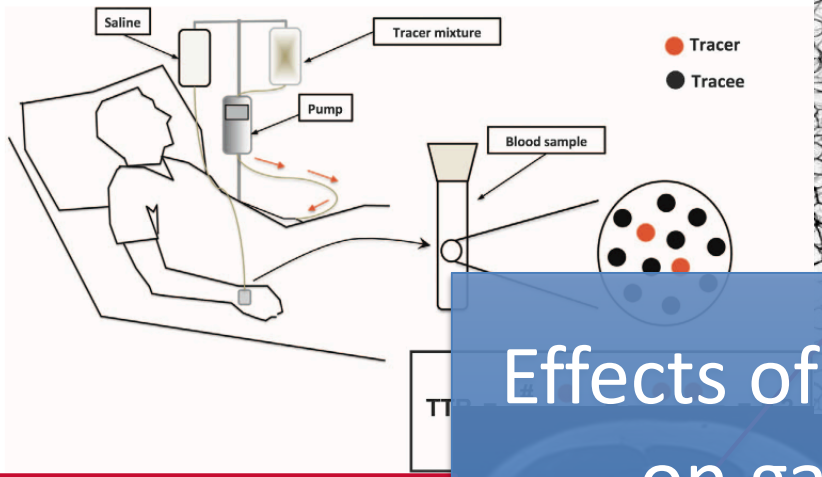
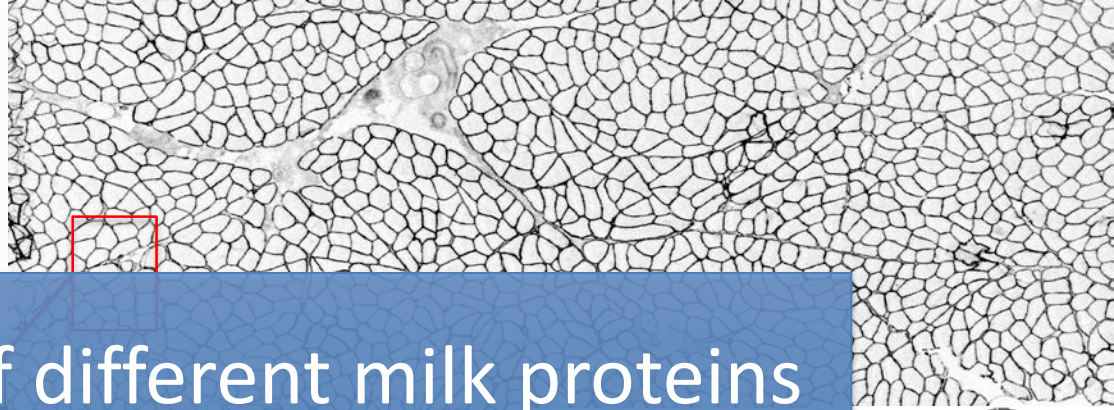
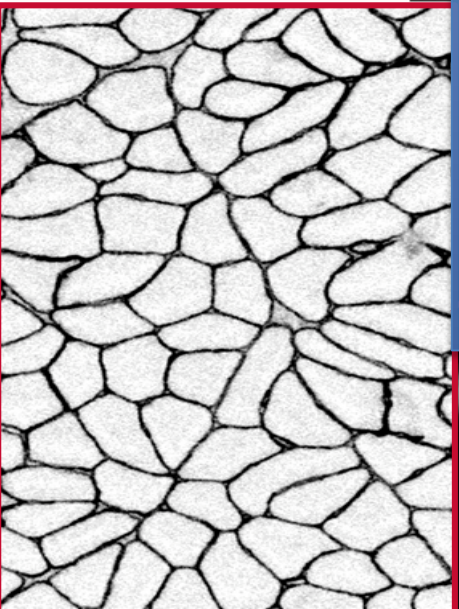
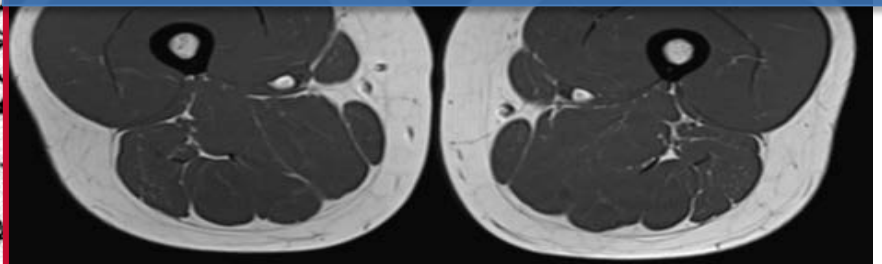




Effects of different milk proteins on gains in muscle mass

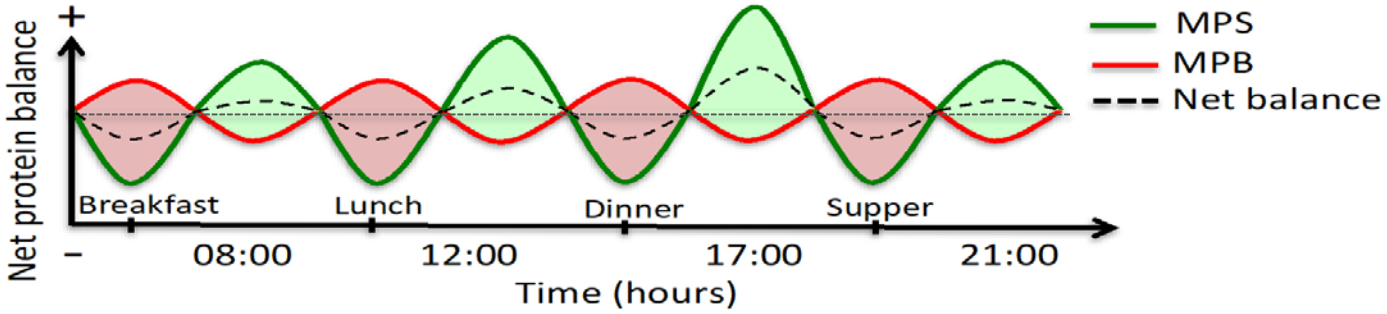
Håvard Hamarsland
INN University of Applied Sciences

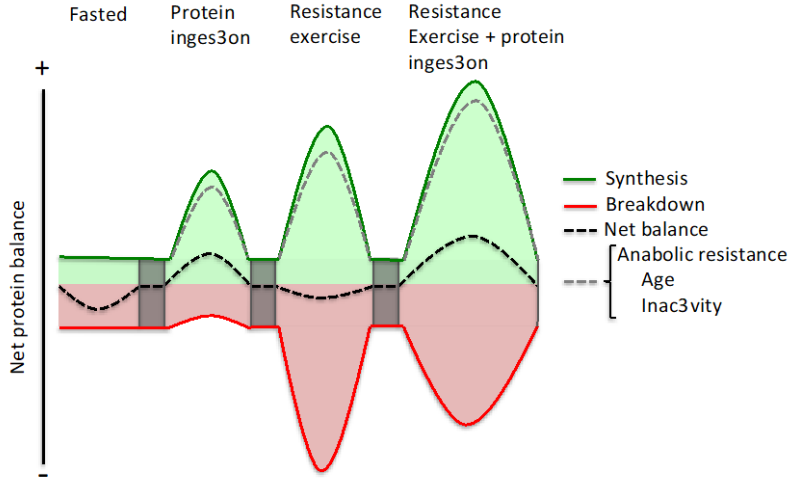




havard.hamarsland@inn.no

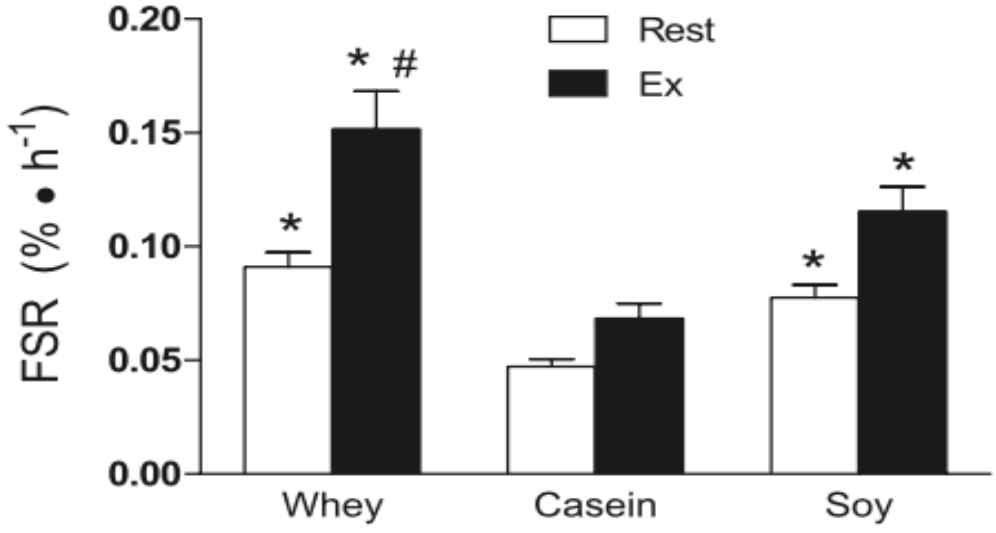
What makes muscles grow?

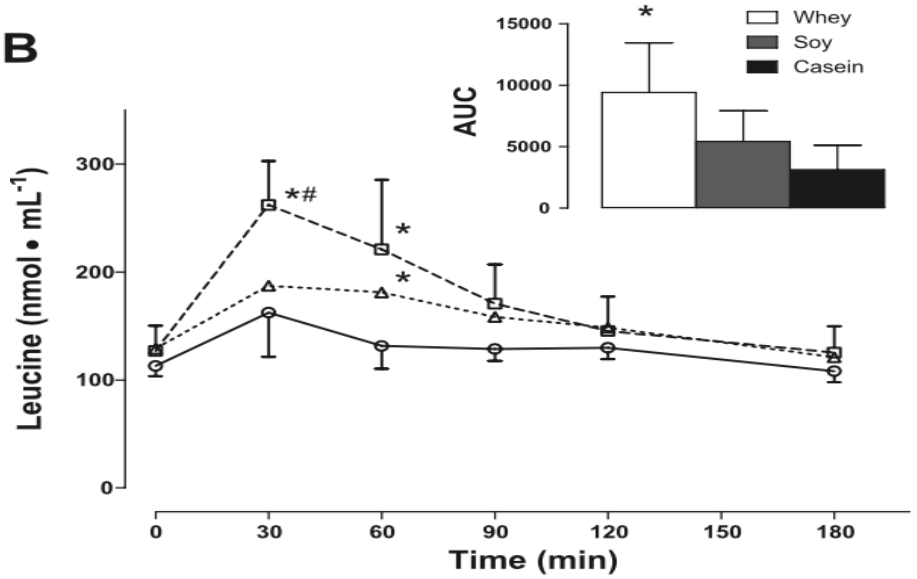




Some proteins types seem more potent than others

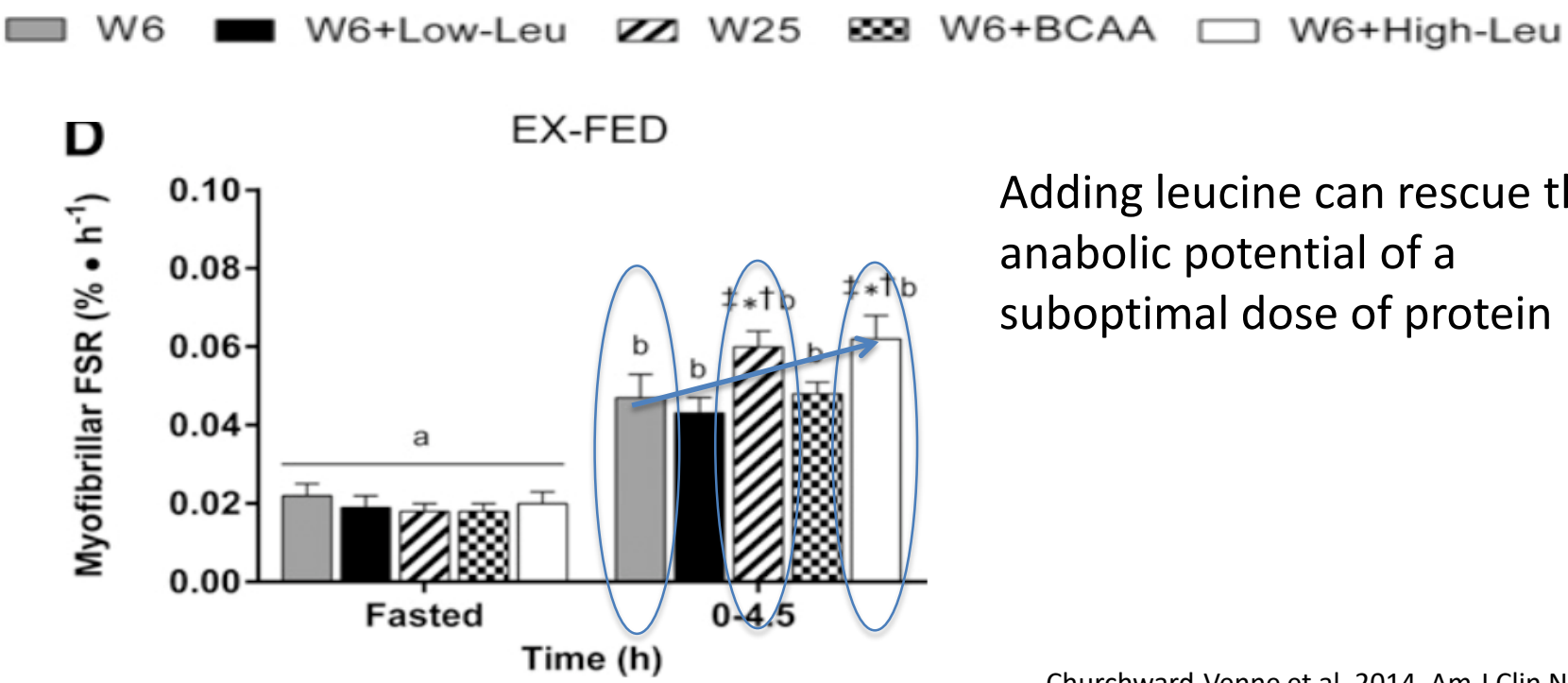
- Faster proteins with higher leucine concentration
  - Large MPS response





Tang et al. 2009, J Physiol

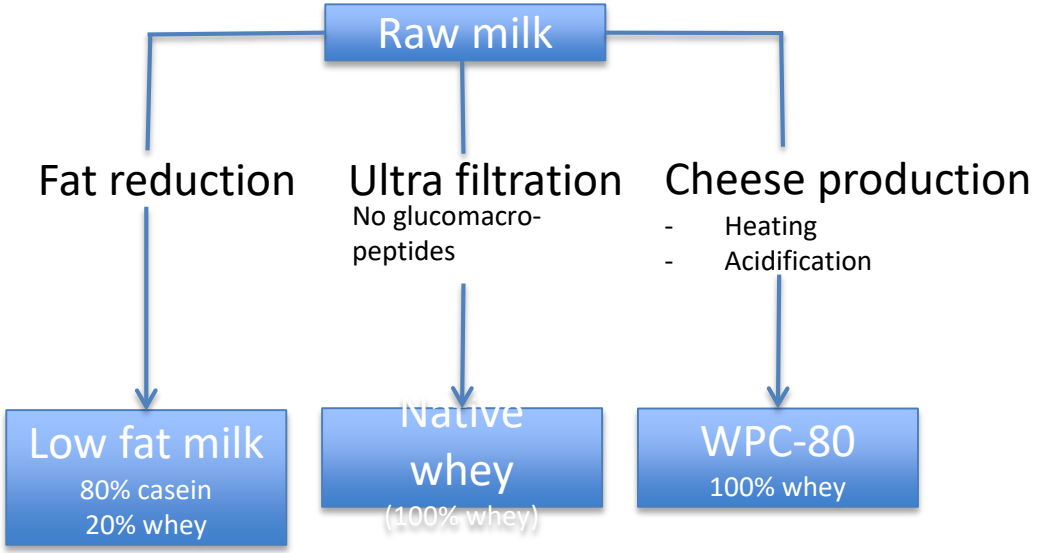
Some amino acids are more potent than others



Adding leucine can rescue the anabolic potential of a suboptimal dose of protein

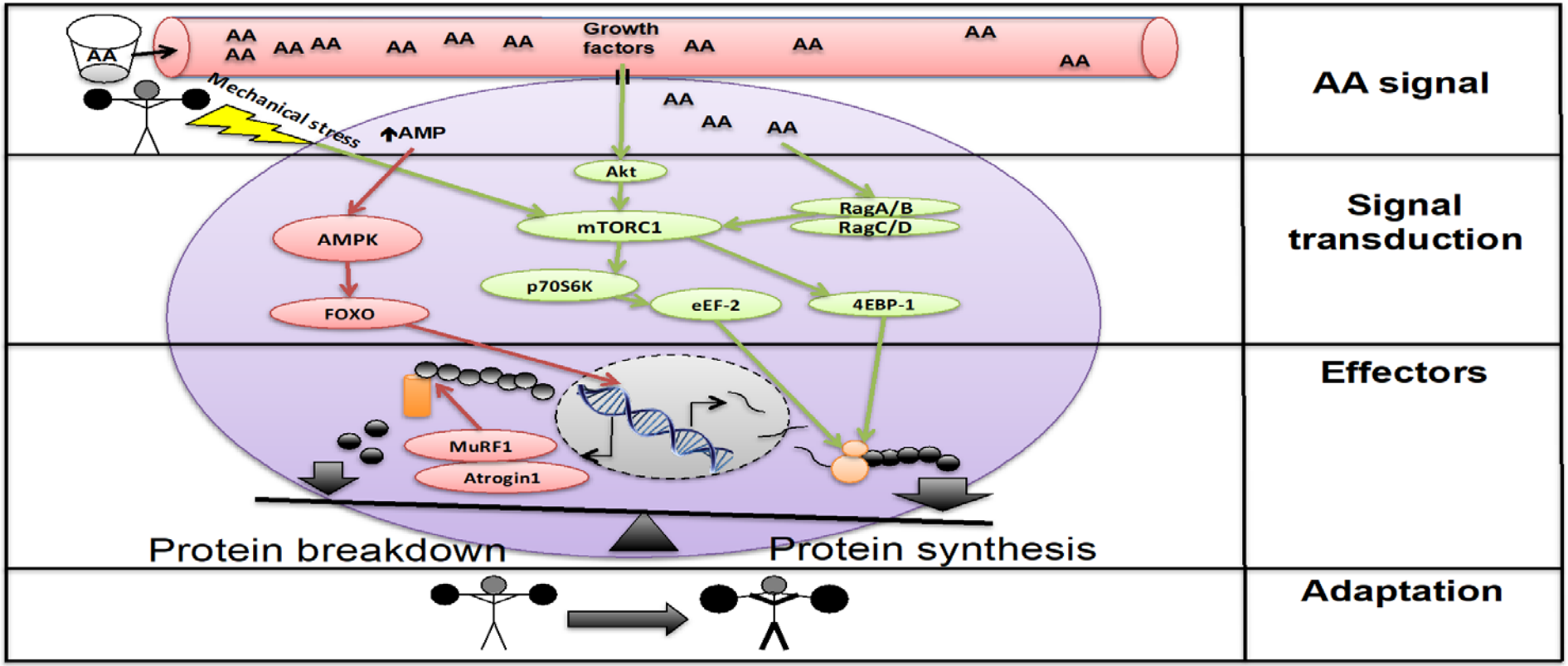
Churchward-Venne et al. 2014 Am J Clin Nutr

Why native whey?

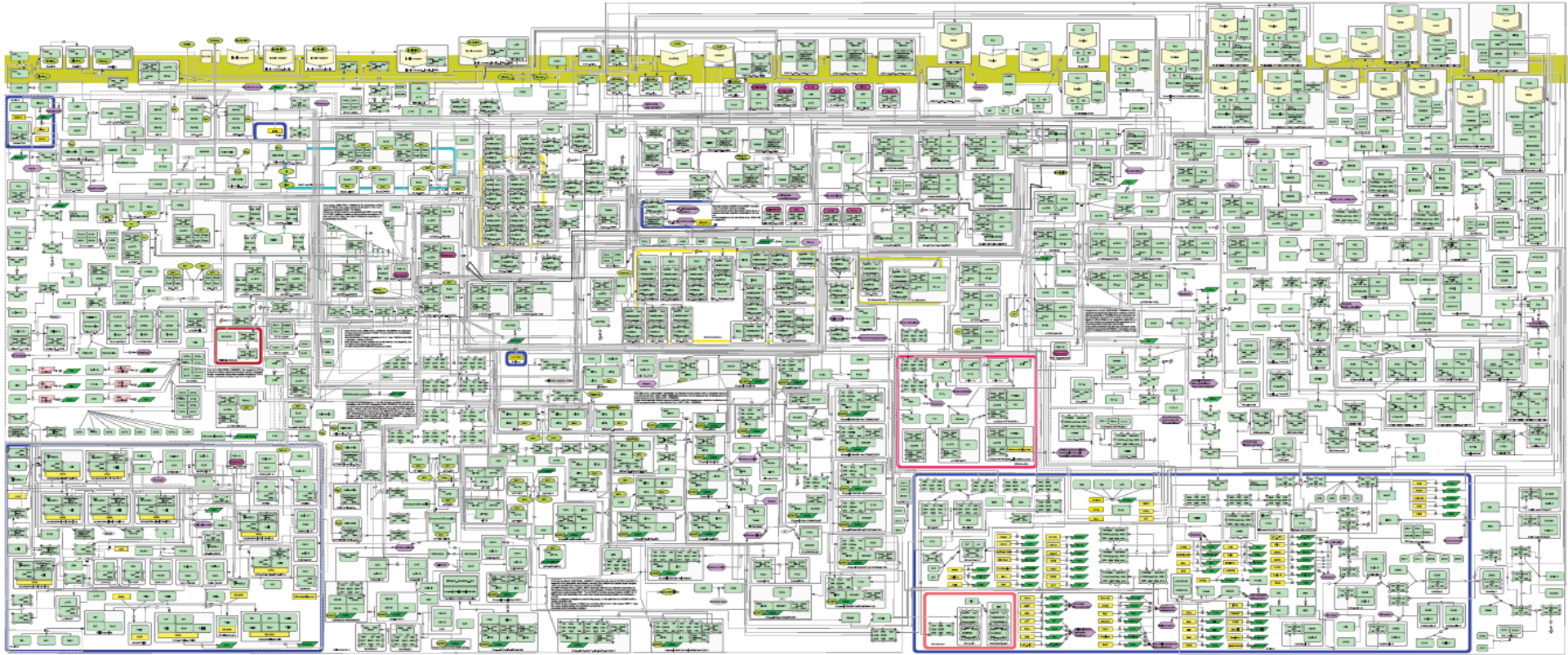


	Amino acids (g/100 g)		
	Native whey	WPC-80	Milk
Alanine	0.17	0.16	0.10
Arginine	0.09	0.08	0.11
Aspartic acid	0.40	0.35	0.25
Cysteine	0.09	0.07	0.03
Phenylalanine	0.13	0.11	0.15
Glutamic acid	0.60	0.56	0.67
Glycine	0.07	0.06	0.06
Histidine	0.07	0.06	0.09
Isoleucine	0.19	0.20	0.16
Leucine	0.43	0.34	0.31
Lysine	0.36	0.30	0.27
Methionine	0.08	0.07	0.08
Proline	0.18	0.21	0.32
Serine	0.16	0.18	0.18
Threonine	0.18	0.23	0.14
Tyrosine	0.09	0.07	0.12
Valine	0.18	0.19	0.20
Tryptophan	0.08	0.05	0.04
Total protein	3.33	3.10	3.23
Fat	1.08	1.06	0.99
Carbohydrate	6.40	6.60	6.00

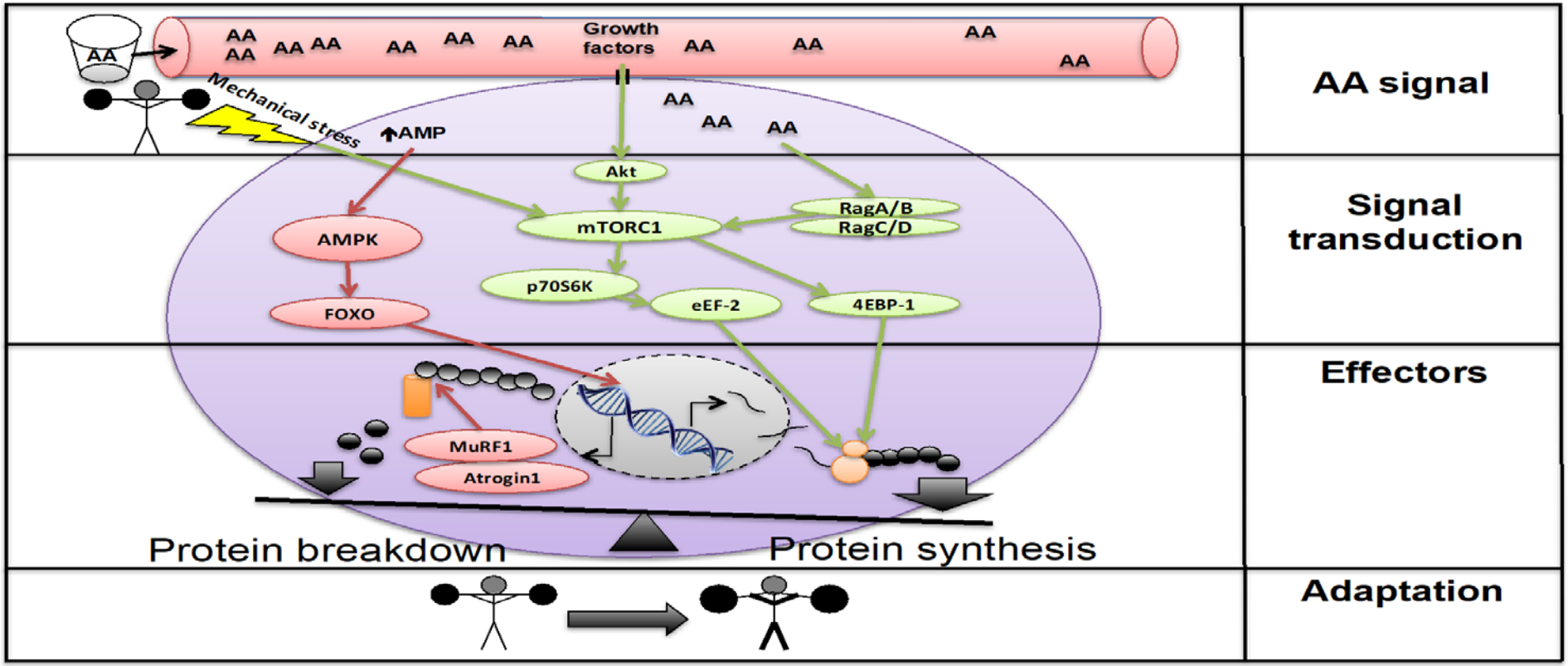
What makes muscles grow?



What makes muscles grow?



What makes muscles grow?

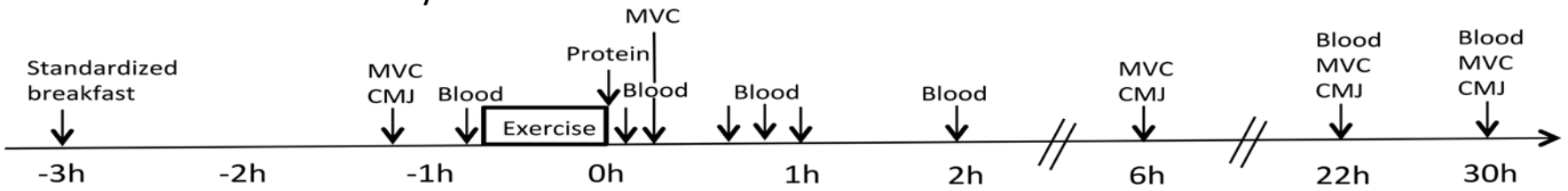


Aims

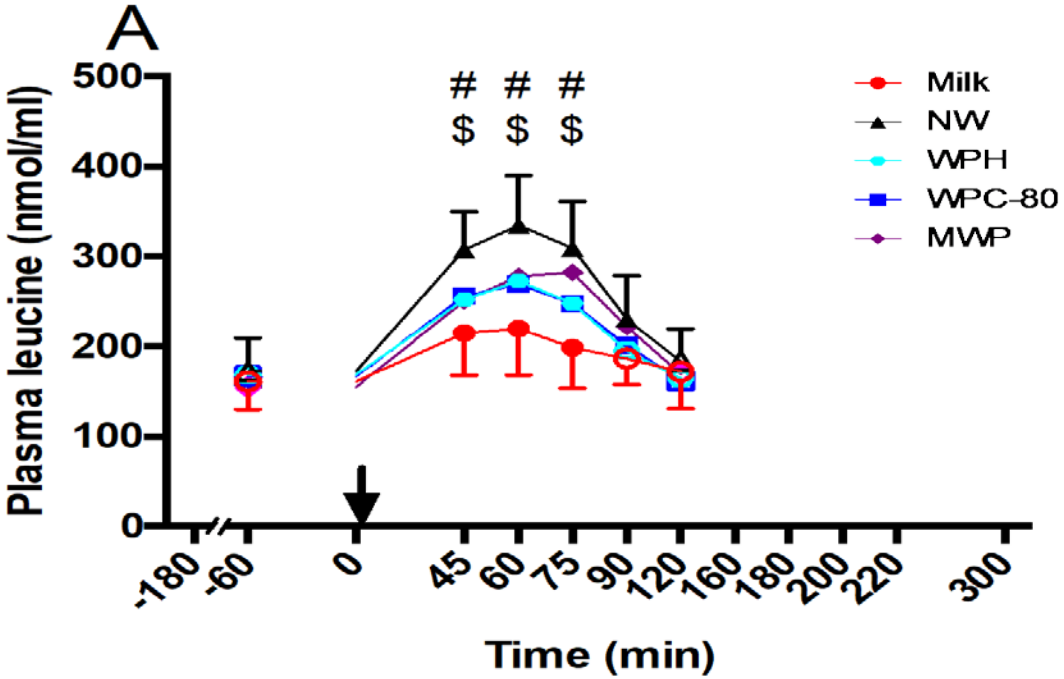
Compare changes in blood concentrations of amino acids after ingestion of WPC-80, microparticulated whey, hydrolyzed whey, native whey and milk	**AA signal**
Compare changes in intracellular anabolic signaling of central kinases after ingestion of WPC-80, native whey and milk	**Signal transduction**
Compare changes muscle protein synthesis (1-5h) after resistance exercise and ingestion of WPC-80, native whey and milk	**Effectors**
Compare changes in muscle mass and strength when supplementing with milk or native whey during a 12 week strength training period	**Adaptation**

Signal – Leucine concentration in blood

- Young men
- N = 10
- Body mass: 80.8 ± 6.3 kg
- 5 milk protein supplements of 20 g (cross over) after resistance exercise
  - Milk
  - Regular whey
    - Intact WPC-80
    - Microparticulated WPC-80
    - Hydrolyzed WPC-80
  - Native whey

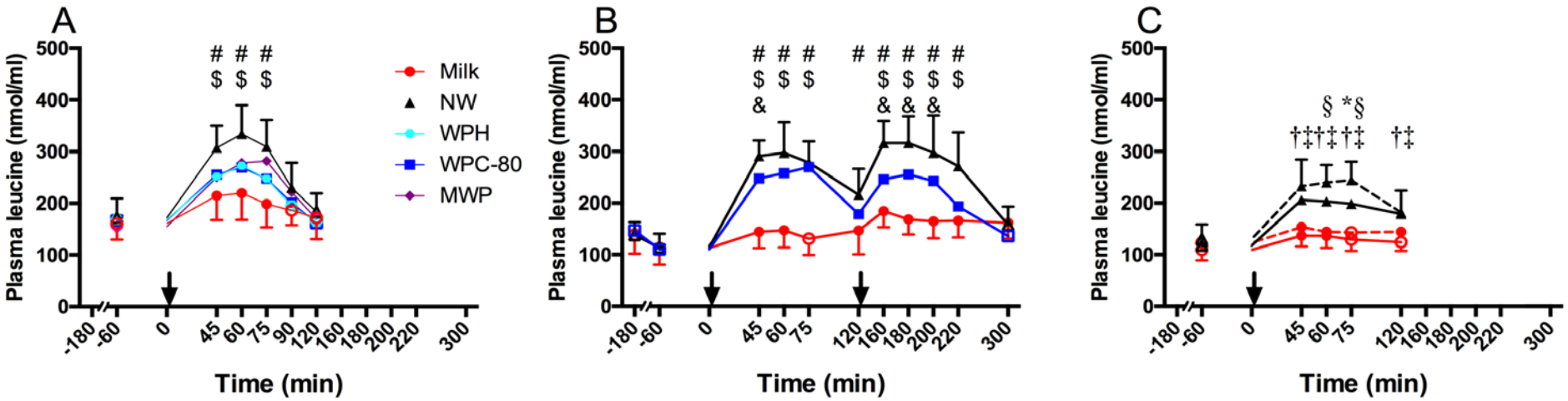


Signal - Leucine concentration in blood

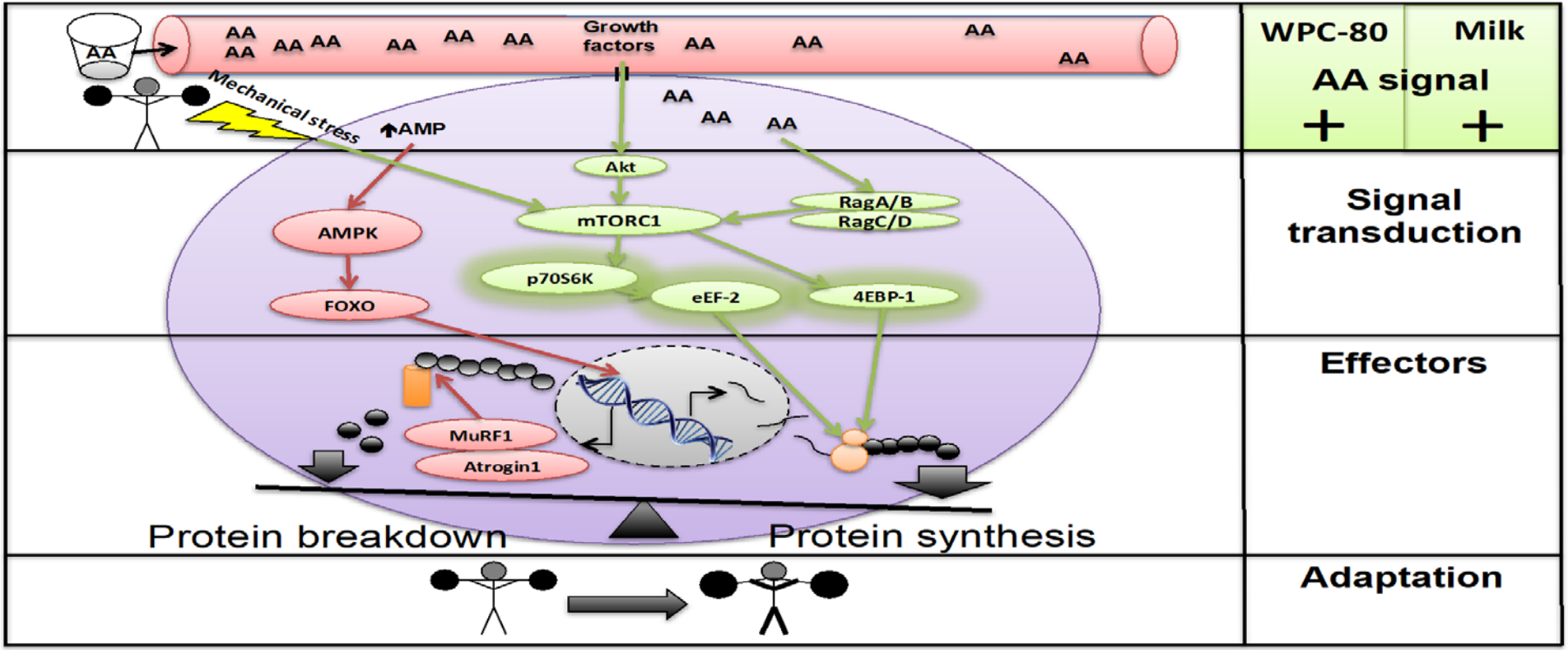


Difference between WPC-80 and milk
$ Difference between native whey and WPC-80

Leucine concentrations in blood



Summary


Native whey vs.
WPC-80
Milk
AA signal
+
+
Signal transduction
Effectors
Adaptation
AA
Growth factors
Mechanical stress
AMP
Akt
mTORC1
RagA/B
RagC/D
AMPK
FOXO
p70S6K
eEF-2
4EBP-1
MuRF1
Atrogin1
Protein breakdown
Protein synthesis

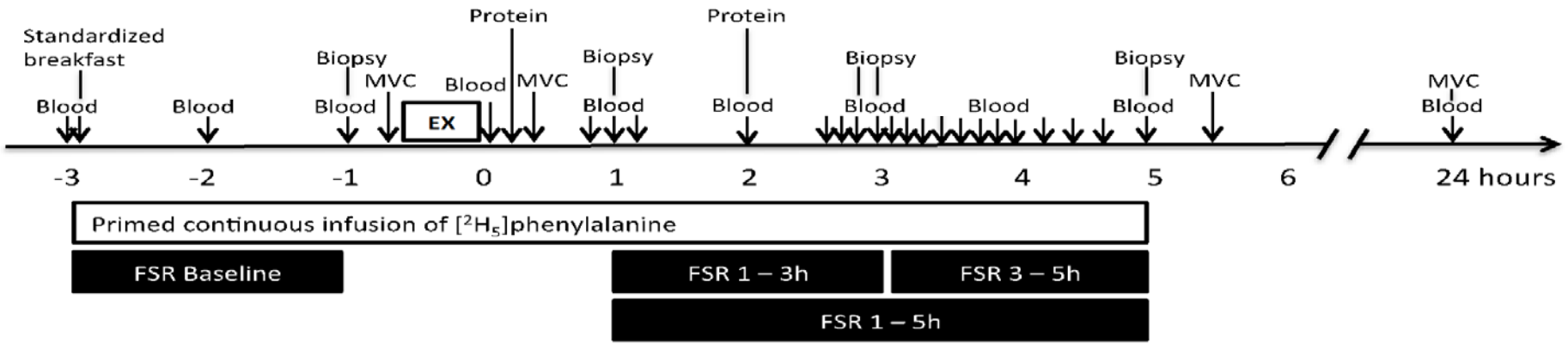
Signal transduction and effectors – Signaling and FSR

	Milk	Whey	*P* values for group differences
N (♂/♀)	(8/4)	(5/5)	
Age (years)	25 ± 5	25 ± 2	0.575
Body mass (kg)	72.8 ±12.4	70.0 ± 11.6	0.595
Lean body mass (kg)	57.1 ± 13.5	52.9 ± 9.6	0.426
Body fat (%)	19.1 ± 7.2	21.5 ± 6.4	0.407
Leg press 8 RM (kg)	210 ± 48	200 ± 53	0.662
Knee extensions 8 RM (kg)	87.1 ± 26.2	77.5 ± 17.3	0.335
Total weight lifted (kg)	9287 ± 2286	8766 ± 2170 / 8766 ± 2186	0.592

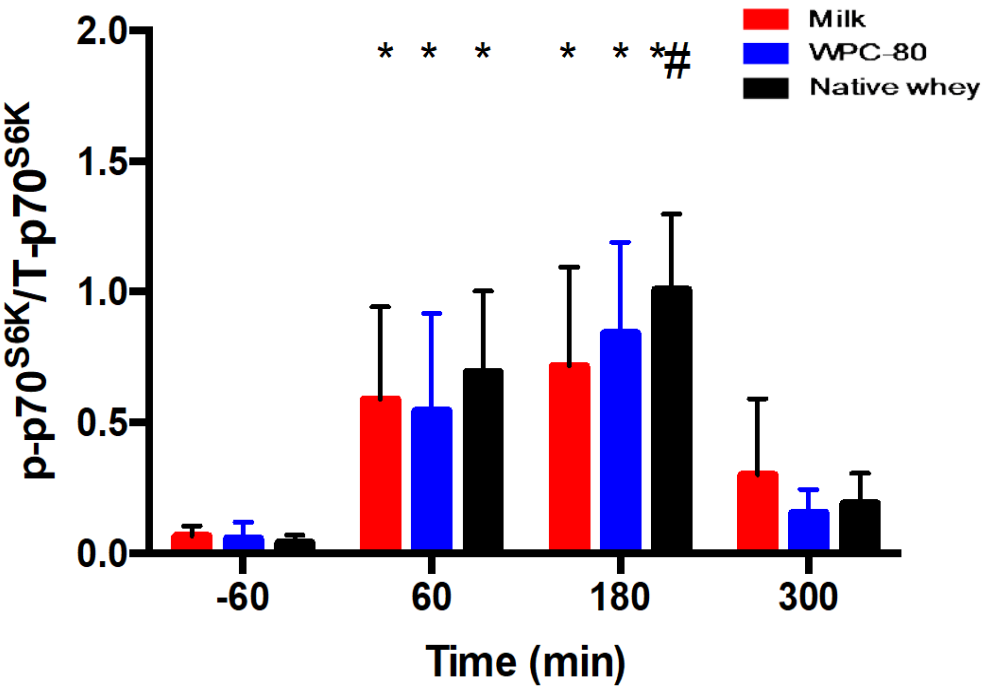
Signal transduction and effectors – Signaling and FSR

- Milk
- WPC-80
- Native whey

} 20g x 2

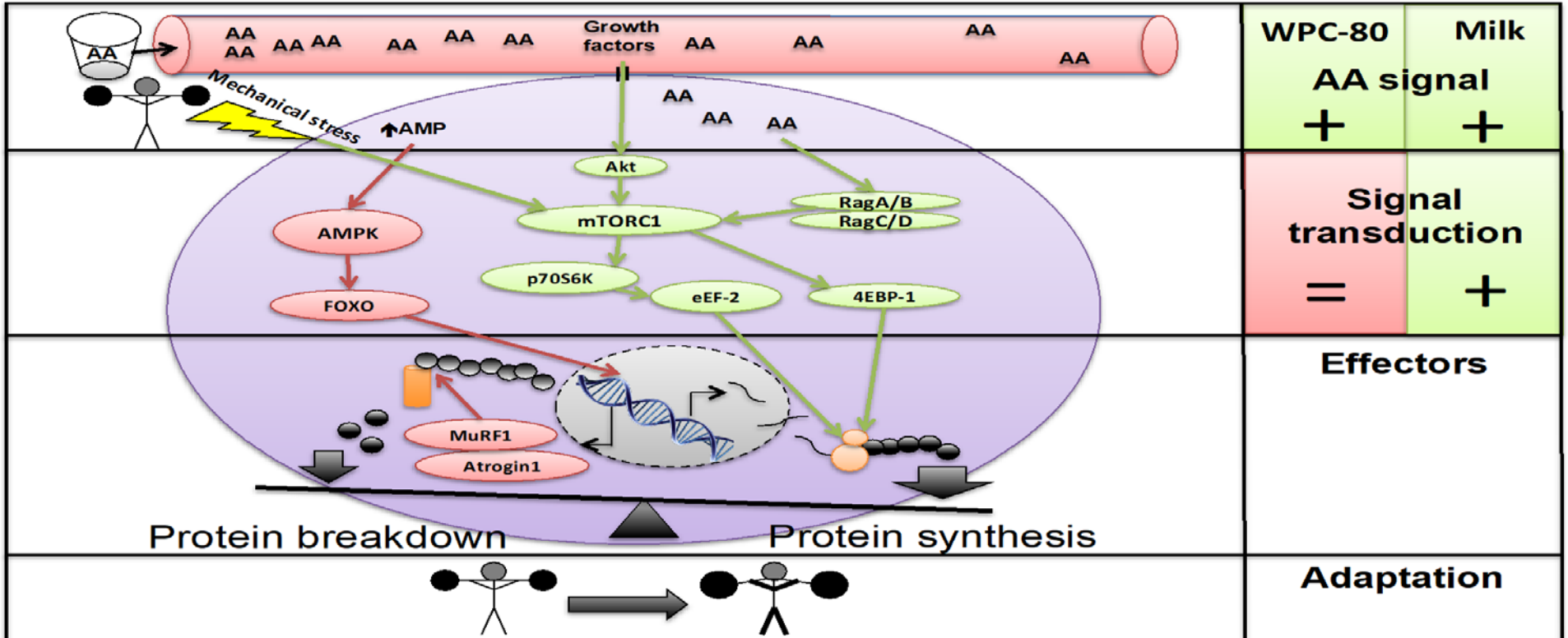


p70s6K signalling



Difference between NW and milk

Summary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Protein breakdown
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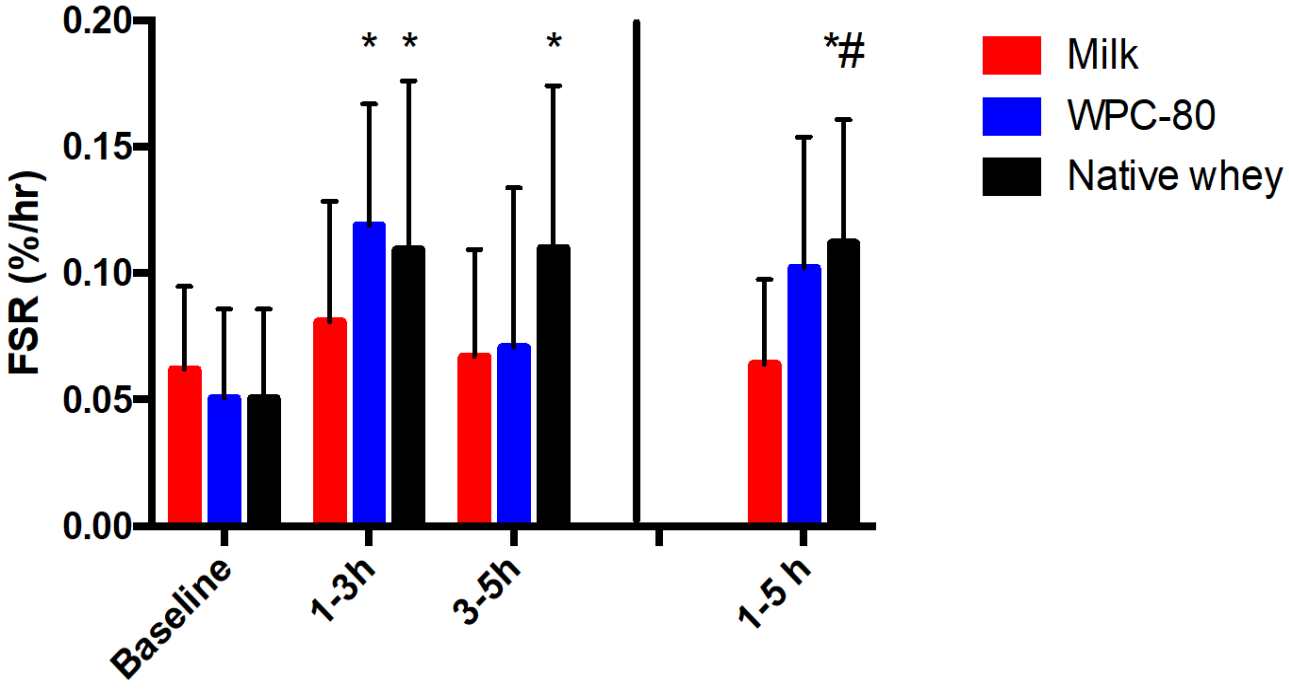
Muscle protein synthesis



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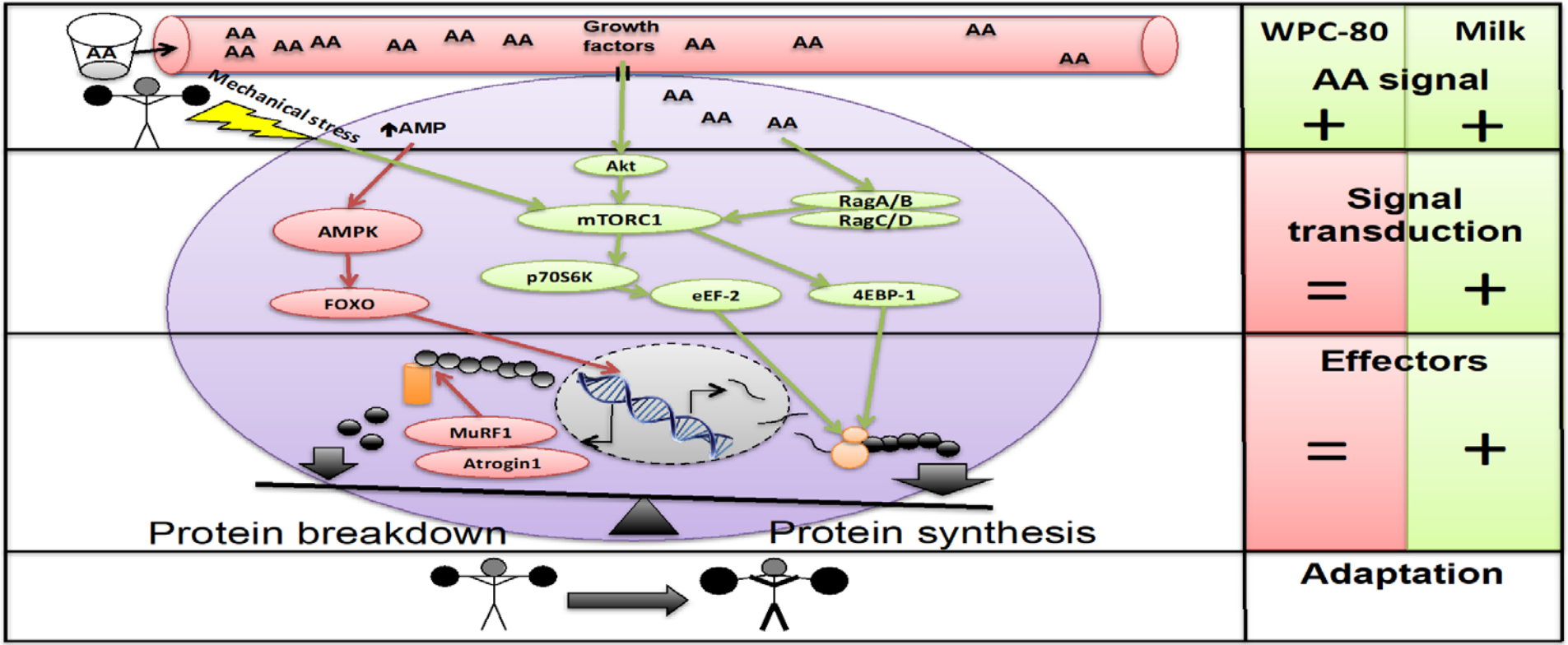
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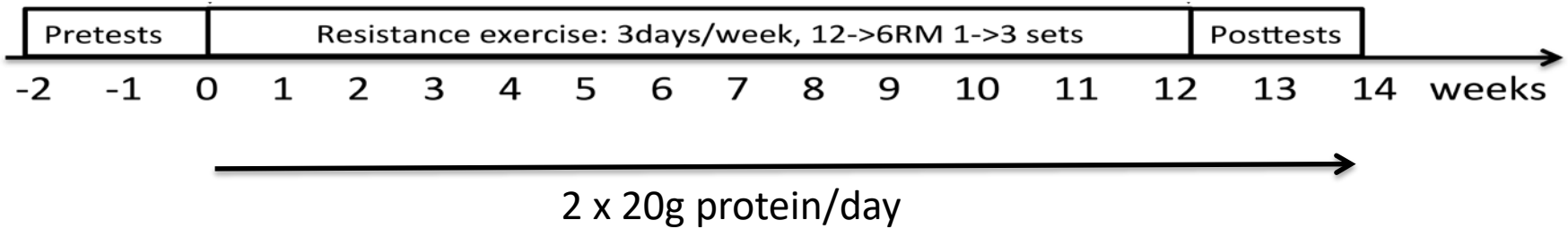
4EBP-1
FOXO
MuRF1
Atrogin1
Protein breakdown
Protein synthesis

Adaptation to strength training

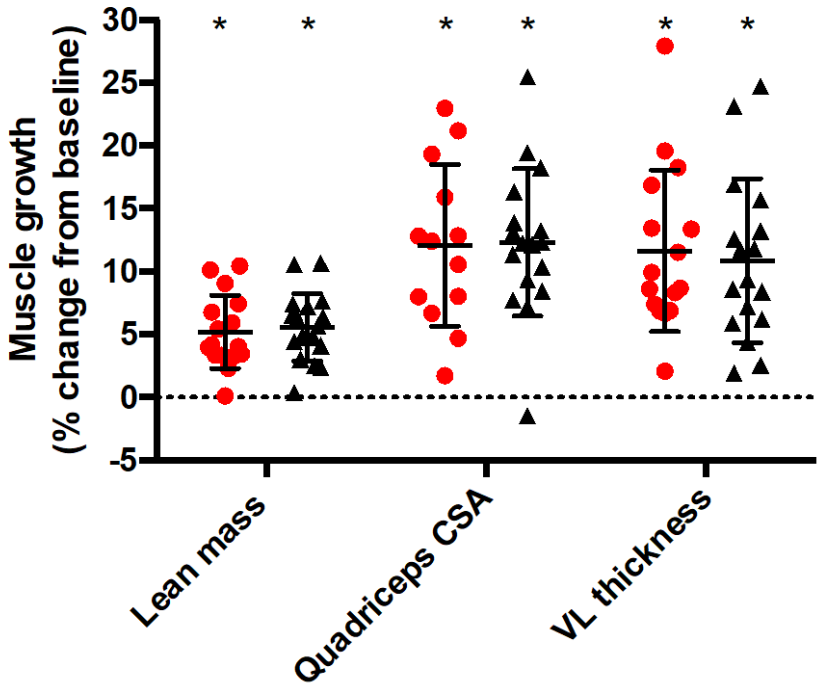
	Milk	Native whey	*P* values for group differences
N (♂/♀)	18 (10/8)	18 (10/8)	
Age (years)	29 ± 5	30 ± 6	0.51
Body mass (kg)	77.9 ± 16.0	77.9 ±11.7	0.99
Lean body mass (kg)	53.2 ± 10.7	54.2 ± 8.0	0.75
Body fat (%)	29.1 ± 6.1	27.3 ± 7.9	0.47
Leg press 1 RM (kg)	273 ± 83.0	269 ± 76.6	0.87

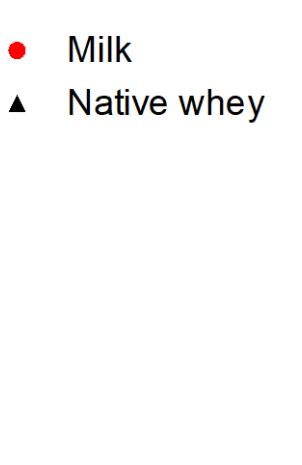
Adaptation to strength training

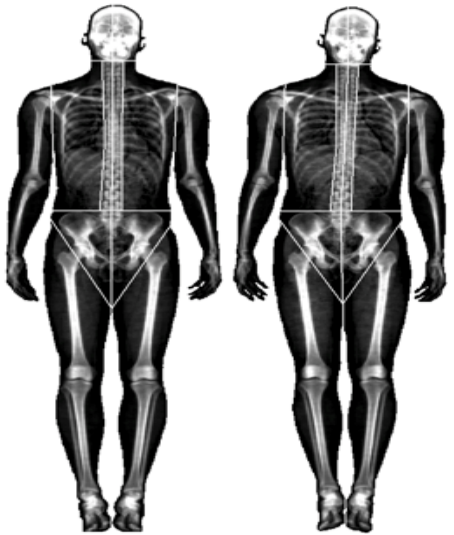
- Milk
- Native whey



Muscle growth

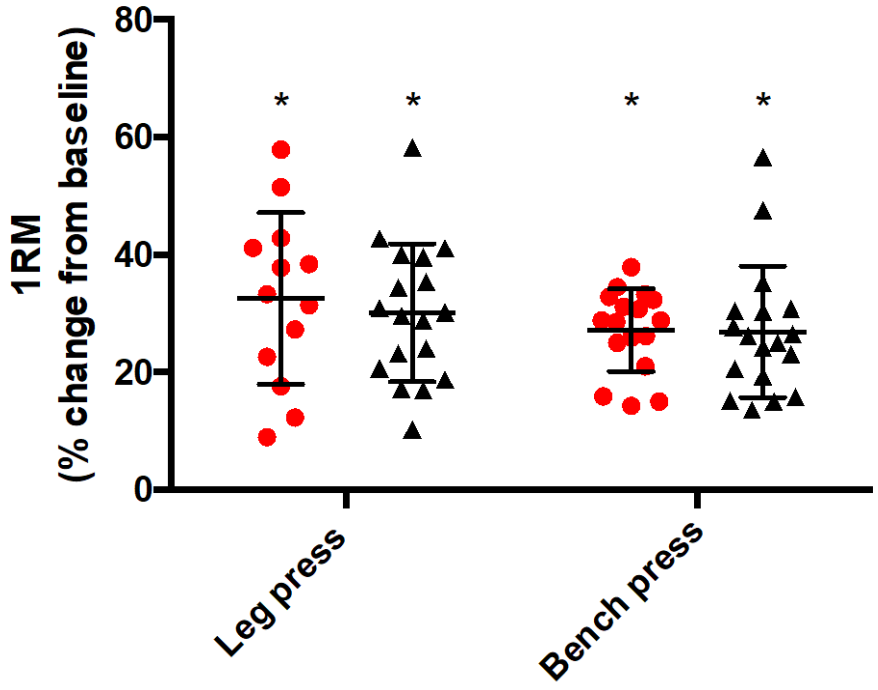






* Different from baseline

Muscle strength

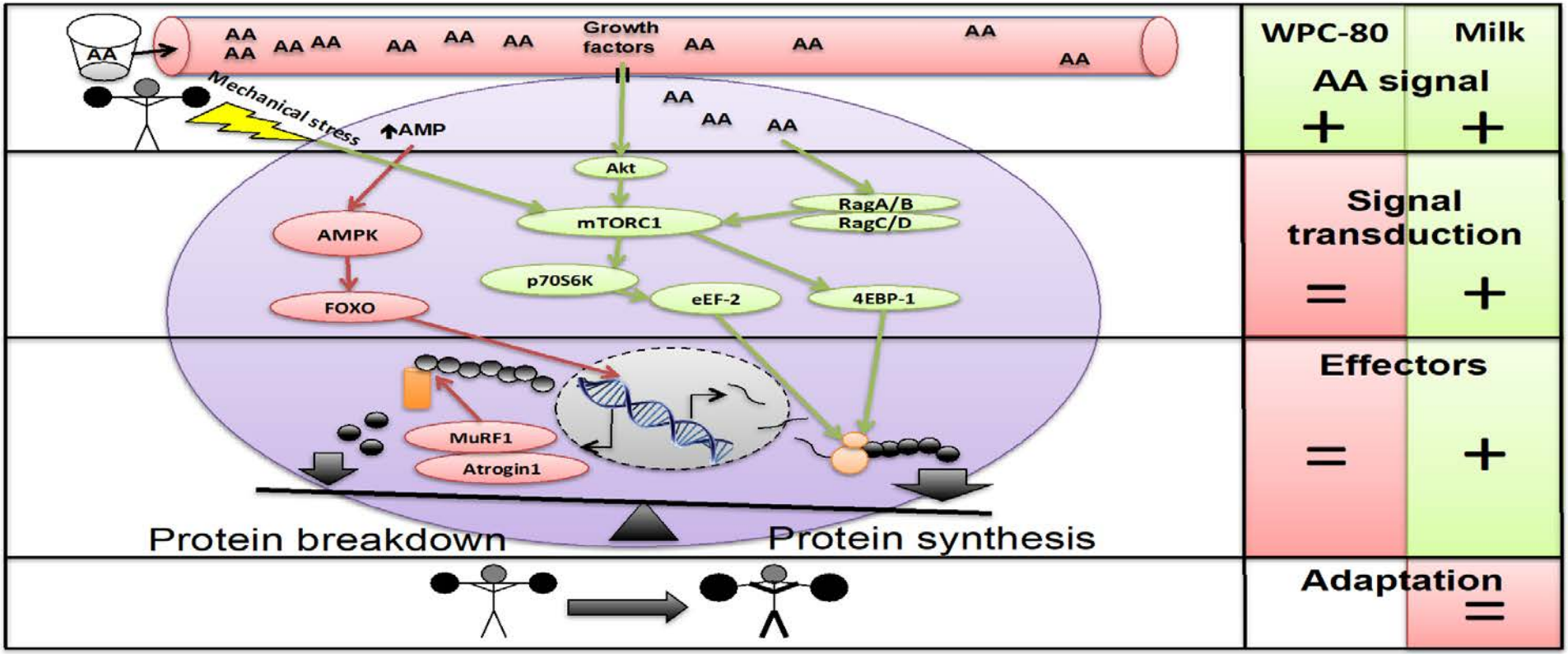


Milk

Native whey

* Different from baseline

Summary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WPC-80
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+
Signal transduction
=
+
Effectors
=
+
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AA
AA
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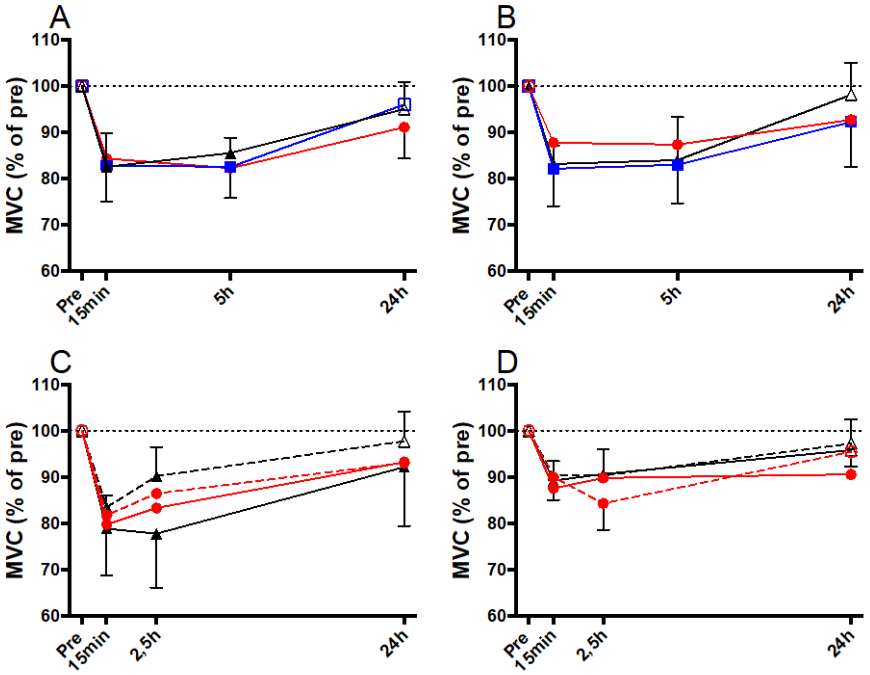
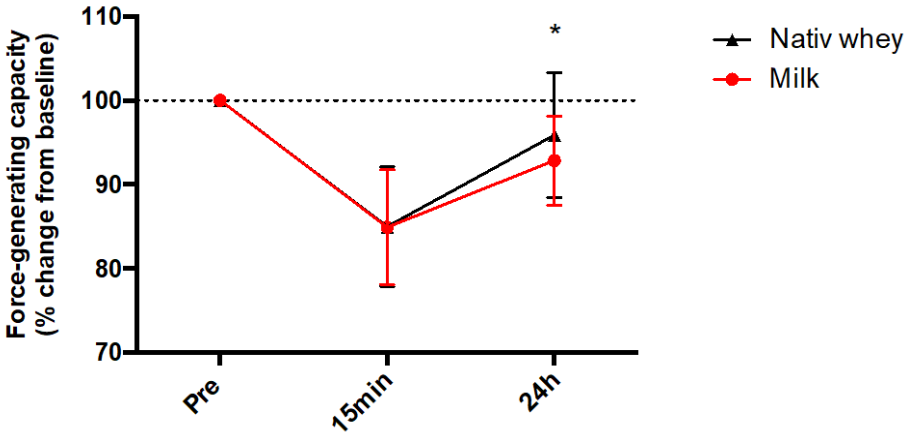
Atrogin1
Protein breakdown
Protein synthesis

Recovery


A
B
C
D
MVC (% of pre)
110
100
90
80
70
60
Pre
15min
2,5h
5h
24h


Force-generating capacity
(% change from baseline)
110
100
90
80
70
Pre
15min
24h
*
Nativ whey
Milk

Conclusions

- Combination of high protein intake and strength training was very effective at increasing muscle mass and strength
- Higher leucine concentrations (native whey vs milk) led to
  - Acute differences
  - Not translated into superior training adaptation
- The importance of a fast and high rise in blood leucine concentrations can be questioned in the long term
  - Protein quality less relevant with high protein intakes?
- Post exercise ingestion of native whey may enhance recovery compared to milk

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