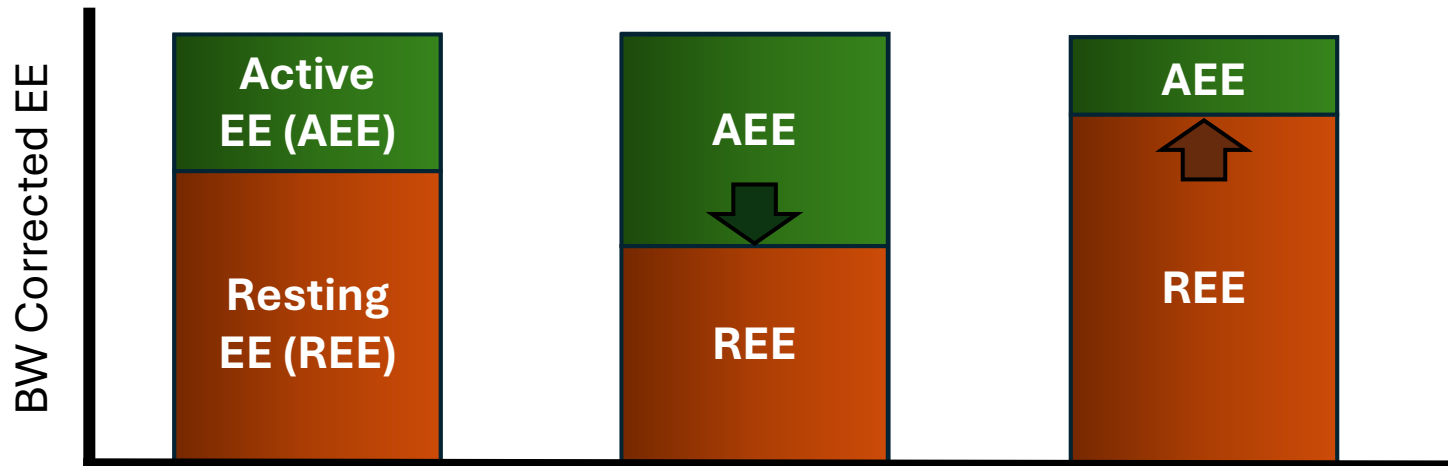
Sedentary Population



Active Population

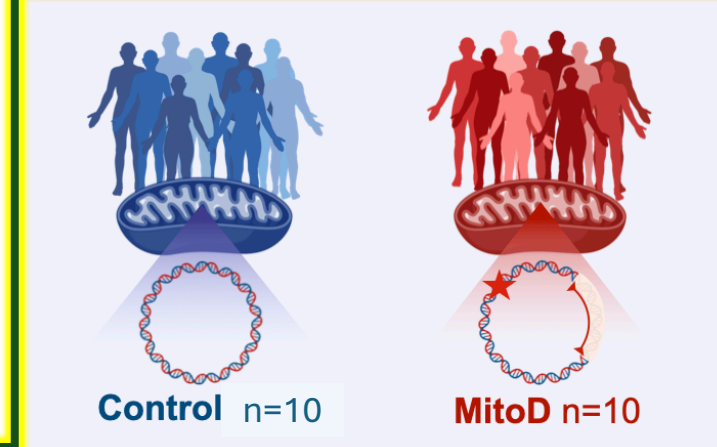
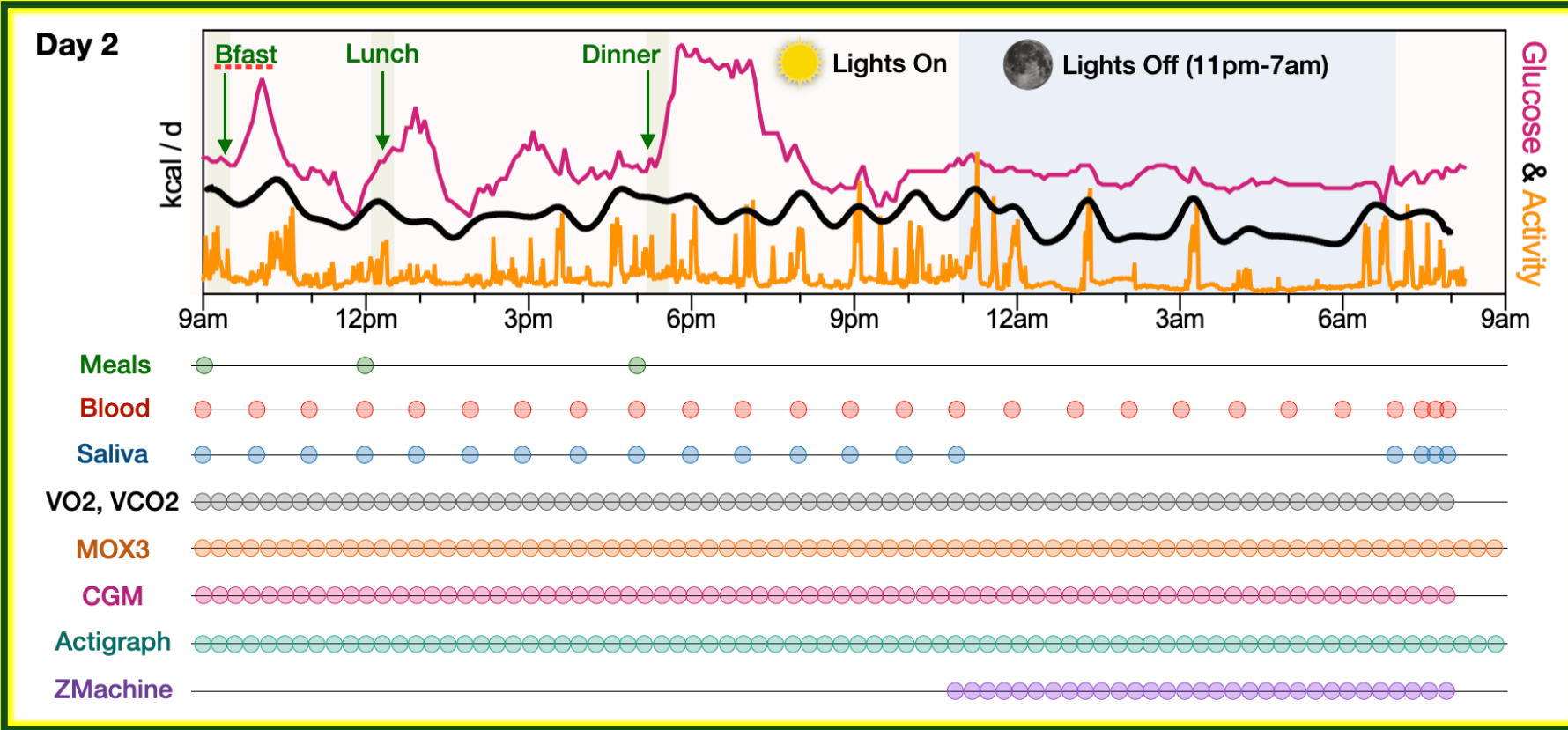
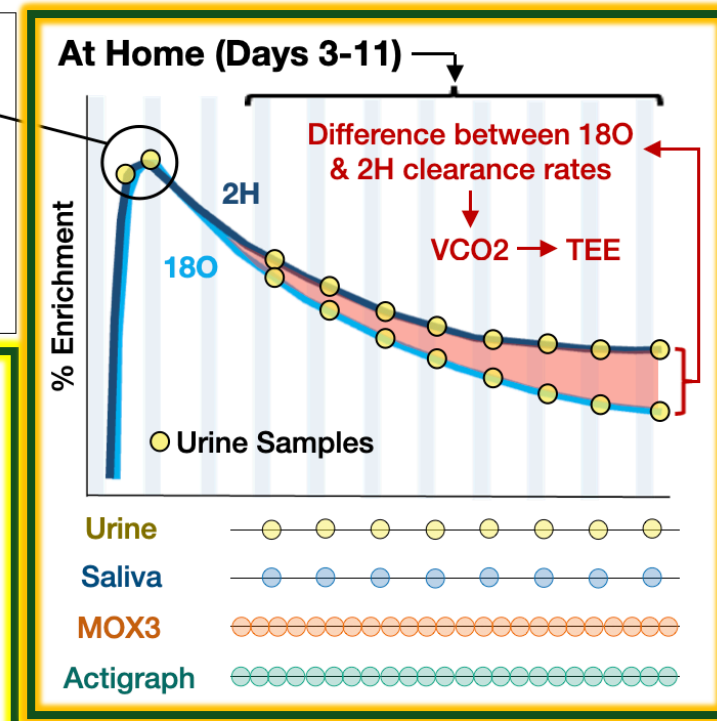
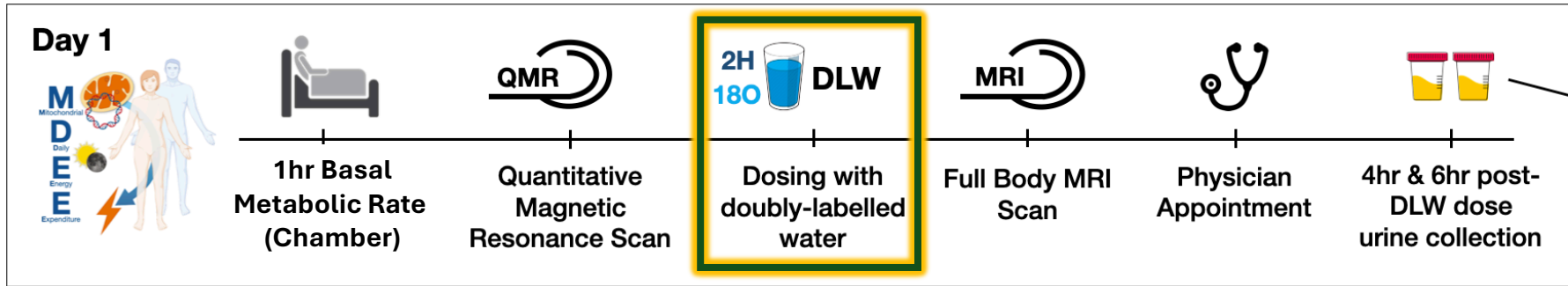


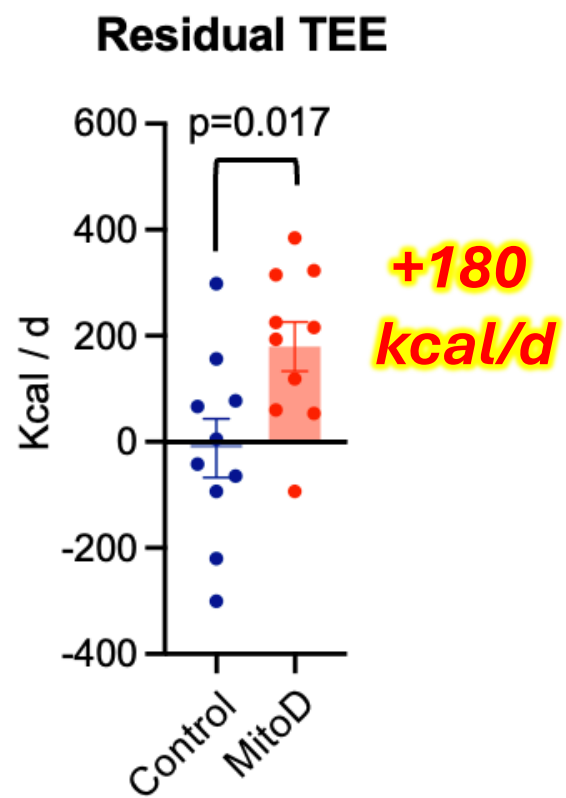
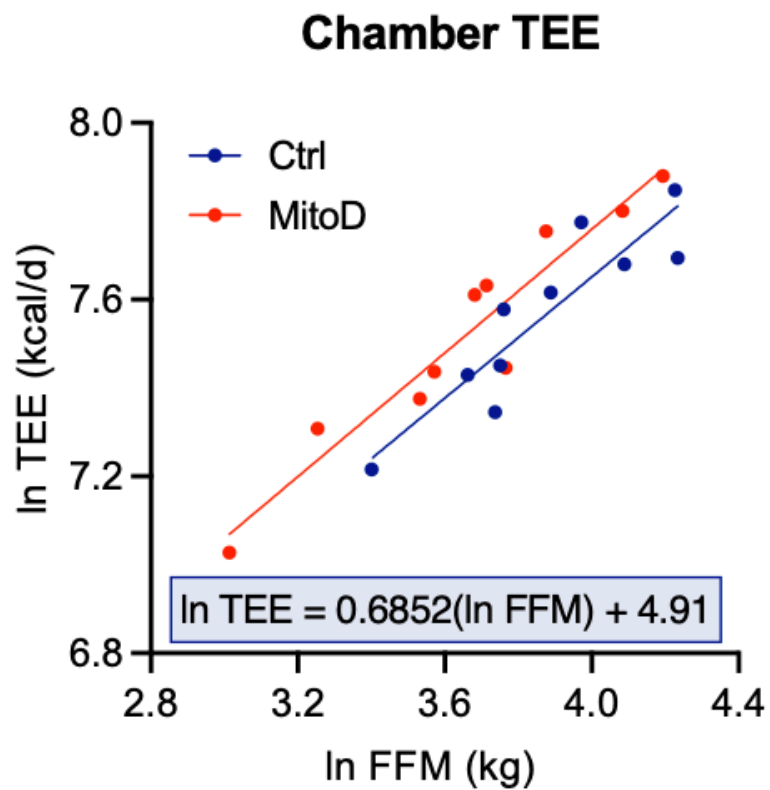
Acute Infection



What do these tradeoffs look like in mitochondrial disease?

Mitochondrial Daily Energy Expenditure (MDEE)

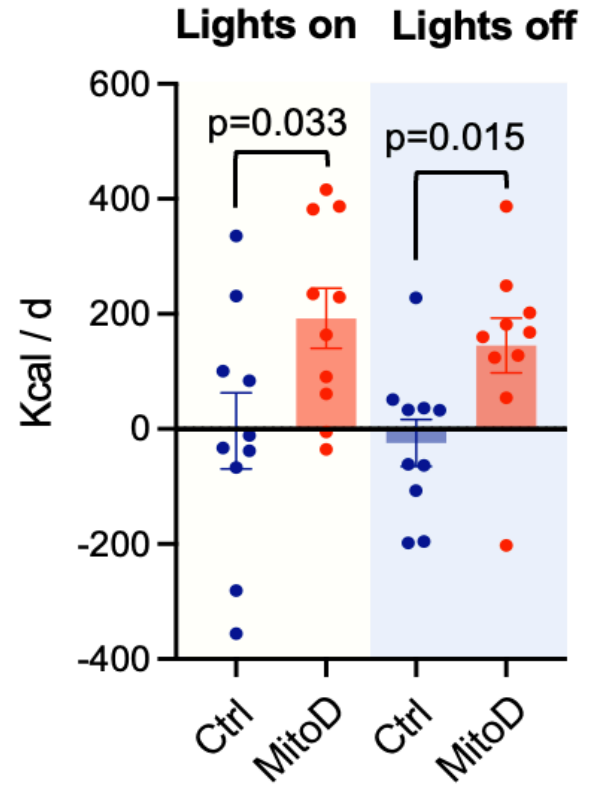
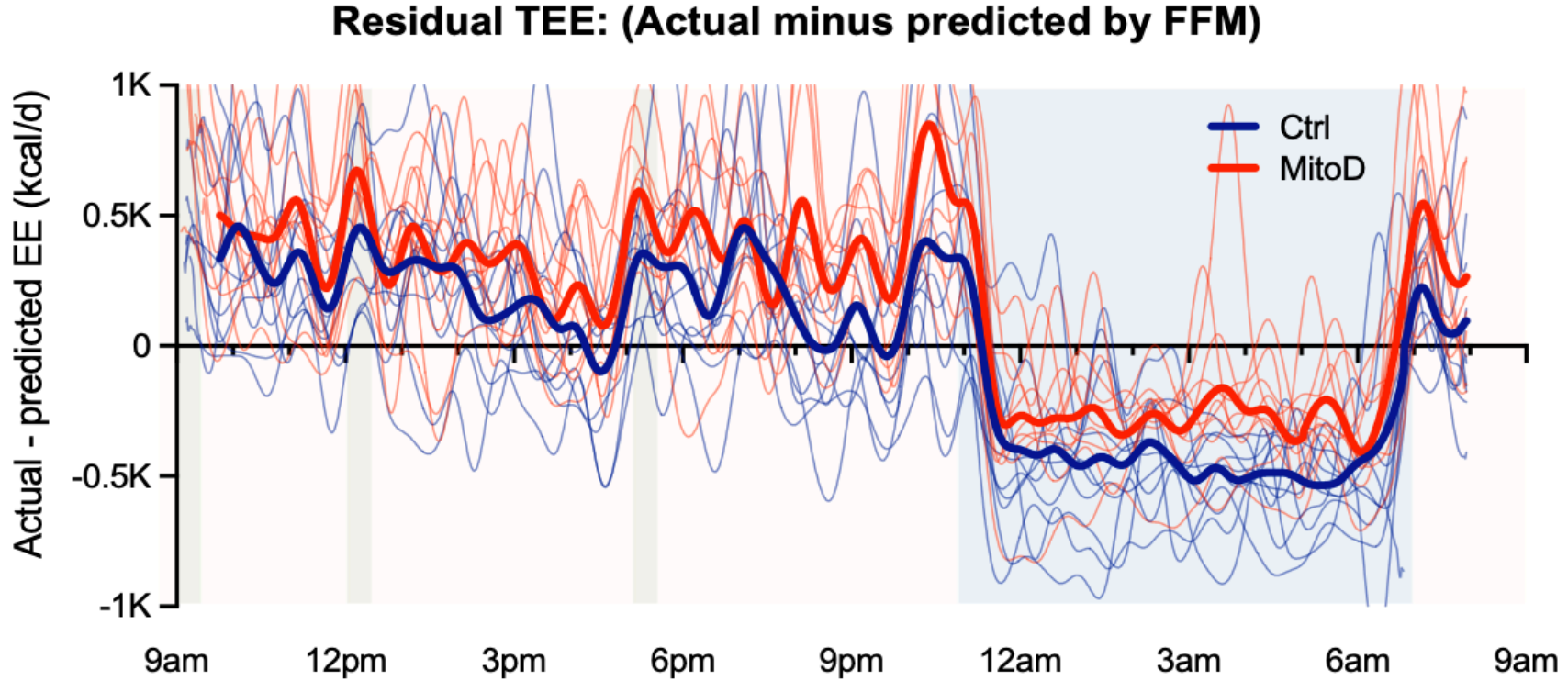




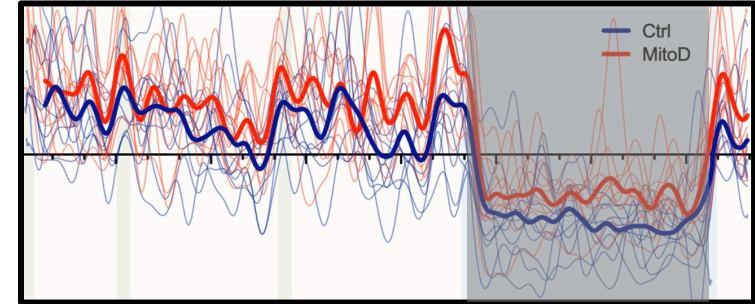
What is MitoD spending more on?



Consistent Hypermetabolism Across Day & Night



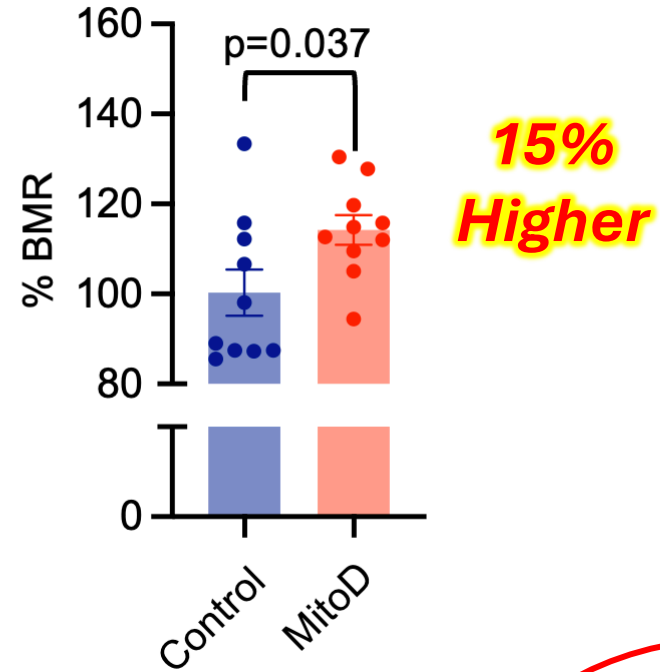
Day: Higher EE despite lower PA



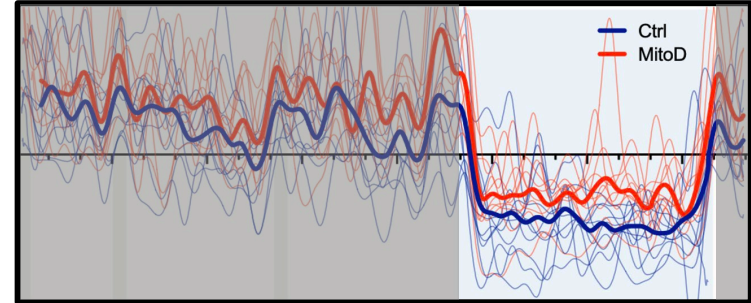
The subject in this image was generated by Google Gemini's Nano Banana Pro

Night: Elevated Sleeping EE

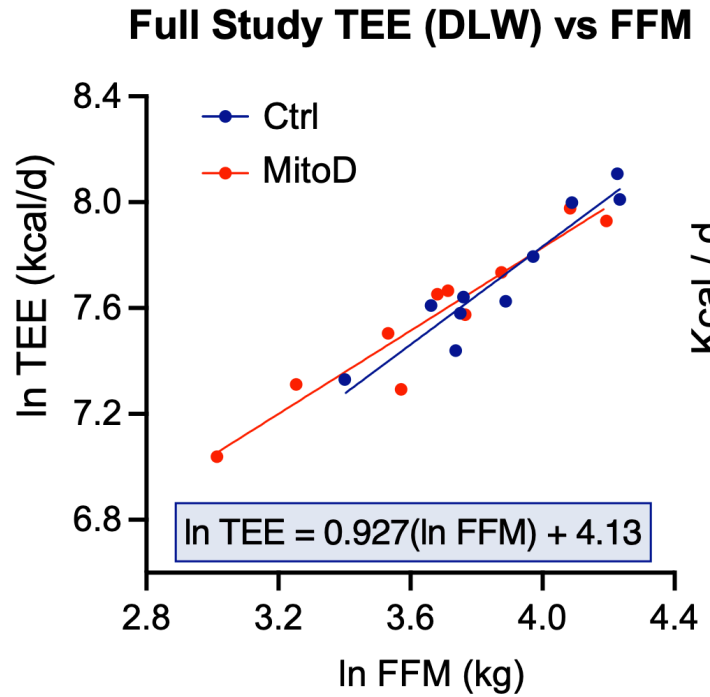
Sleep EE



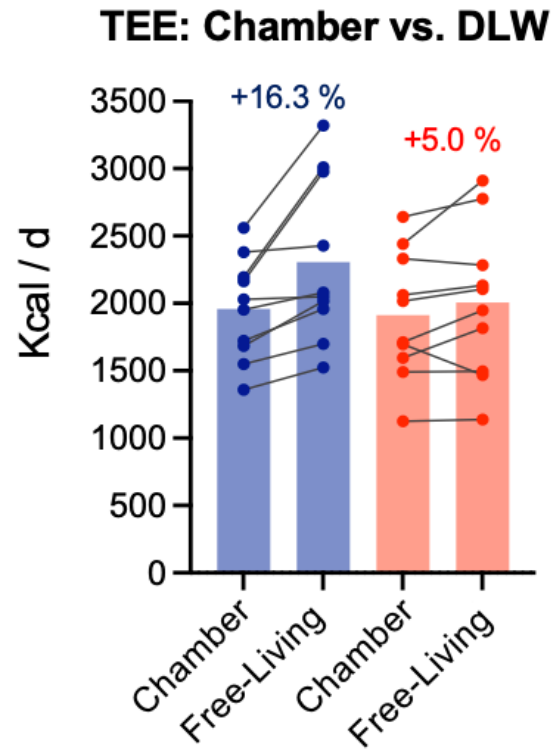
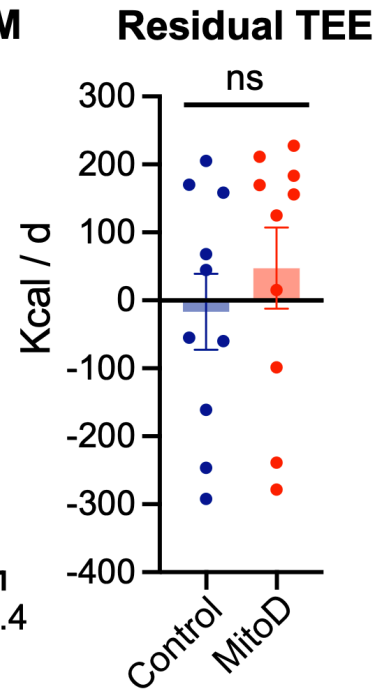
t
tion



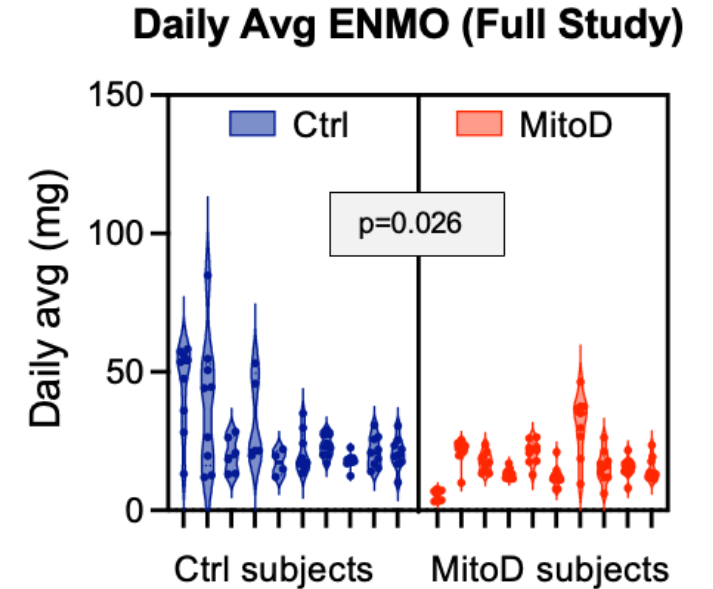
180kcal/d “Tax” – How is it paid in the real world?



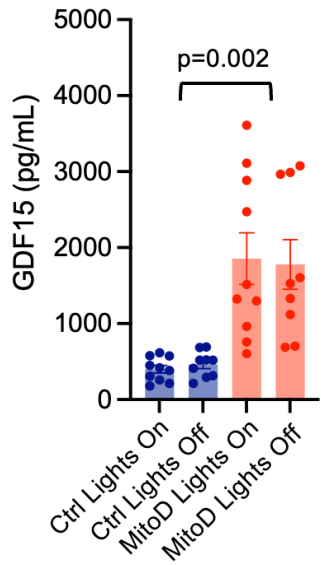
Free-living TEE is similar between groups



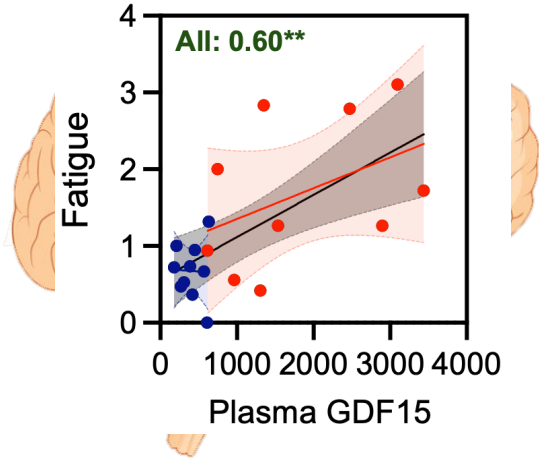
Chamber day more similar to a typical day for MitoD



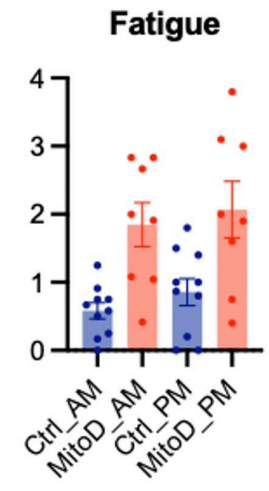
Lower physical activity average & range in MitoD



GDF15

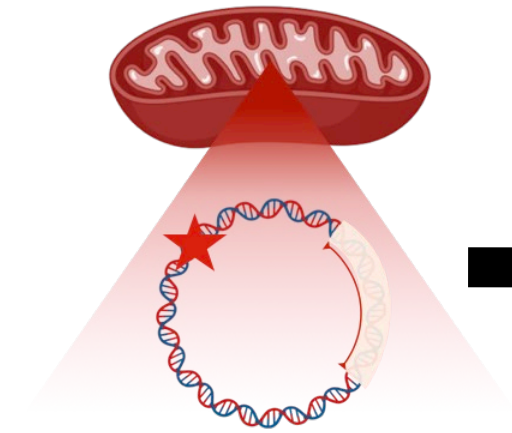


Fatigue

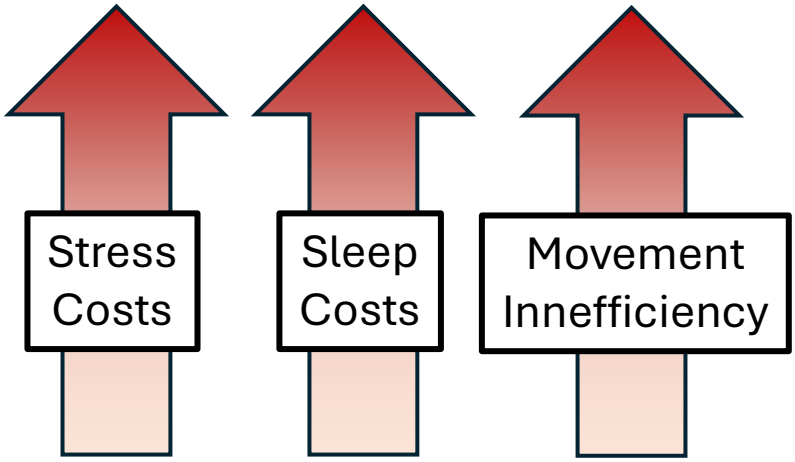
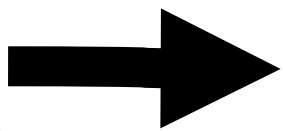


What it means for MitoD:

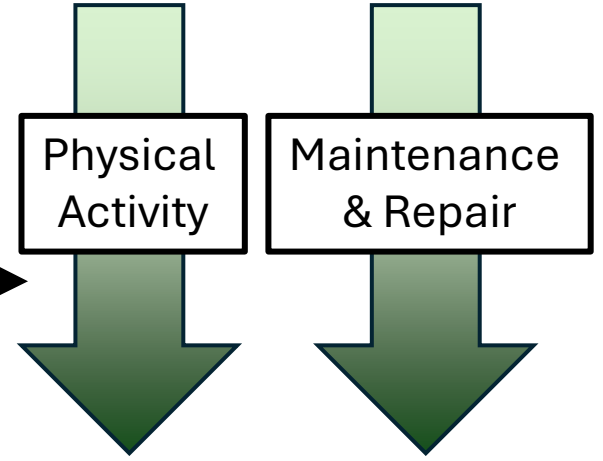
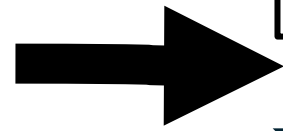
- Manage allostatic load
- Exercise enhances efficiency



mtDNA Defect



Allostatic Load

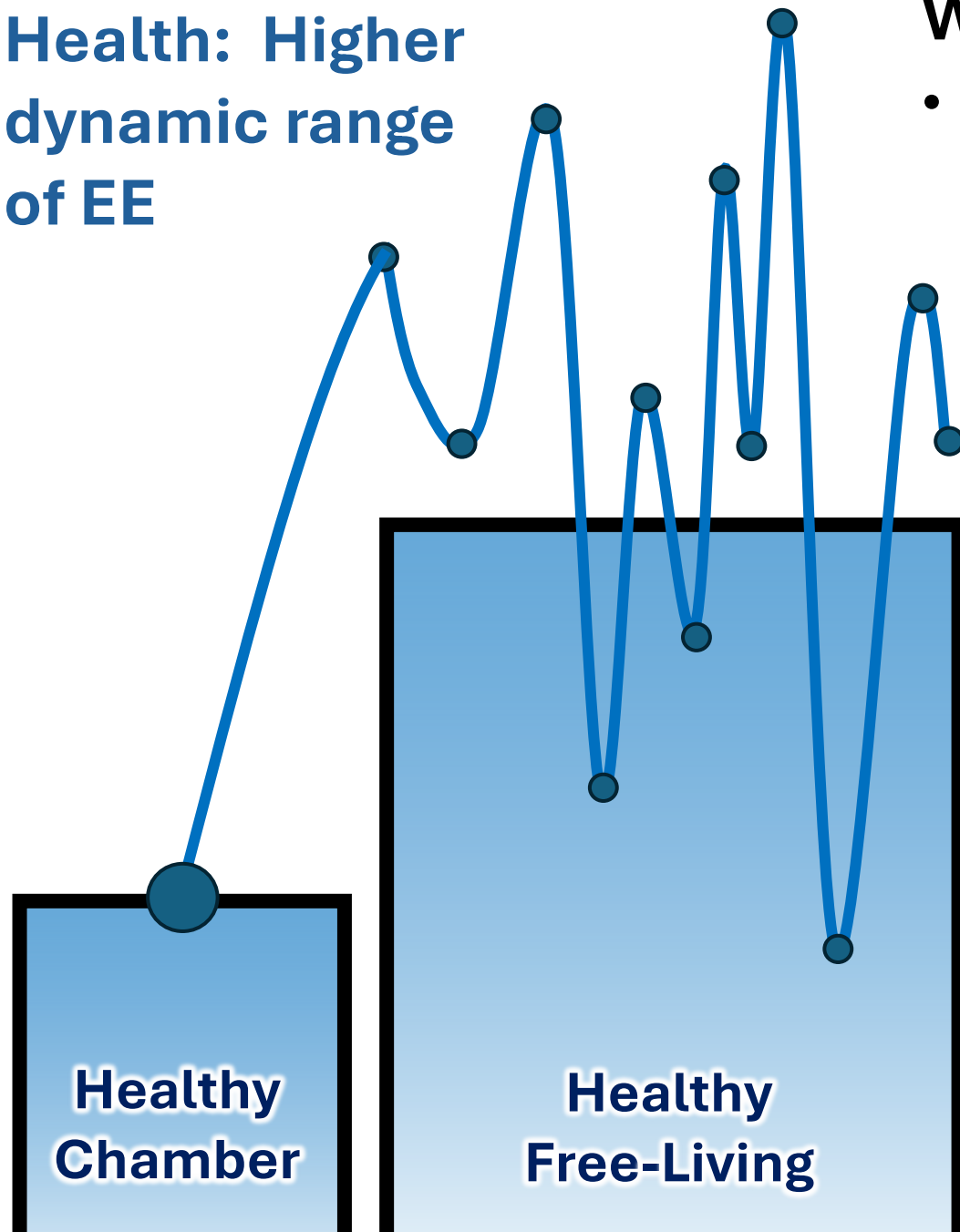


Compensation

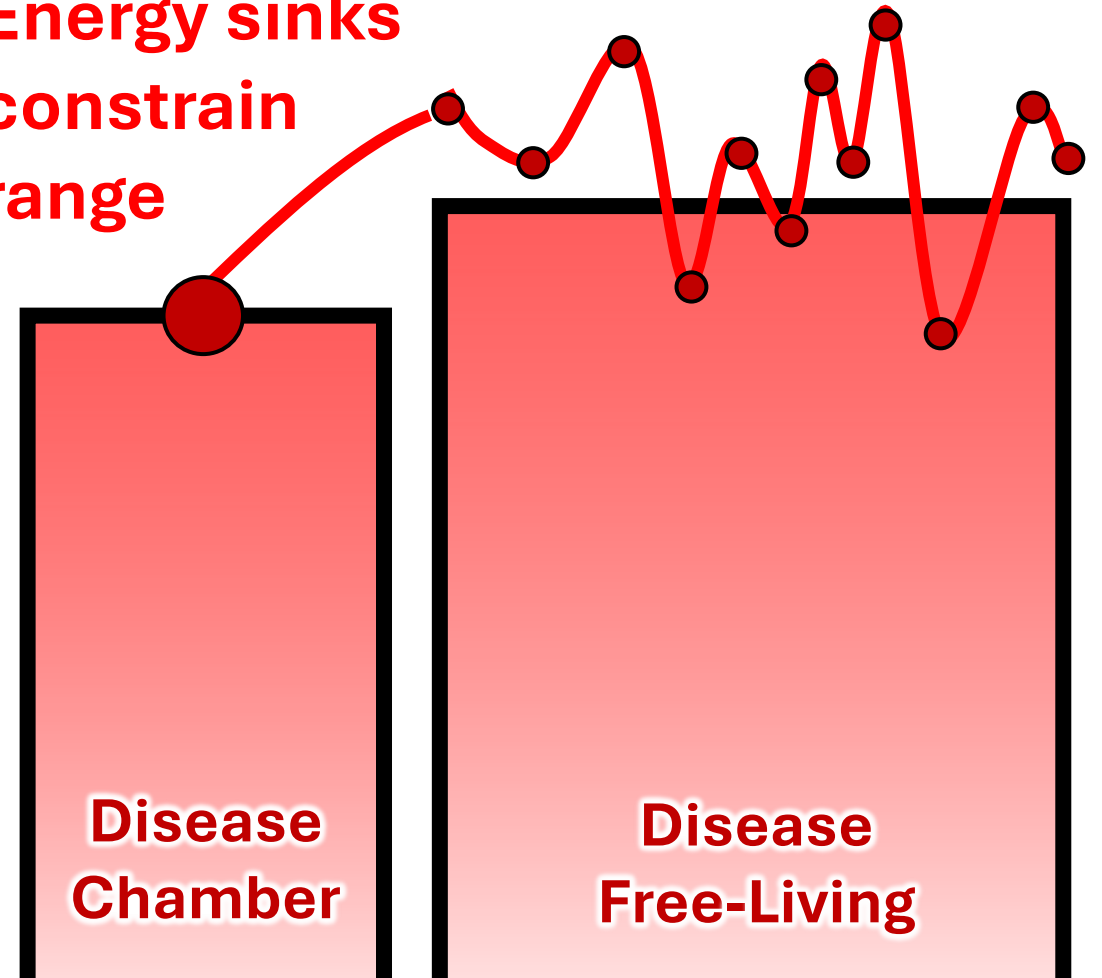
Health: Higher dynamic range of EE

What it means for health more broadly

- Capacity to push oneself and handle stress depends on capacity to rest and recover



Energy sinks constrain range



Thank You!

Picard Lab

Martin Picard

*Alexander Sercel

*Shannon Rausser

*Samantha Leonard

*Hannah Huang

*Alex Junker

*Darshana Kapri

*Mangesh Kurade

*David Shire

*Joanna Chen

*Catherine Kelly

Caroline Trumpff

Janell Smith

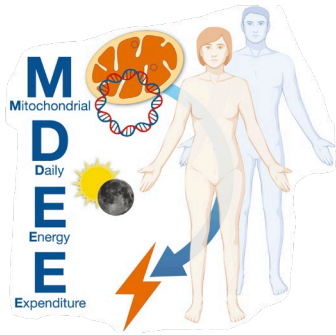
Vanessa Giardino

Cynthia Liu

Anna Monzel

Jack Devine

Sasha Volos



MDEE

Michio Hirano

Michael Rosenbaum

Dympna Gallagher

Kathryn White

Faris Zuraikat

Marie-Pierre St-Onge

Seth Creasy

Ed Melanson

***Study Participants!**



Alex Junker



Hannah Huang



Dr. Darshana Kapri



Dr. Kathryn White



Sam Leonard



Dr. Faris Zuraikat



Shannon Rausser

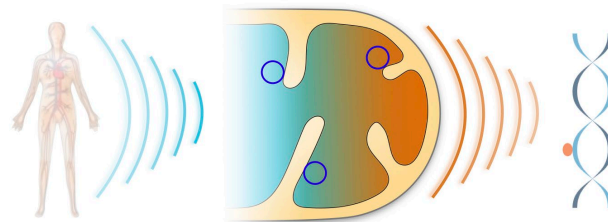


Dr. Alex Sercel



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IN THE DEPARTMENT OF MEDICINE



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PSYCHOBIOLOGY LAB



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GROUP