

AGEING & LIFESTYLE IMPACT ON SKELETAL MUSCLE FUNCTION

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Physical Activity and Nutrition Influences In ageing

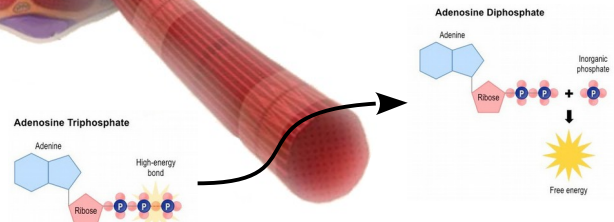
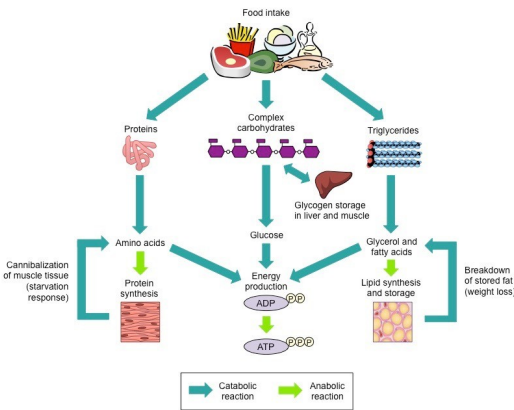
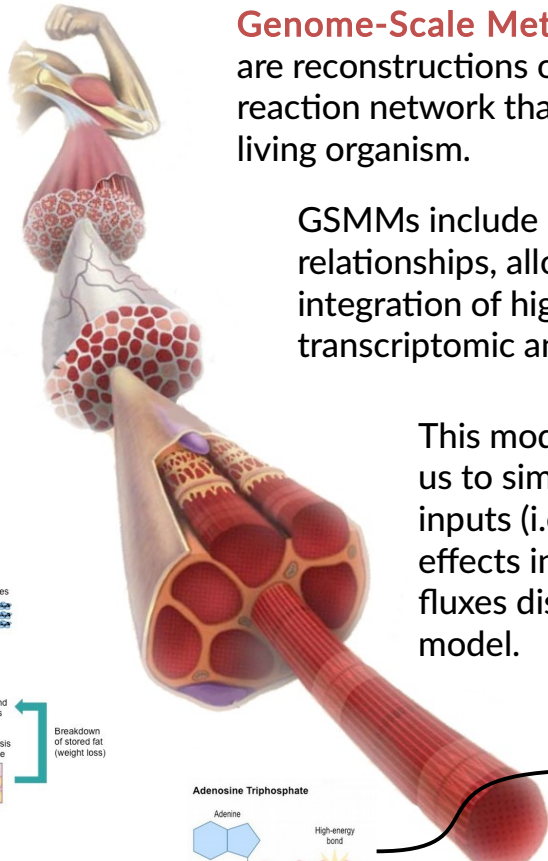
Our muscles decay with age, losing mass, strength and the ability to support us in daily life activities.

Muscle loss can be slowed with a regular exercise regime and an appropriate diet.

Genome-Scale Metabolic Models are reconstructions of the biochemical reaction network that take place inside a living organism.

GSMs include Gene-Protein-Reaction relationships, allowing the systematic integration of high-throughput data such as transcriptomic and proteomic data.

This modelling framework allows us to simulate arbitrary nutritional inputs (i.e. diets) and see their effects in terms of metabolic fluxes distributions in the muscle model.



Flux Balance Analysis

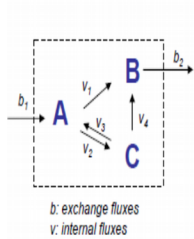
Metabolic network

Mass balance equations

Matrix notation

Feasible solution space

Optimal solution

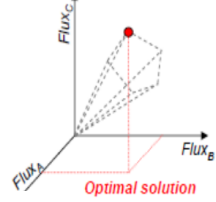
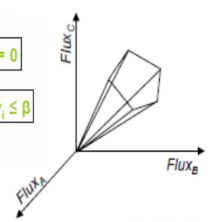


$$\begin{aligned}
 A: \frac{dA}{dt} &= -v_1 - v_2 + v_3 + b_1 \\
 B: \frac{dB}{dt} &= v_1 + v_4 - b_2 \\
 C: \frac{dC}{dt} &= v_2 - v_3 - v_4
 \end{aligned}$$

$$\begin{bmatrix} \frac{dA}{dt} \\ \frac{dB}{dt} \\ \frac{dC}{dt} \end{bmatrix} = \begin{bmatrix} -1 & -1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & -1 \\ 0 & 1 & -1 & -1 & 0 & 0 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ b_1 \\ b_2 \end{bmatrix} = \begin{bmatrix} s_1 \\ s_2 \\ s_3 \end{bmatrix}$$

Constraints:

- (1) Mass balance $Sv = 0$
- (2) Thermodynamic $\alpha \leq v_i \leq \beta$
- (3) Enzymatic capacity
- (4) Nutrients availability



Optimization
Max./Min. objective

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This project has received funding from the European Union's Horizon 2020 research and innovation Programme under the Marie Skłodowska-Curie grant agreement 657003

