Experimental approaches to promote healthy aging

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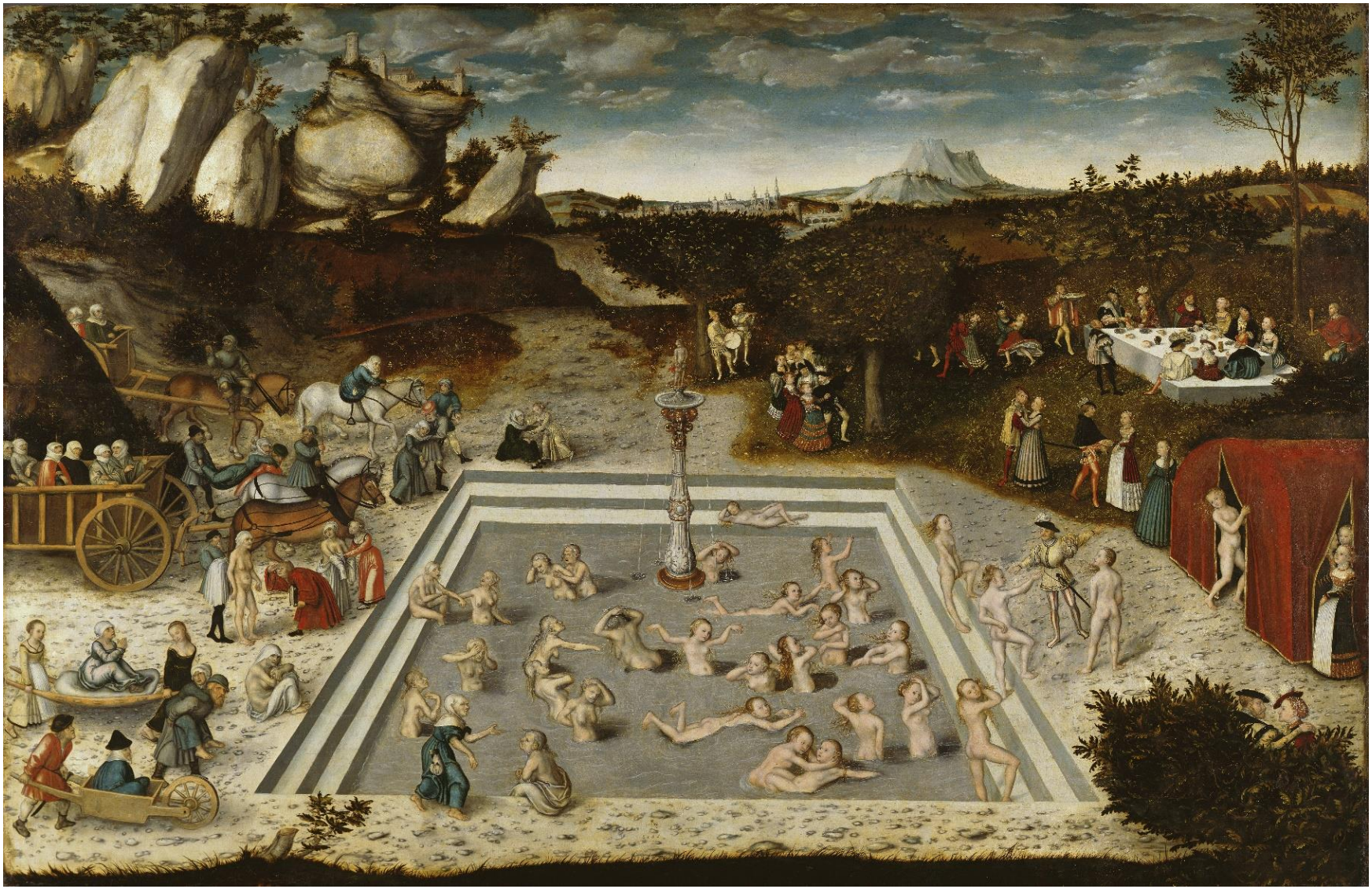
We are aging!

The hope of restoring youth, an old aspiration



A reality and a major achievement in human history

		Life expectancy at birth (years)			Healthy life expectancy (HALE) at birth (years)		
		Both sexes	Male	Female	Both sexes	Male	Female
Europe	2016	77.5	74.2	80.8	68.4	66.1	70.7
	2015	77.2	73.8	80.5	68.1	65.7	70.5
	2010	75.7	72.0	79.3	66.9	64.3	69.5
	2005	73.5	69.5	77.6	65.1	62.2	68.2
	2000	72.5	68.4	76.7	64.2	61.2	67.3
(WHO) Global	2016	72.0	69.8	74.2	63.3	62.0	64.8
	2015	71.7	69.5	73.9	63.0	61.7	64.5
	2010	70.1	68.0	72.3	61.7	60.4	63.1
	2005	68.2	66.1	70.3	60.0	58.7	61.3
	2000	66.5	64.4	68.7	58.5	57.2	59.9

New estrategies to improve the aging experience

		Life expectancy at birth (years)			Healthy life expectancy (HALE) at birth (years)		
		Both sexes	Male	Female	Both sexes	Male	Female
Europe	2016	77.5	74.2	80.8	68.4	66.1	70.7
	2015	77.2	73.8	80.5	68.1	65.7	70.5
	2010	75.7	72.0	79.3	66.9	64.3	69.5
	2005	73.5	69.5	77.6	65.1	62.2	68.2
	2000	72.5	68.4	76.7	64.2	61.2	67.3
(WHO) Global	2016	72.0	69.8	74.2	63.3	62.0	64.8
	2015	71.7	69.5	73.9	63.0	61.7	64.5
	2010	70.1	68.0	72.3	61.7	60.4	63.1
	2005	68.2	66.1	70.3	60.0	58.7	61.3
	2000	66.5	64.4	68.7	58.5	57.2	59.9

What is aging?

A continuous, universal, progressive, intrinsic, and deleterious process that decreases an organism's ability to maintain homeostasis in the face of environmental stressors and therefore increases the organism's likelihood of dying.

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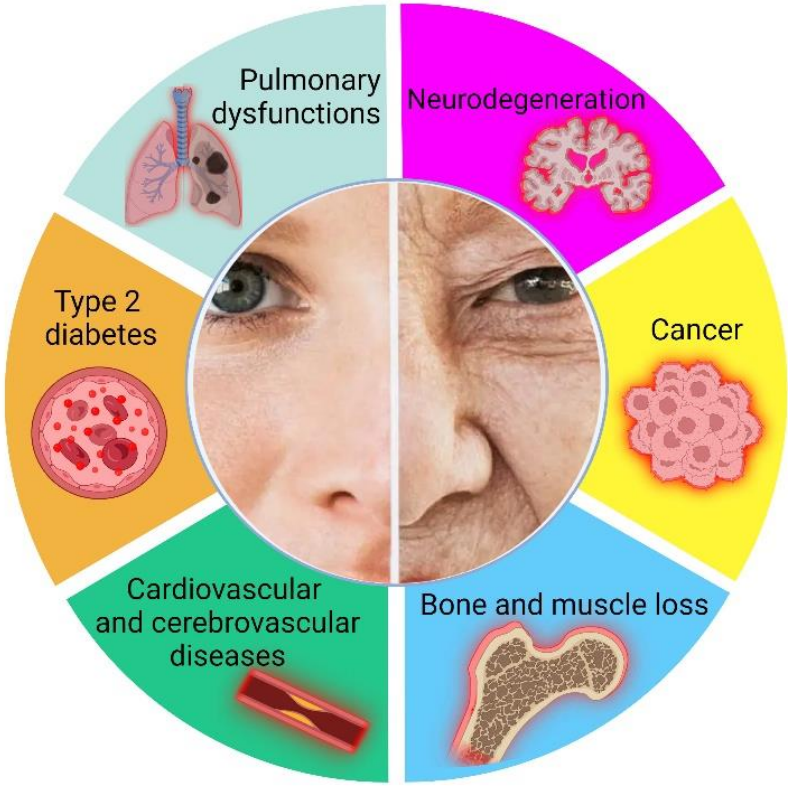

The hallmarks of aging and cancer

Cell

Leading Edge
Review

The Hallmarks of Aging

Carlos López-Otín,[1] Maria A. Blasco,[2] Linda Partridge,[3,4] Manuel Serrano,[5,*] and Guido Kroemer[6,7,8,9,10]

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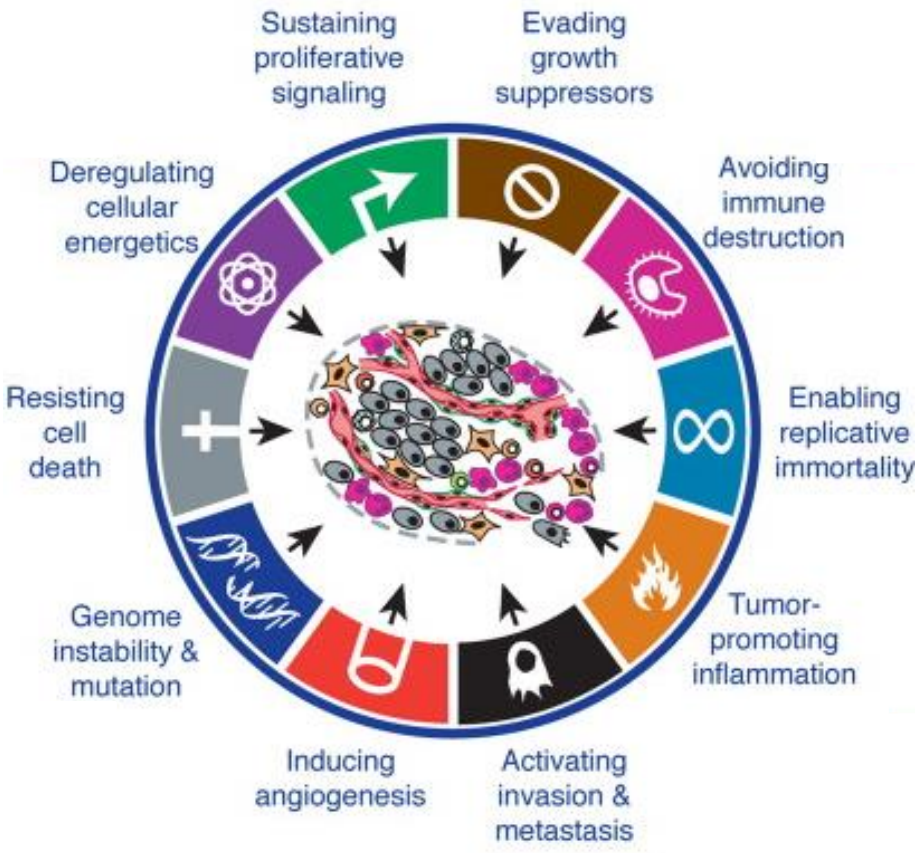
Hallmarks of Cancer: The Next Generation

Douglas Hanahan[1,2,*] and Robert A. Weinberg[3,*]



The hallmarks of aging and cancer

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The Hallmarks of Aging

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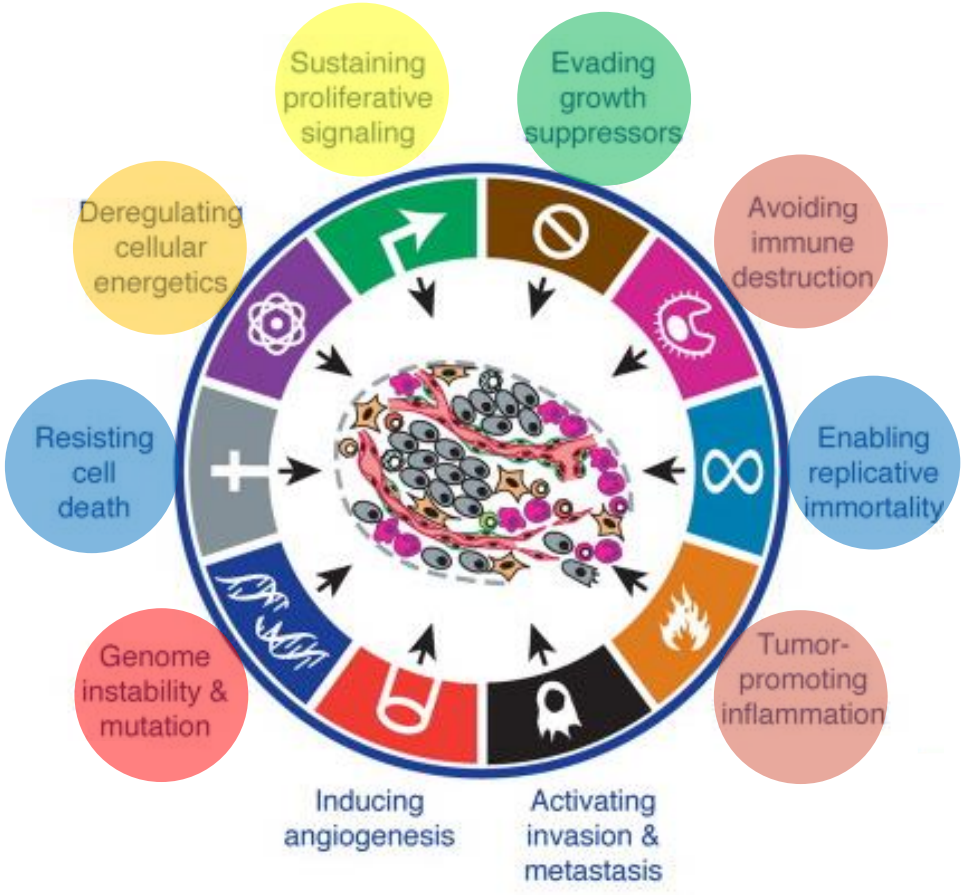
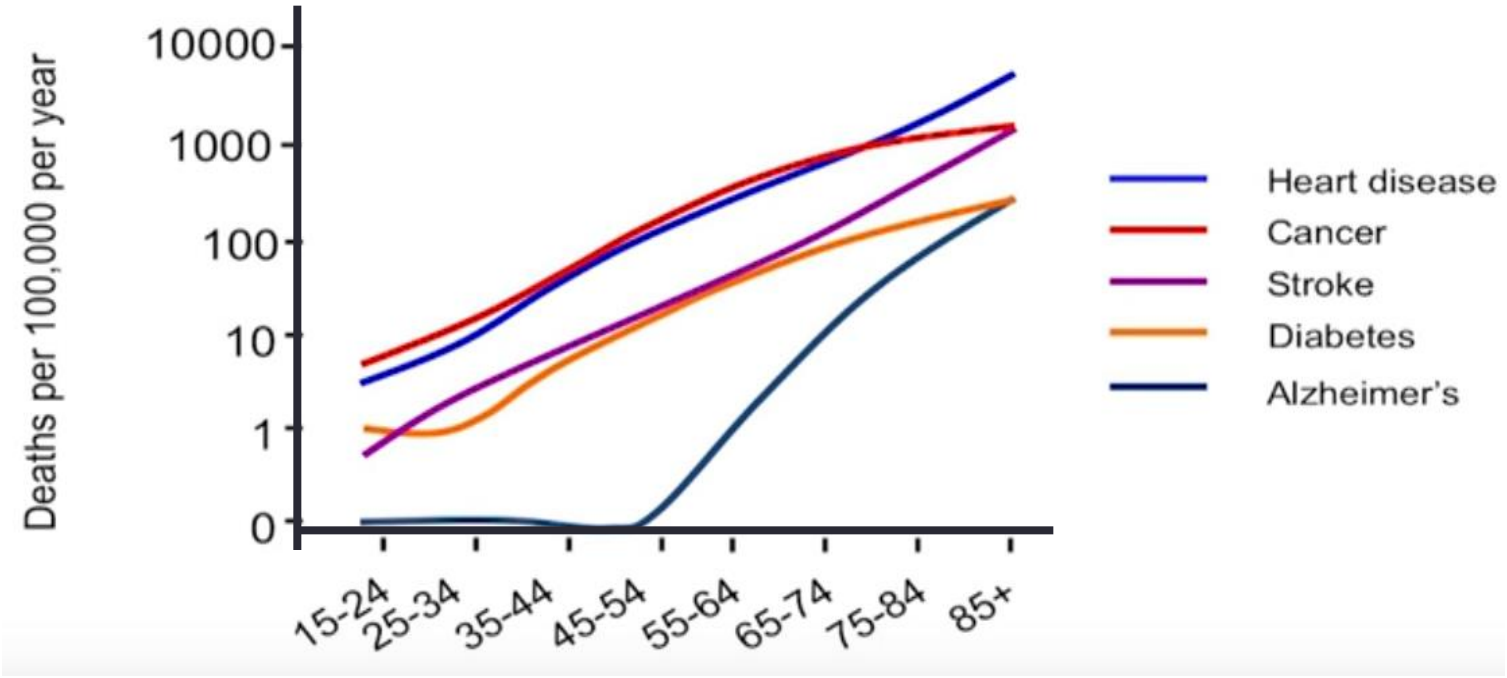
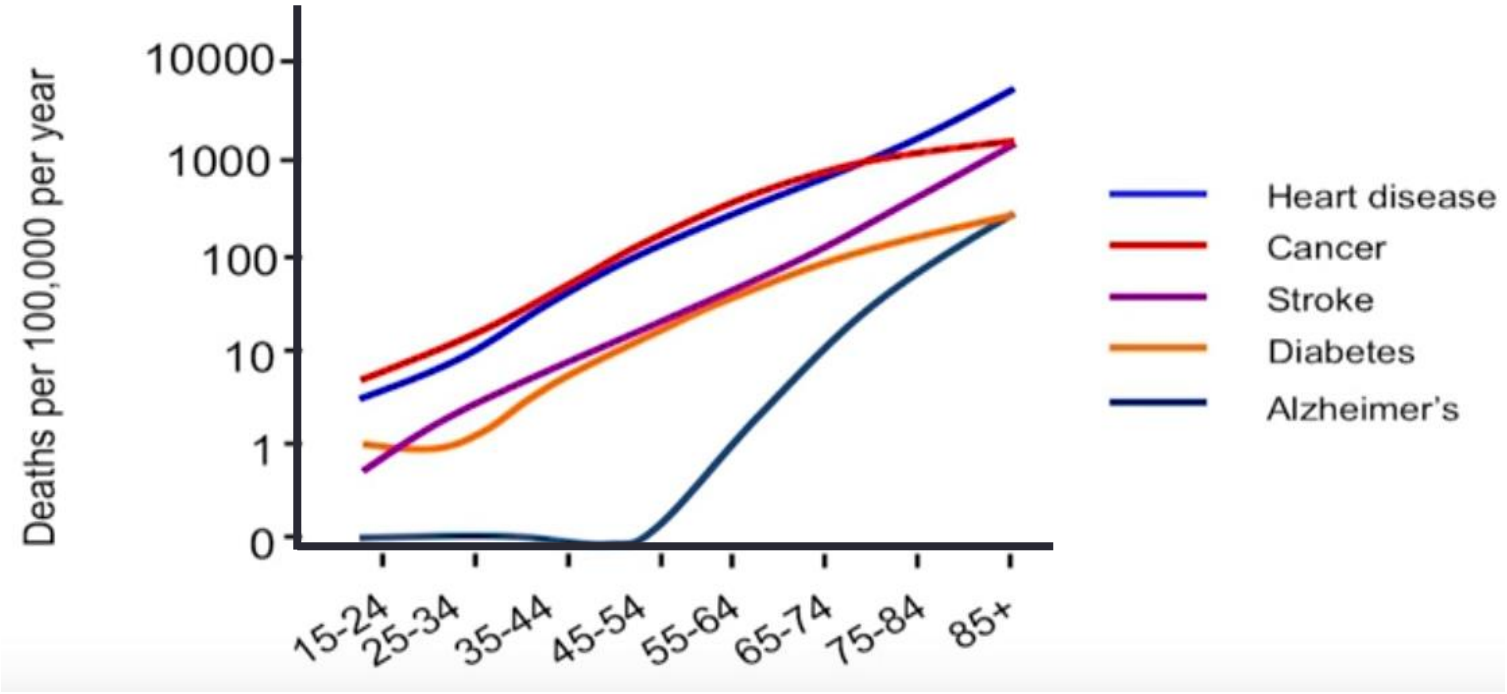


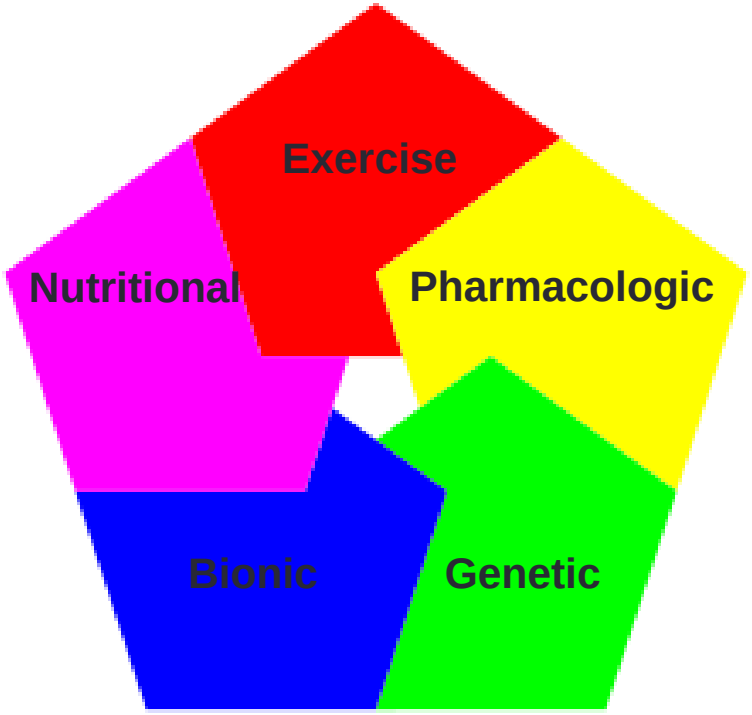
The causes of death by age



The causes of death by age;
One strategy to rule them all



How do we approach to improve the aging experience?



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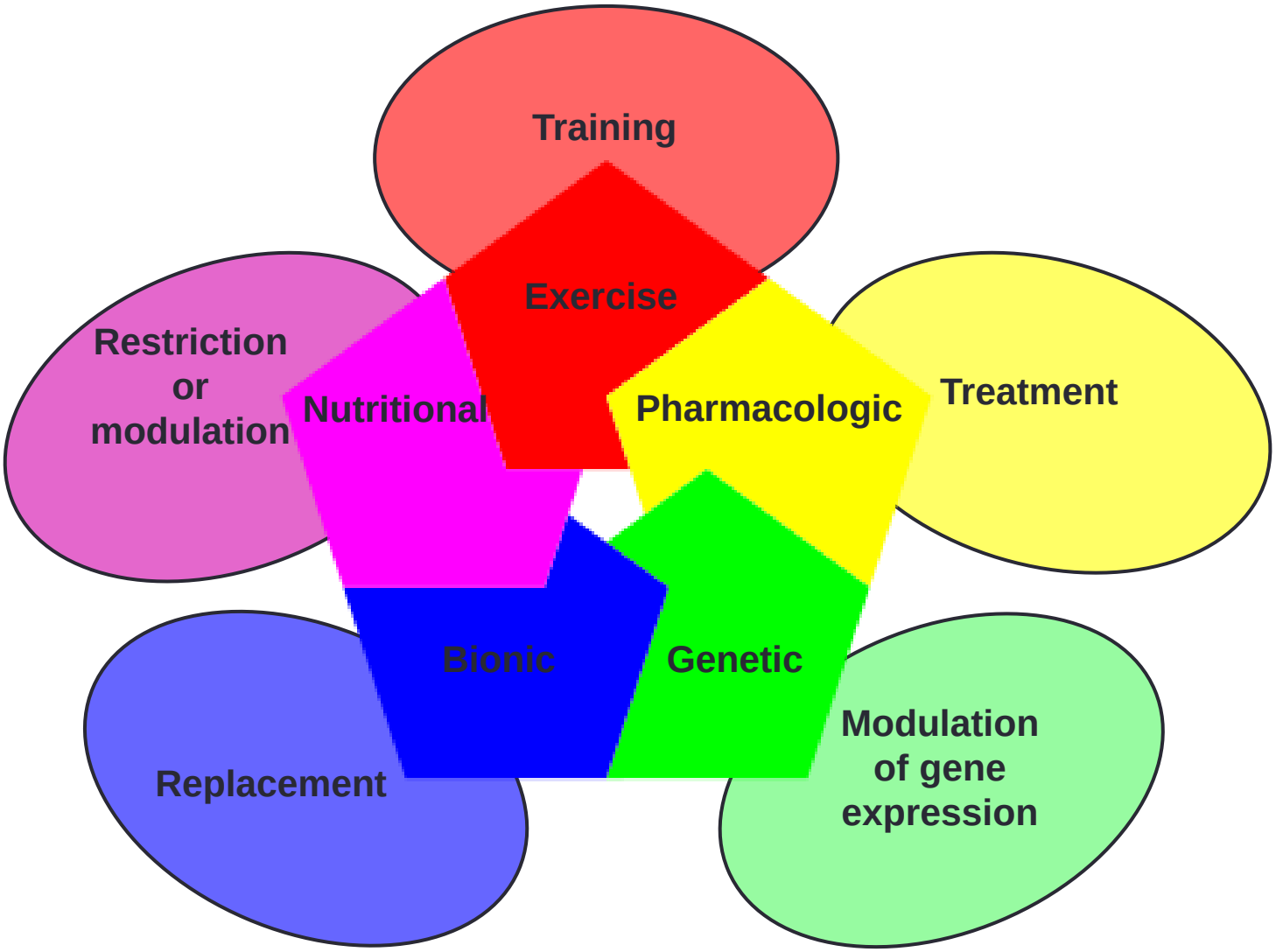
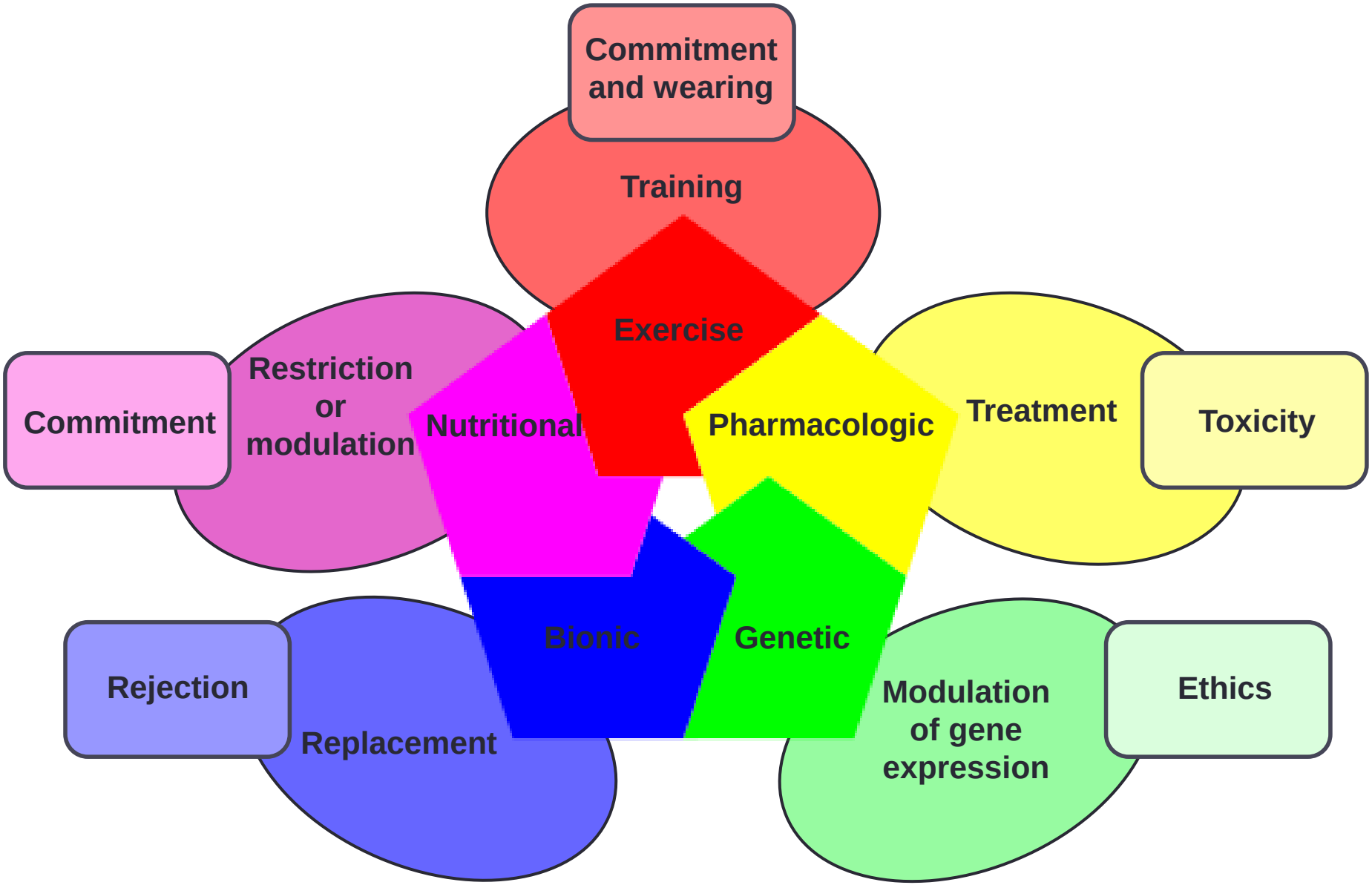
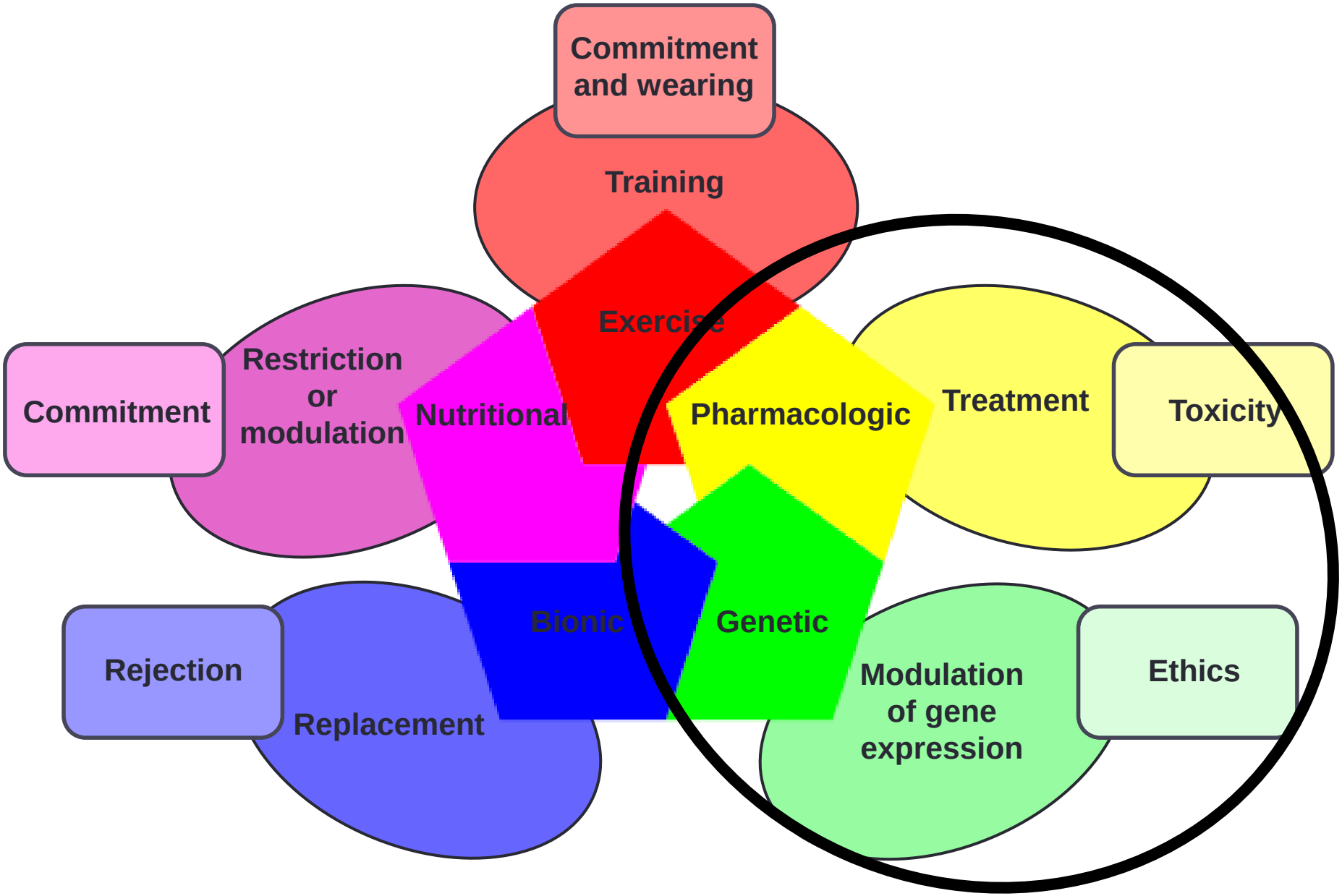


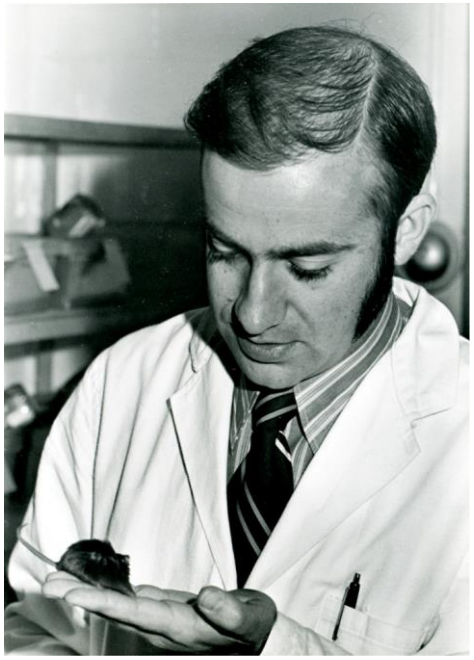
Important aspects to improve the aging experience



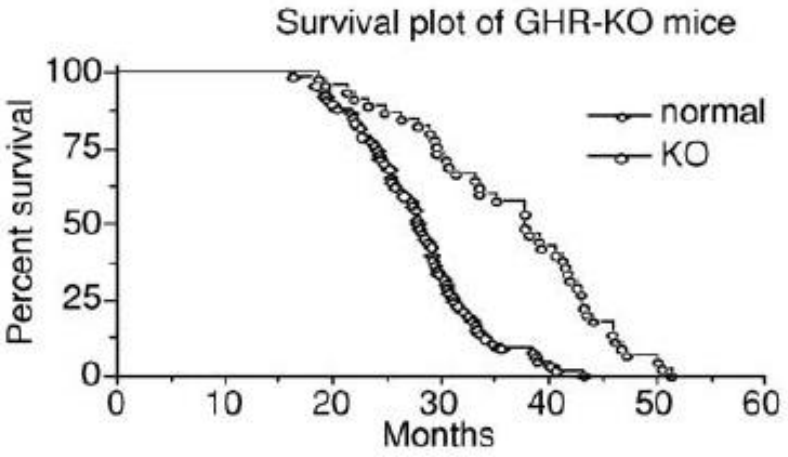
Experimental approaches to modulate aging; clinical trials



Methuselah prize of mouse longevity 1,819 days (~180 years in human)



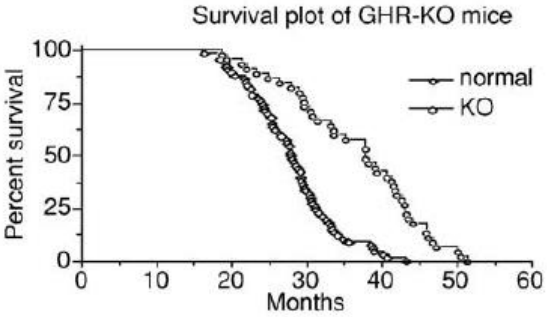
Laron Dwarf Mice (≥ 30%)



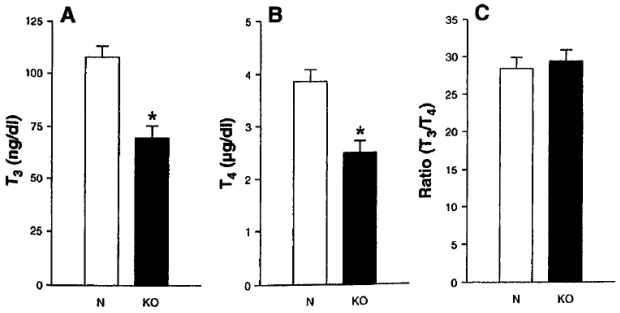
Bartke et al. Neuropeptides (2002)

Thyroid hormones are low in the longest living mice

Laron Dwarf (GH Receptor KO)

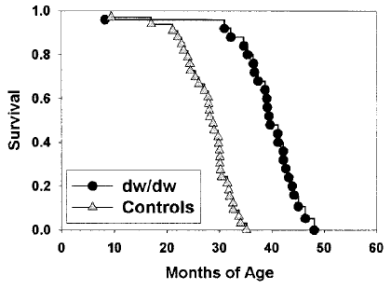


Bartke et al. Neuropeptides (2002)

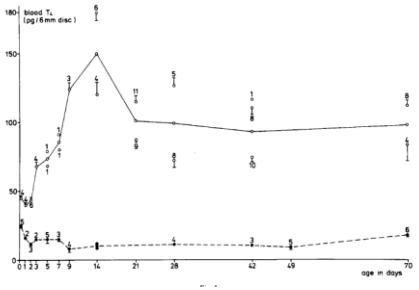


Hauck SJ. Exp Biol Med (2001)

Snell dwarf mice (Pit1 mutated mice)

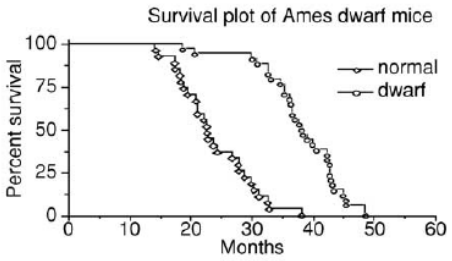


Flurkey et al. PNAS (2001)

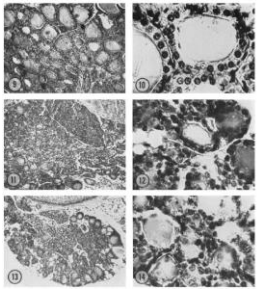


van Buul-Offers S et al. Acta Endo. (1983)

Ames dwarf mice (Prop1 mutated mice)



Brown-Borg et al. Nature (1996)



Bartke The Anat. Record. (1964)

Thyroid hormones are reduced in calorie resticted humans

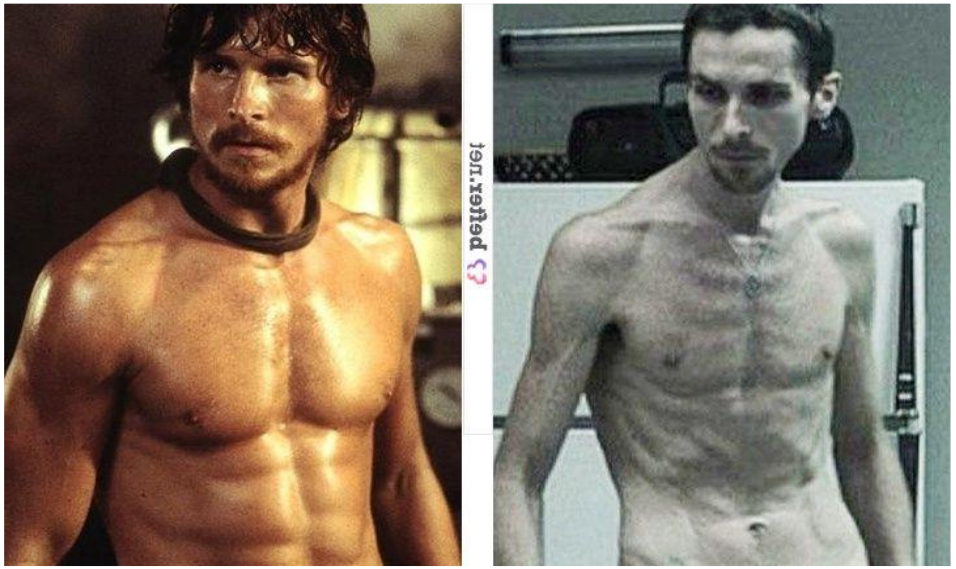


TABLE 1. Characteristics of the study subjects

	CR group (n = 28)	EX group (n = 28)	WD group (n = 28)	*P* value		
				CR vs. EX	CR vs. WD	EX vs. WD
Age (yr)	52.0 ± 12	52.1 ± 12	52.3 ± 10	ns	ns	ns
Sex (M/F)	24/4	24/4	24/4			
Height (m)	1.73 ± 0.1	1.75 ± 0.1	1.77 ± 0.1	ns	ns	ns
Weight (kg)	58.8 ± 5.9	68.2 ± 7.6	81.9 ± 14.6	0.003	0.0001	0.0001
BMI (kg/m^2)	19.7 ± 1.7	22.2 ± 1.9	26.0 ± 3.2	0.0001	0.0001	0.0001
TSH (mIU/liter)	1.27 ± 0.7	1.68 ± 1.0	1.24 ± 0.6	ns	ns	ns
T_3 (ng/dl)	73.6 ± 22	94.3 ± 17	91.0 ± 13	0.0001	0.001	ns
T_4 (μg/dl)	5.4 ± 1.5	5.1 ± 0.7	5.7 ± 0.9	ns	ns	ns
FT4 (ng/dl)	0.96 ± 0.14	1.0 ± 0.09	0.97 ± 0.22	ns	ns	ns
hsCRP (mg/liter)	0.23 ± 0.27	0.65 ± 0.76	1.11 ± 1.17	0.001	ns	ns
TNF-α (pg/ml)	0.74 ± 0.5	1.42 ± 1.3	1.54 ± 0.9	0.030	0.009	ns

Normal ranges: TSH, 0.47–5.0 mIU/liter; T_3, 70–165 ng/dl; T_4, 4.5–12 μg/dl; and FT4, 0.71–1.85 ng/dl. Values are means ± SD. M, Male; F, female; ns, not significant; hsCRP, high-sensitivity CRP.

Fontana et al. JCEM (2006)

Centenarians and their offspring have lower T3/high TSH

Table 2. Serum Levels of Thyroid Hormone Axis Parameters for Offspring and Partners

	Offspring	Partners	*p* Value
All			
Thyrotropin (0.3–4.8 mU/L)	1.65 (1.59–1.71)	1.57 (1.49–1.66)	.11
Free thyroxine (10–24 pmol/L)	15.0 (14.9–15.2)	15.2 (15.0–15.4)	.045
Free triiodothyronine (2.5–5.5 pmol/L)	4.08 (4.04–4.12)	4.14 (4.09–4.20)	.024
Ratio triiodothyronine thyroxine	0.28 (0.27–0.28)	0.28 (0.27–0.28)	.84

Rozing et al. J Gerontol A Biol Sci Med Sci. (2010)

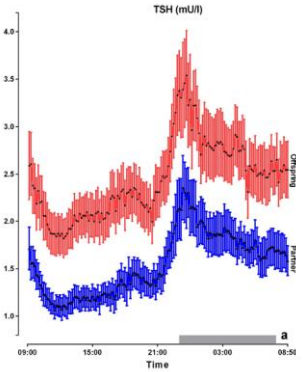
TABLE 1. Age, TSH, and FT4 in female and male controls, offspring, and probands (Ashkenazi Jewish centenarians)

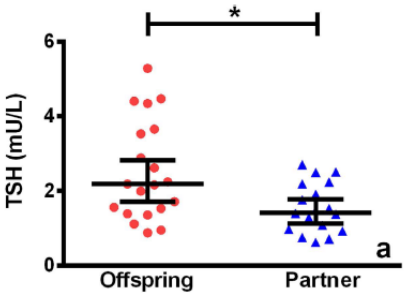
	Controls	Offspring	Centenarians
n (females/males)	163 (79/84)	366 (185/181)	[illegible]
Age (yr)			
All	70 (53–80)	69 (59–79)	97 (95–105)
Females	67 (52–80)	68 (59–79)	97 (95–103)
Males	74 (59–80)	69 (59–79)	97 (95–103)
TSH (mIU/liter)			
All	1.55 (0.63–3.93)	1.68 (0.65–4.79)[a]	1.97 (0.42–7.15)[a]
Females	1.60 (0.60–4.7)	1.72 (0.51–6.3)[a]	2.00 (0.53–7.34)[a]
Males	1.50 (0.55–4.50)	1.68 (0.65–5.9)[a]	1.93 (0.61–6.9)[a]
FT4 (ng/dl)			
All	1.00 (0.69–1.7)	1.03 (0.67–2.0)	1.02 (0.62–2.02)
Females	0.99 (0.74–1.5)	1.04 (0.66–1.9)[a]	1.04 (0.65–2.02)[a]
Males	1.00 (0.57–1.7)	1.02 (0.67–2.0)	0.95 (0.48–2.06)[a]

Data are expressed as median (97.5% CI).

[a] $P < 0.05$ vs. controls.

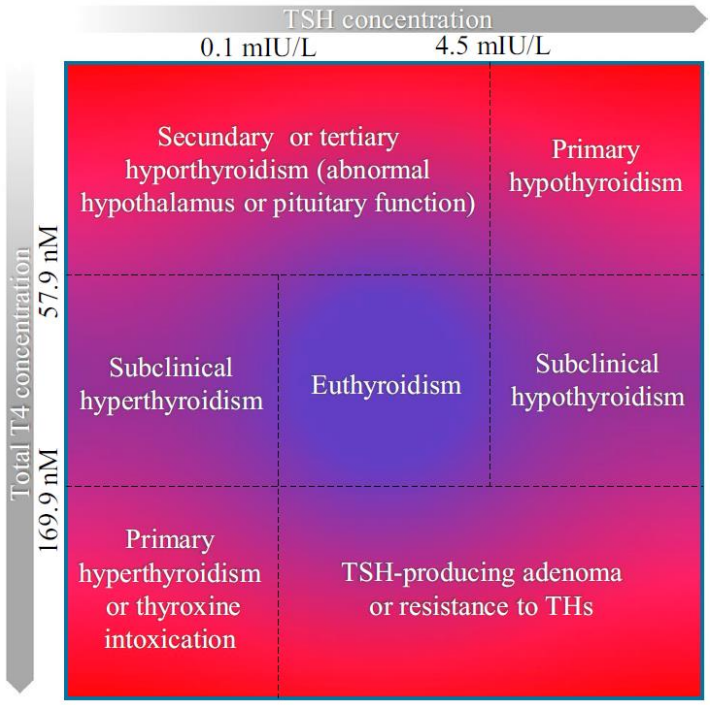
Atzmon et al. J Clin Endocrinol Metab. (2009)

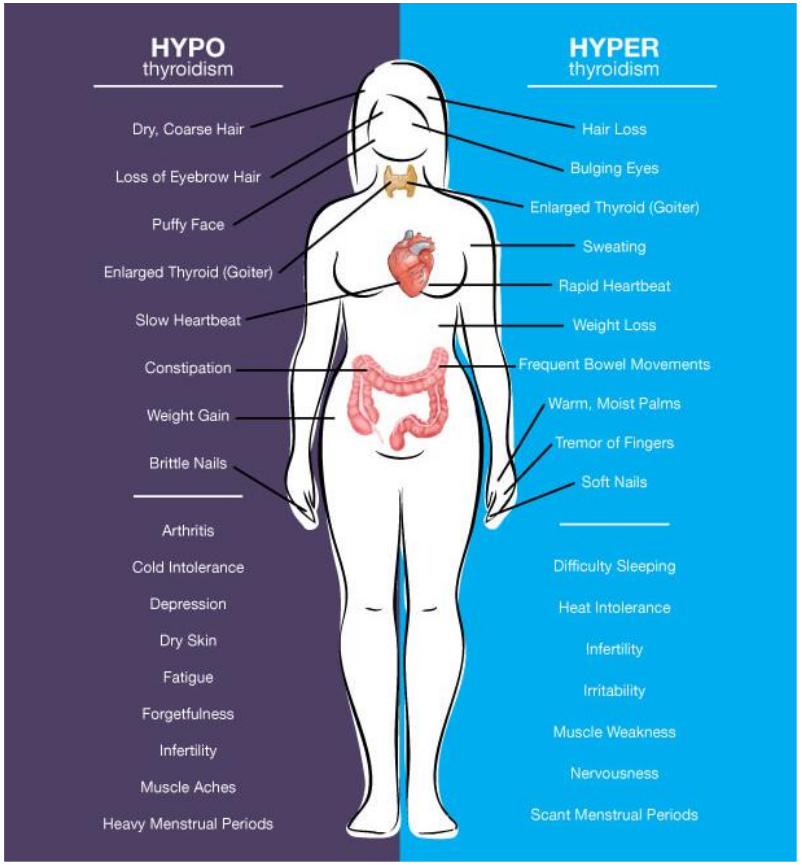




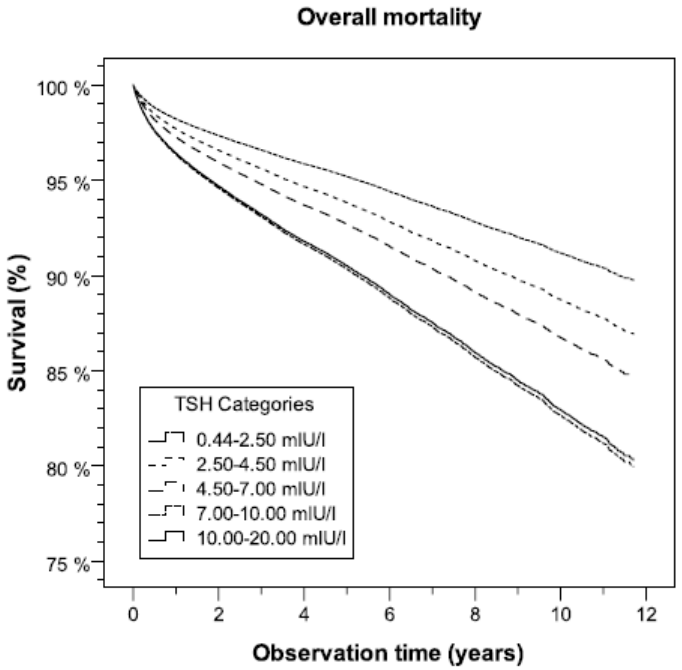
Jansen et al. Sci Rep. (2015)

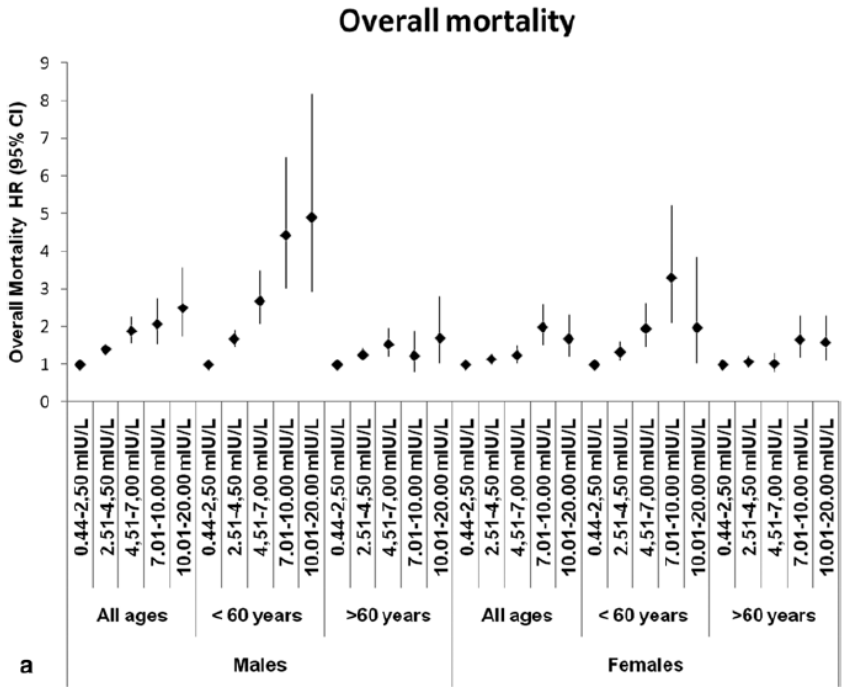
Alterations in thyroid Hormones lead to human diseases





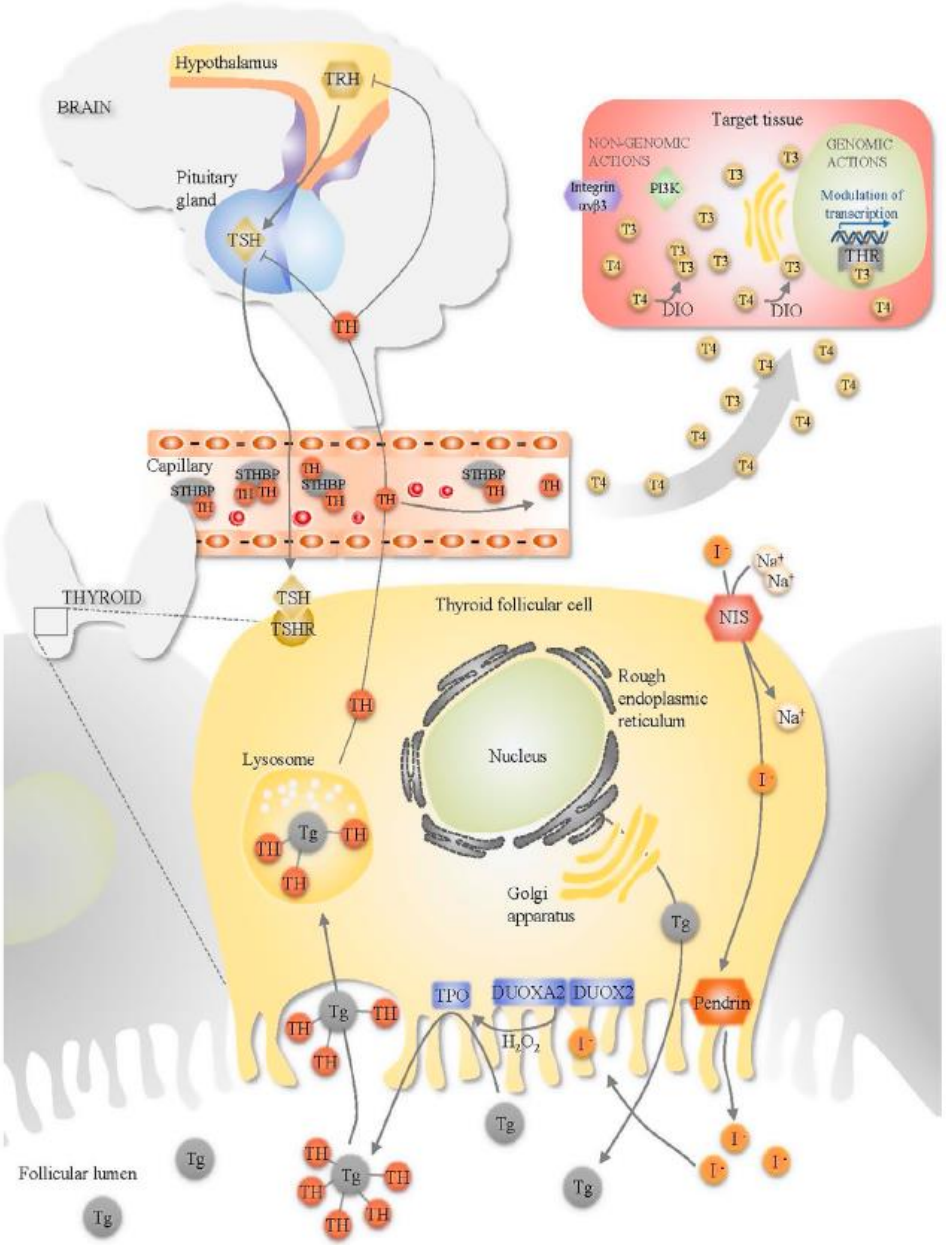
Hypothyroid humans have increased mortality





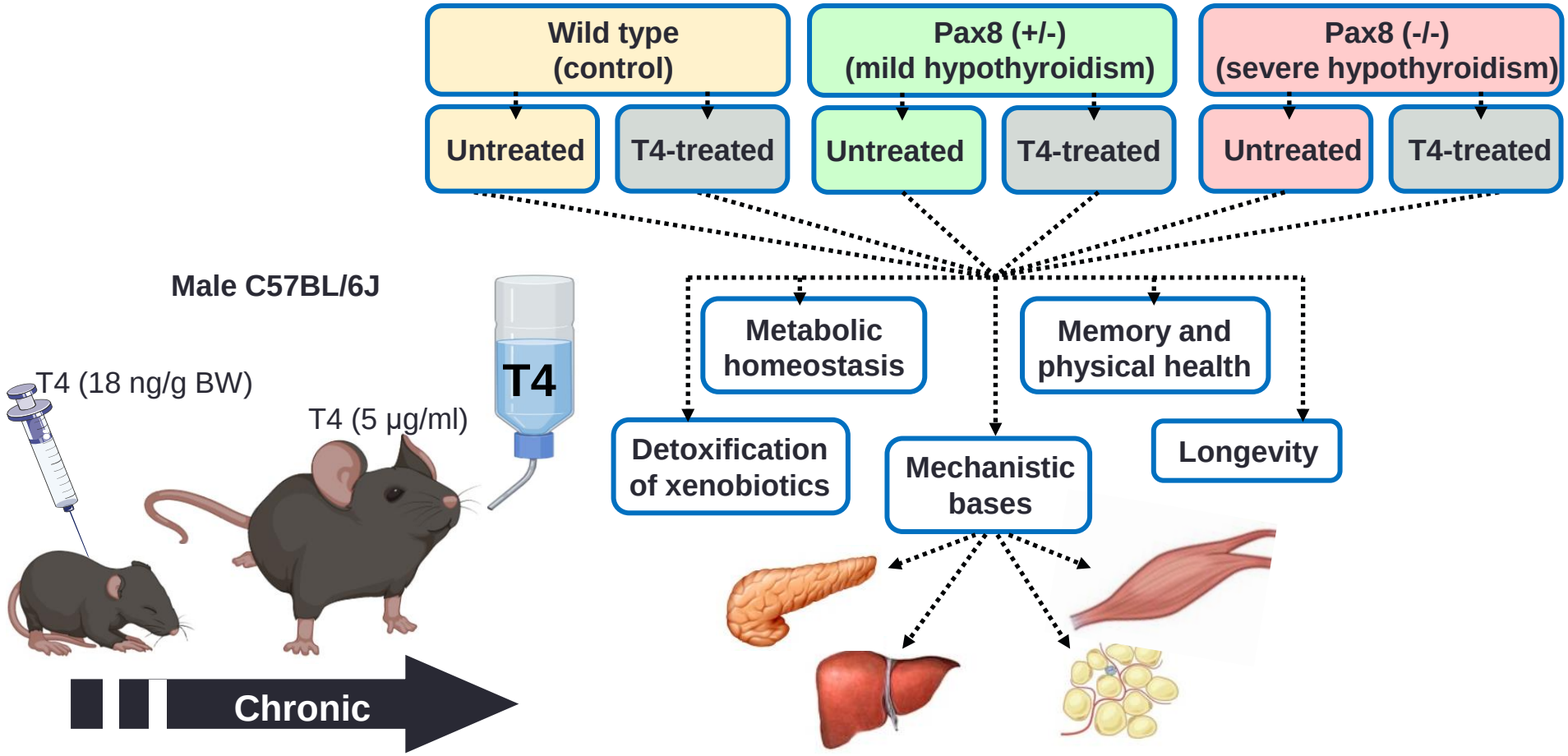
Kovar FM. Et al. Wien Klin Wochenschr. (2015)

The hypothalamic-pituitary-thyroid axis

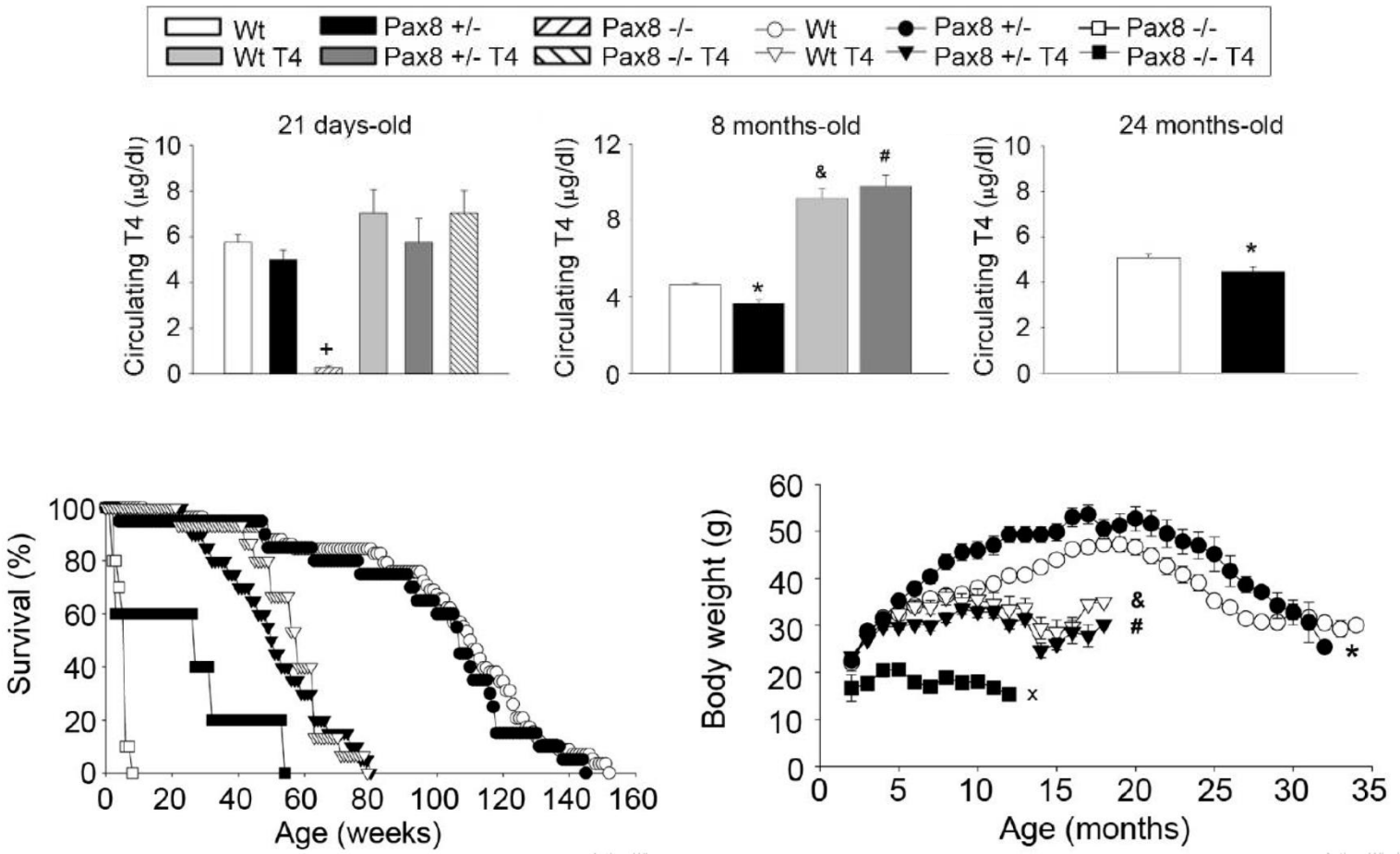


Metabolic rate

The thyroid axis in metabolic health, cancer, and life expetancy

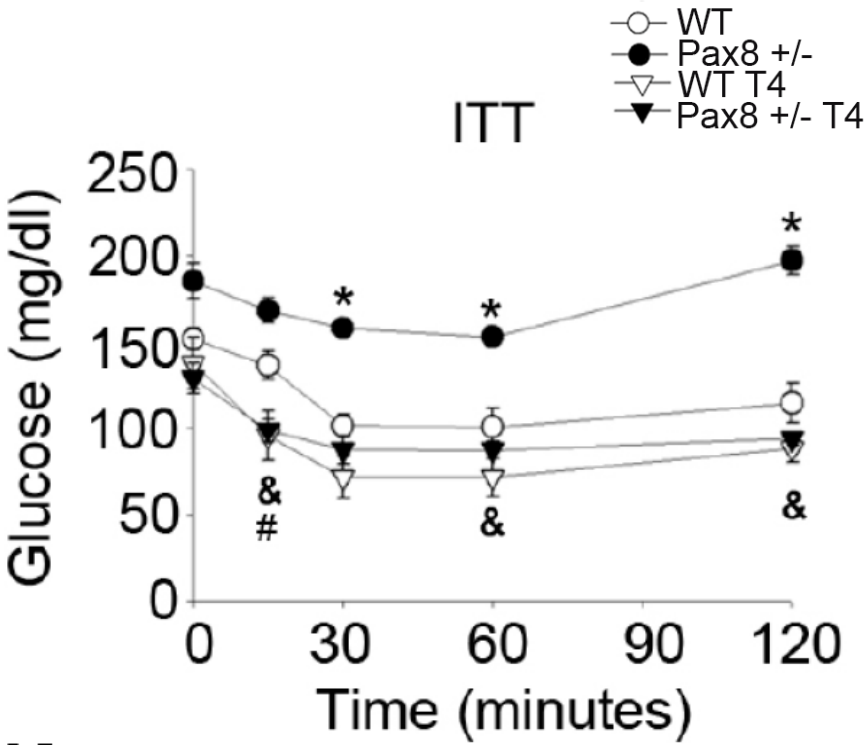


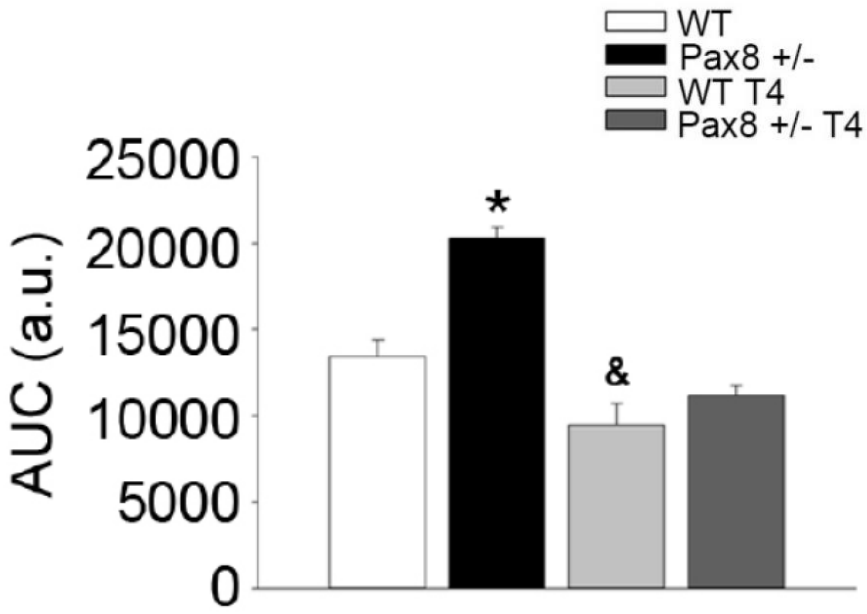
The effects of the modulation of the thyroid axis in longevity



López-Noriega L. et al. Aging 2019

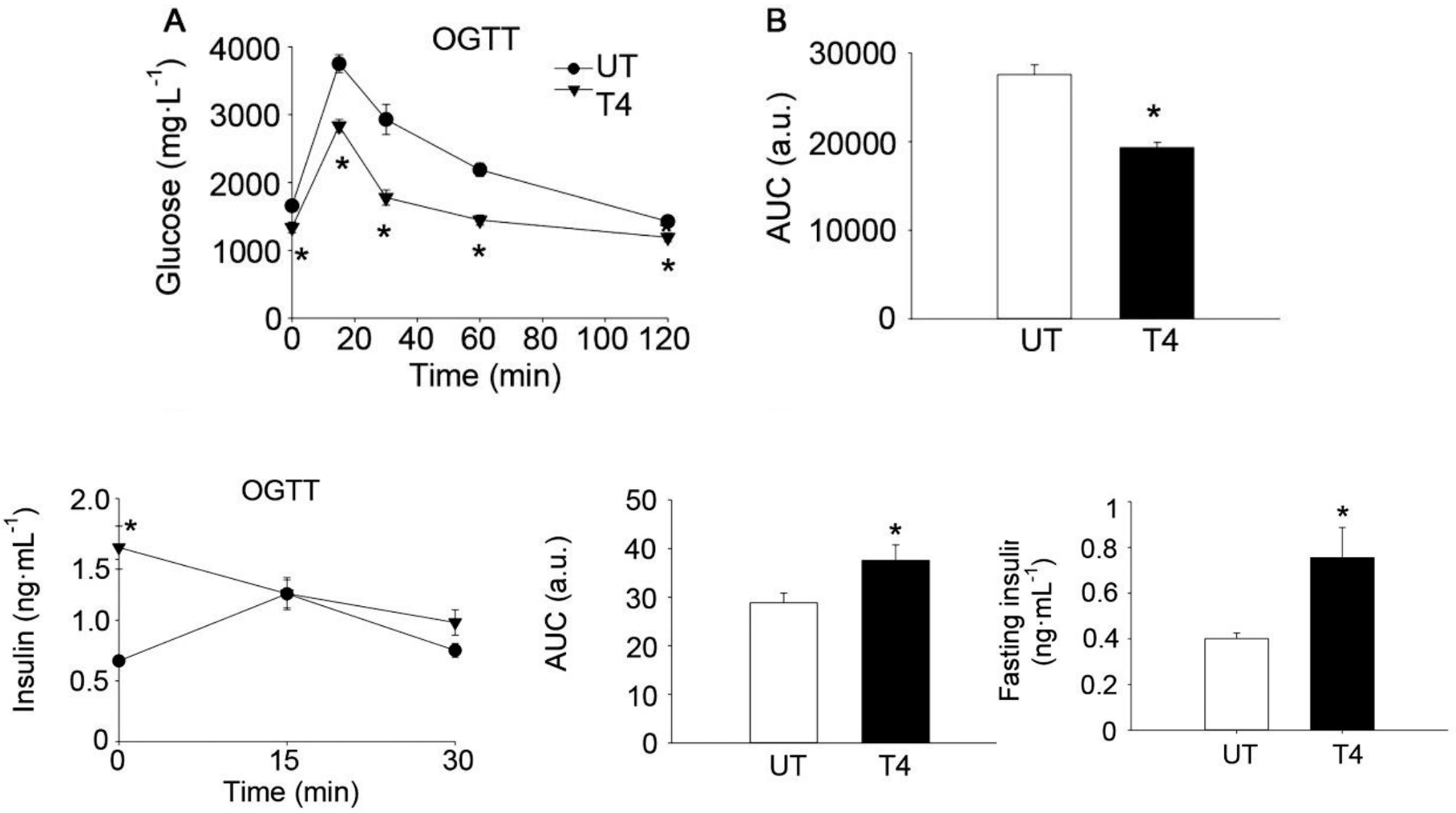
The modulation of thyroid hormones alters glucose metabolism





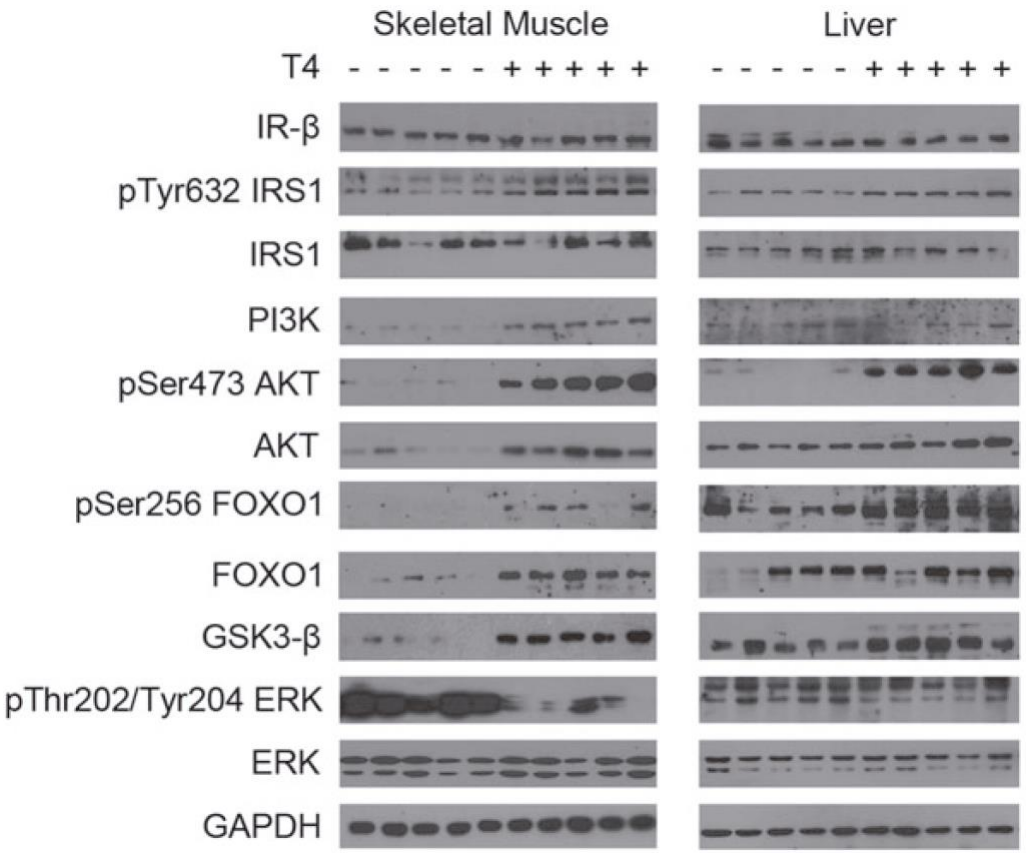
López-Noriega L. et al. Aging 2019

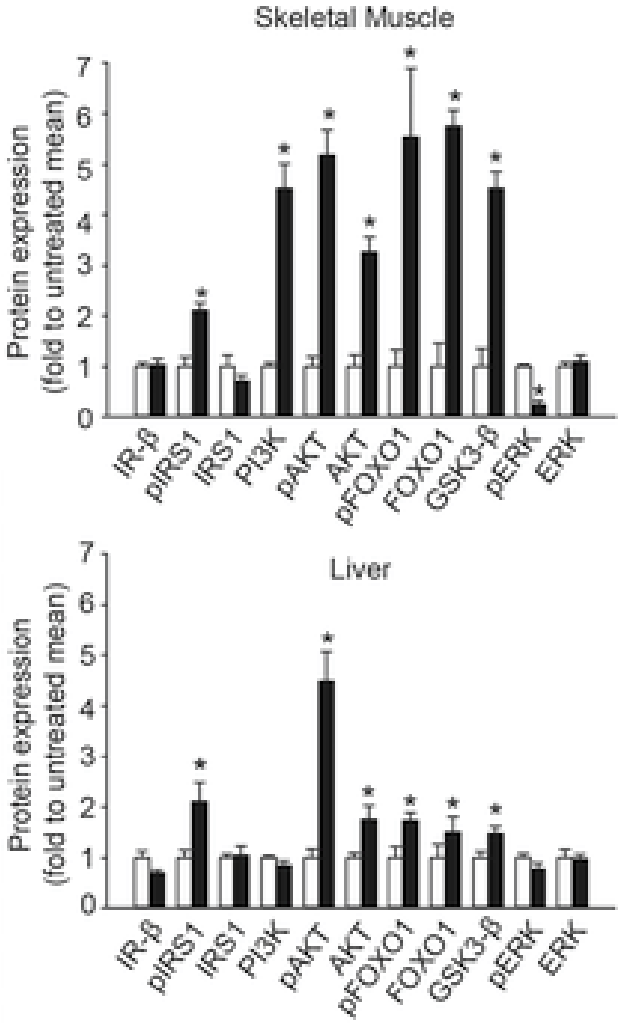
Thyroid hormones in female C57 increase insulin levels



López-Noriega L. et al. B. J. Pharmacology 2017

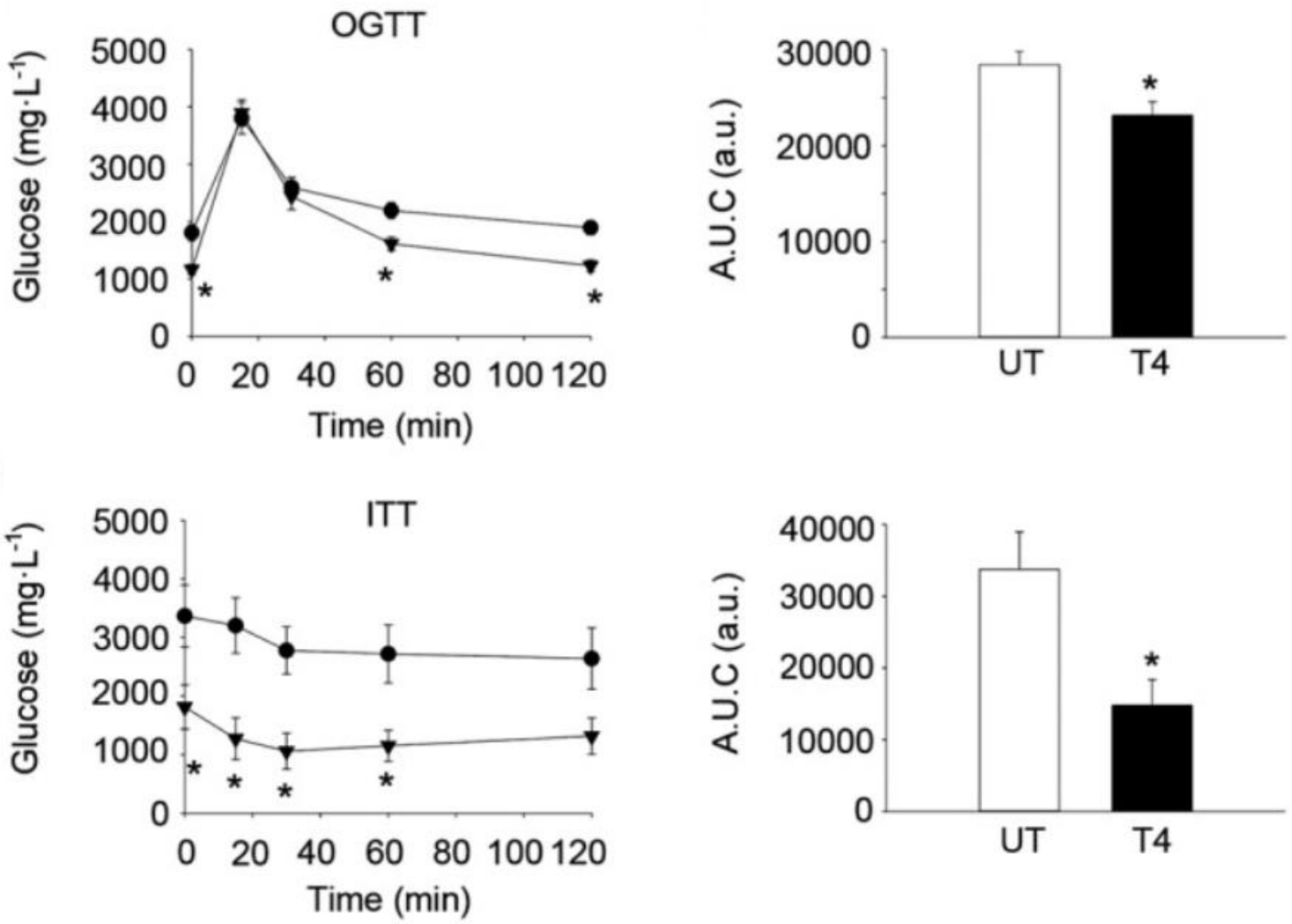
Increased insulin signaling in hyperthyroidism





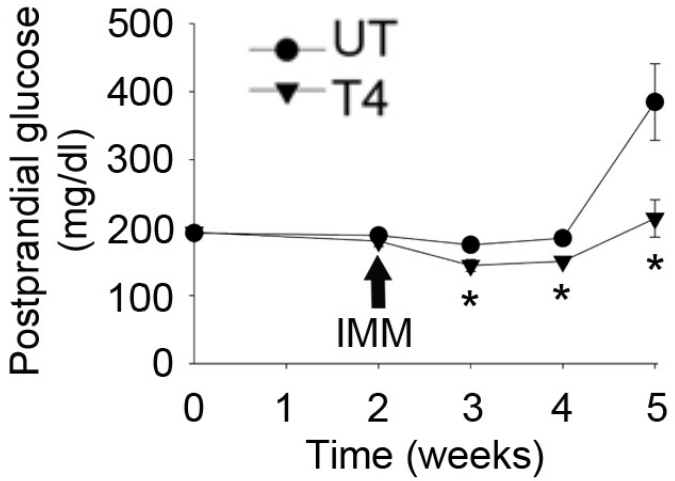
López-Noriega L. et al. B. J. Pharmacology 2017

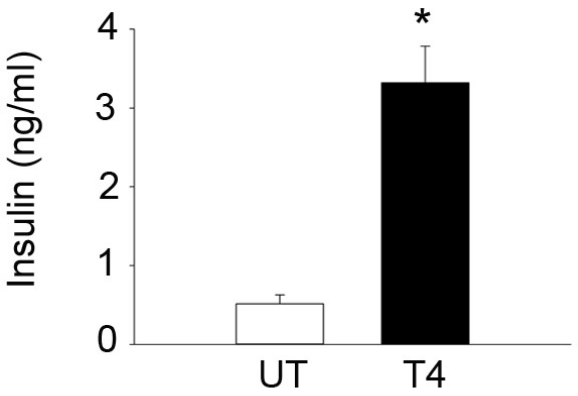
Thyroid hormones improve glucose metabolism in RIP.B7.1 mice

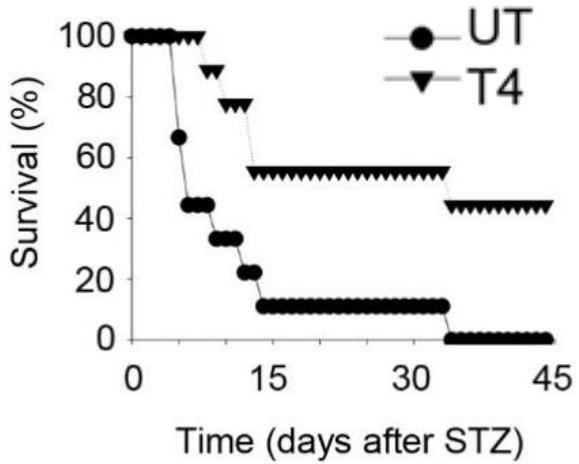


López-Noriega L. et al. B. J. Pharmacology 2017

Thyroid hormones increase insulin levels and survival in ET1DM







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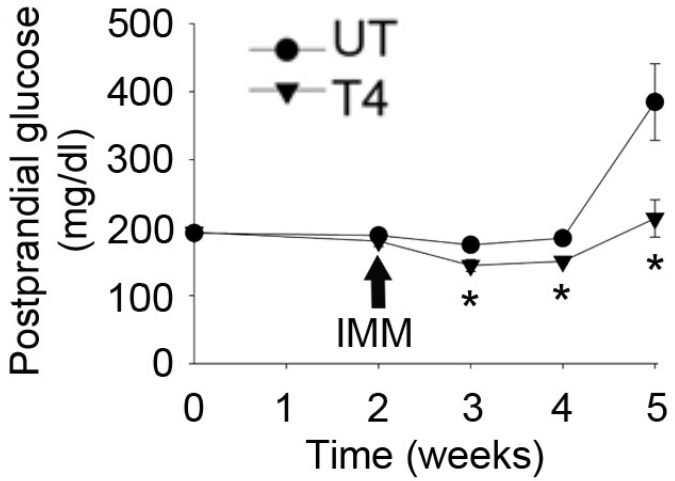
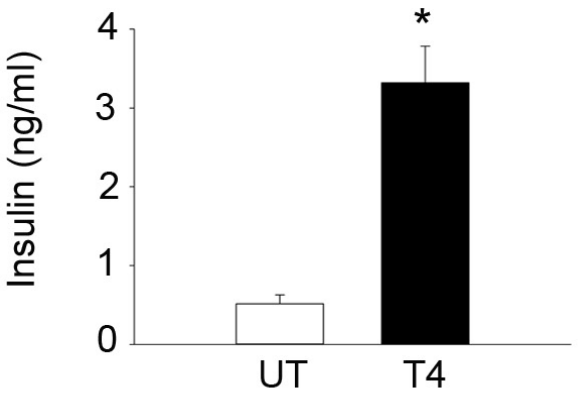
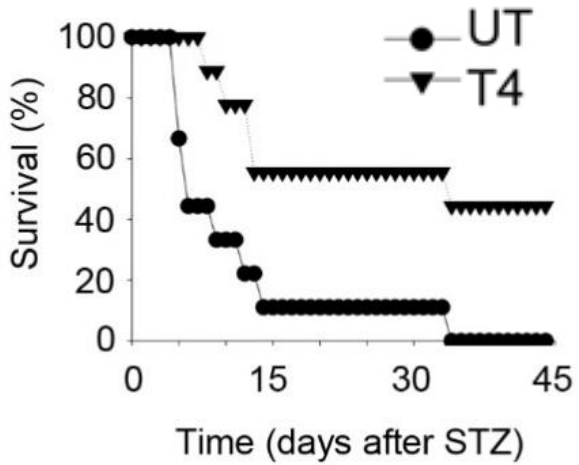
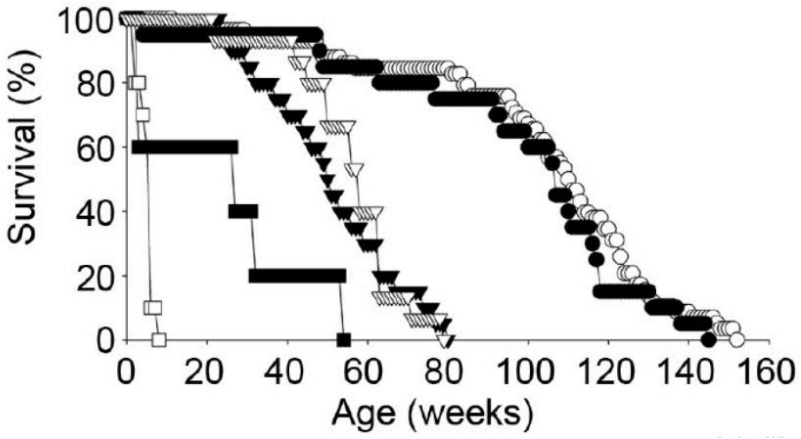
Thyroid hormones produce toxicity in healthy mice





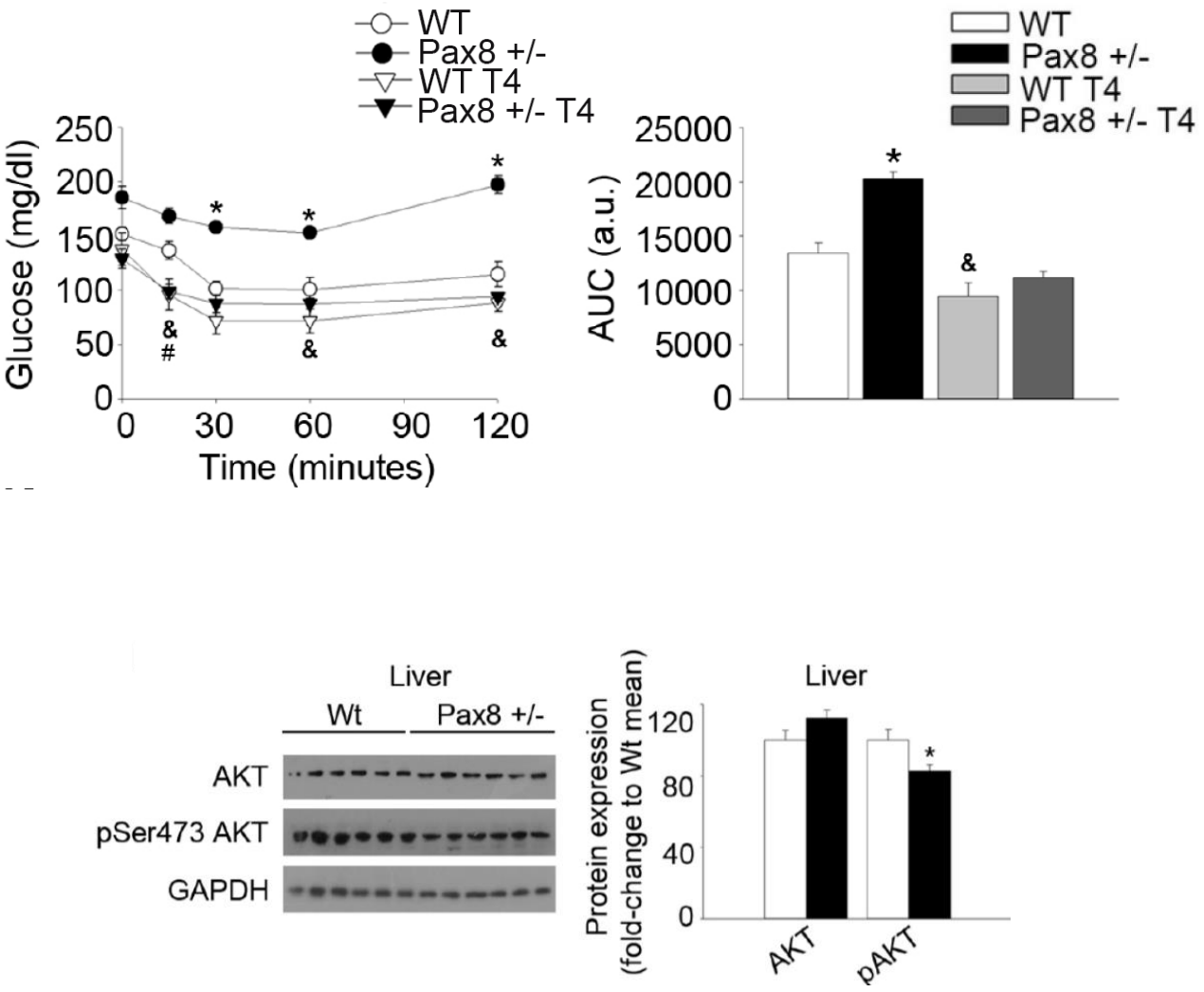




López-Noriega L. et al. Aging 2019

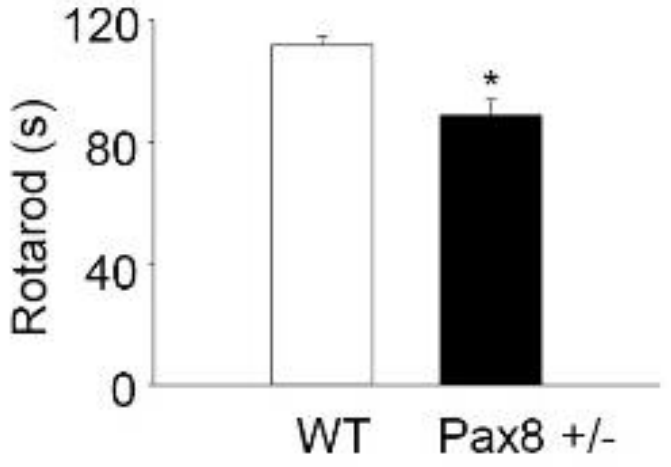
López-Noriega L. et al. B. J. Pharmacology 2017

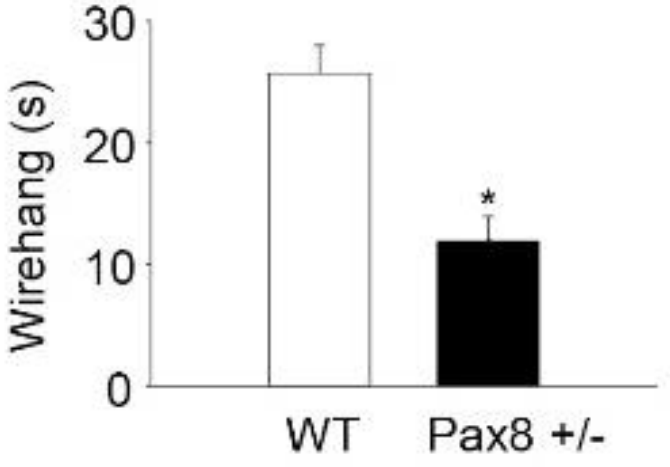
The modulation of thyroid hormones alters glucose metabolism

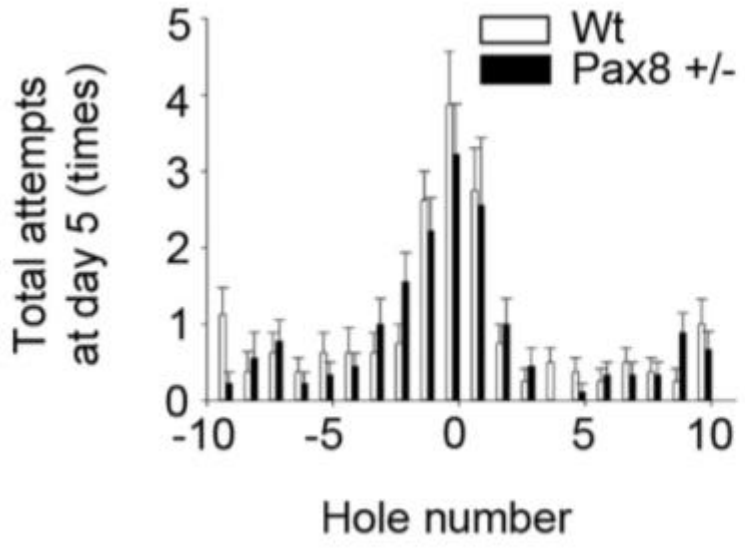


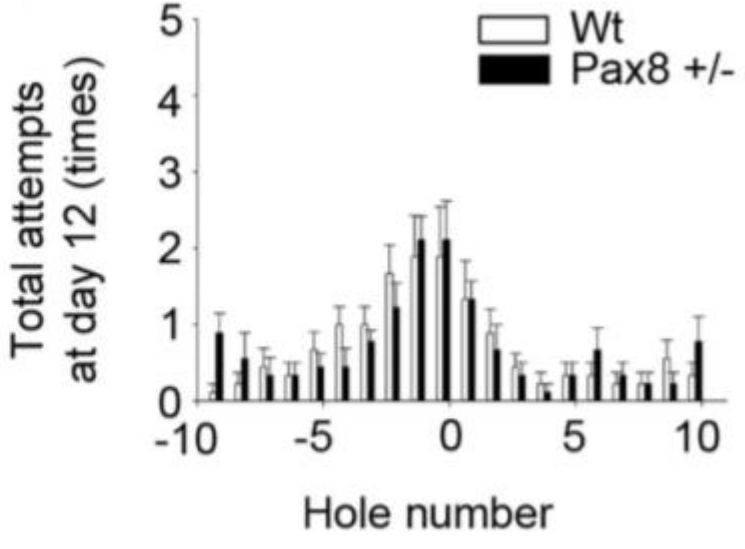
López-Noriega L. et al. Aging 2019

Mild hypothyroid mice have poor locomotor function



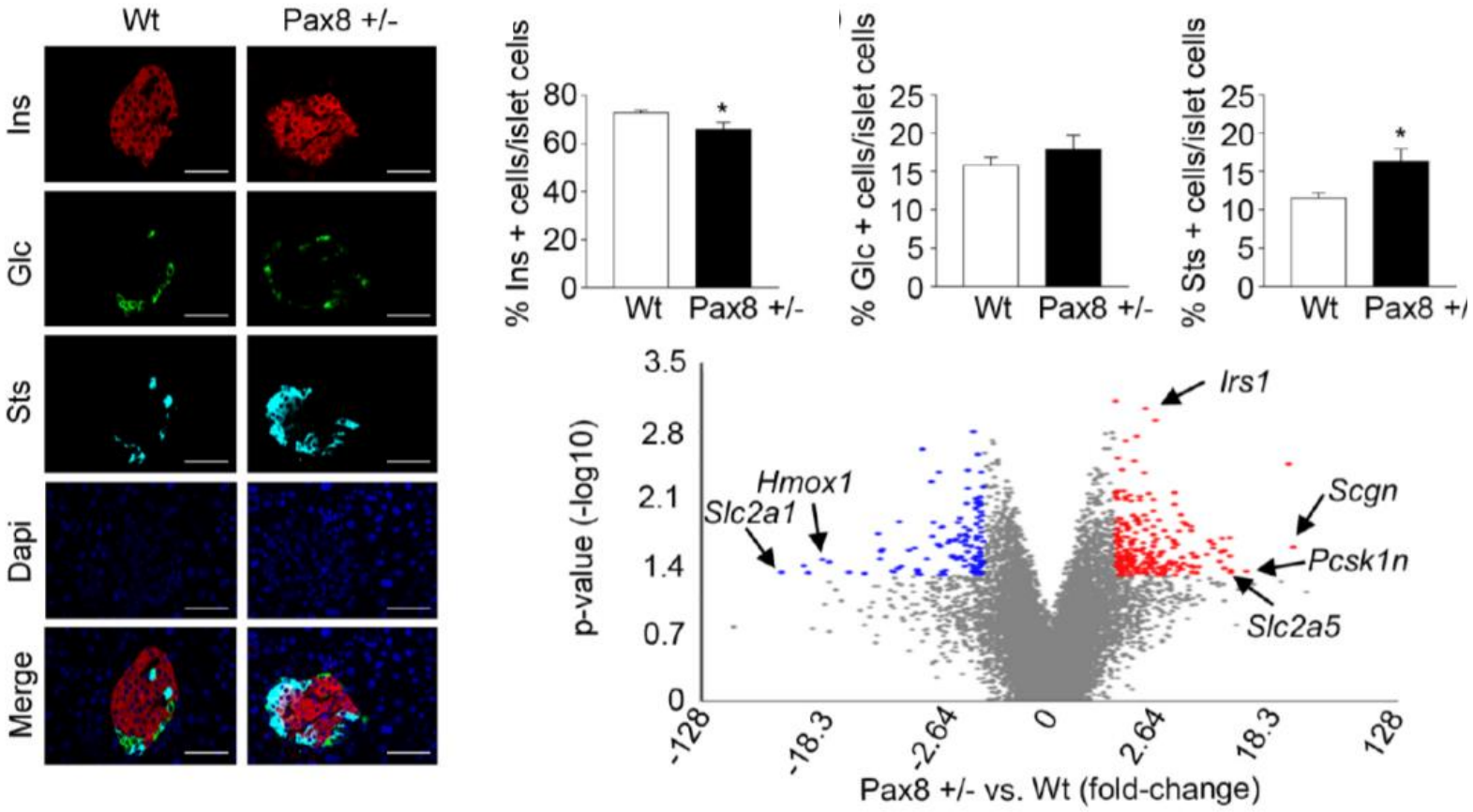






López-Noriega L. et al. Aging 2019

Mild hypothyroid mice have a distinct transcriptional profile



López-Noriega L. et al. Aging 2019

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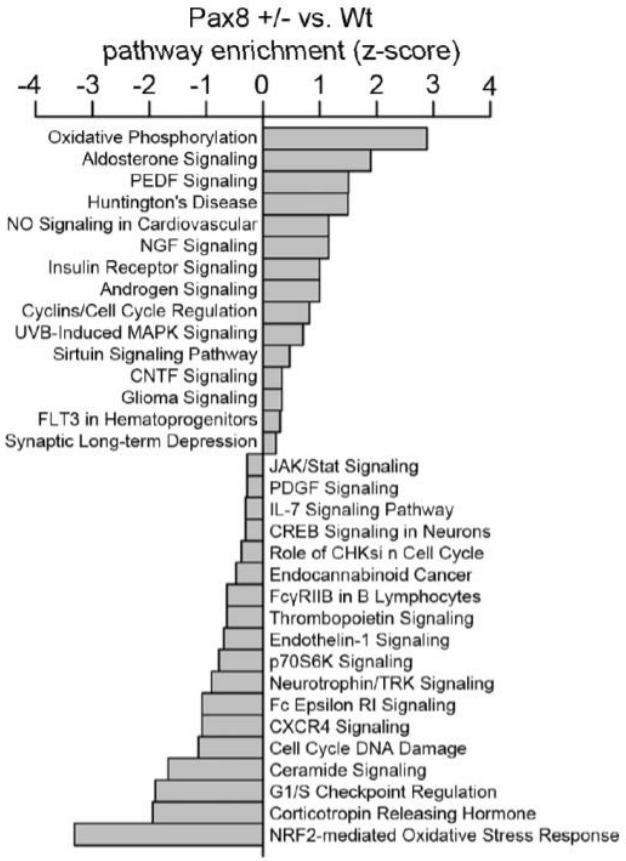

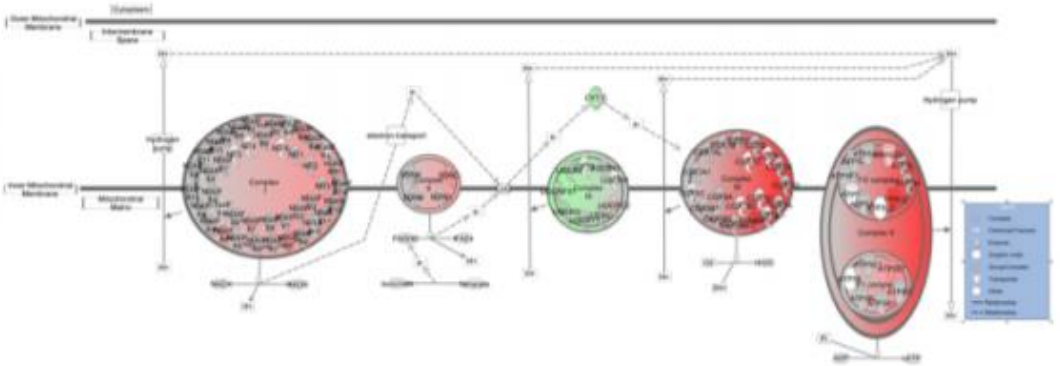

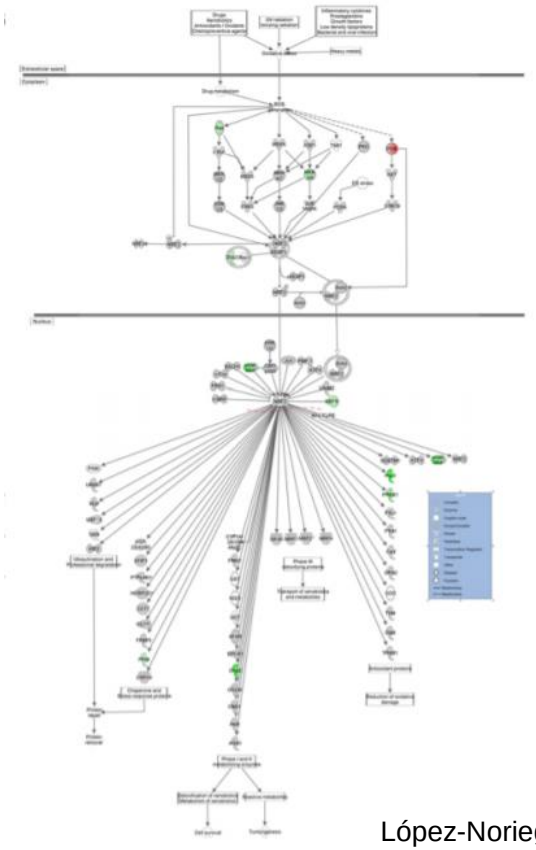

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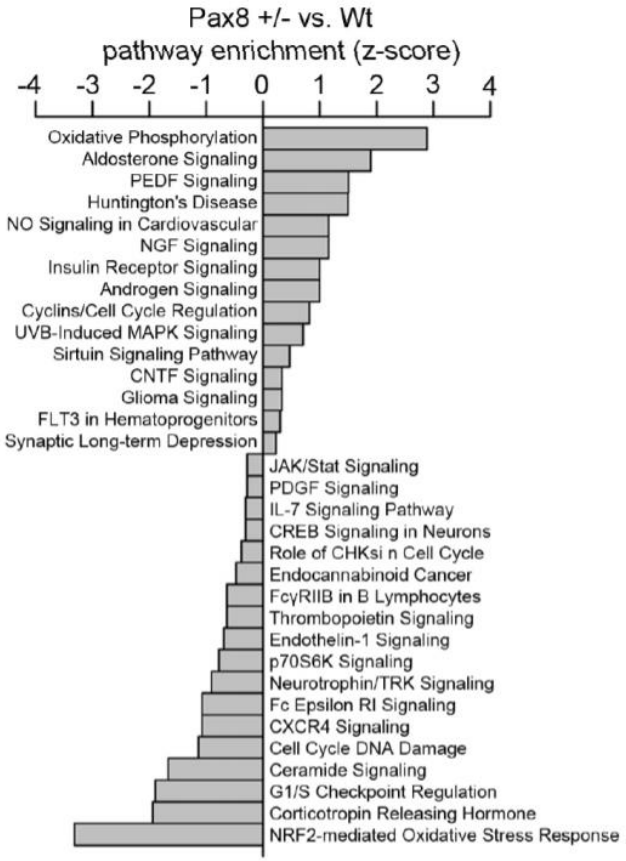
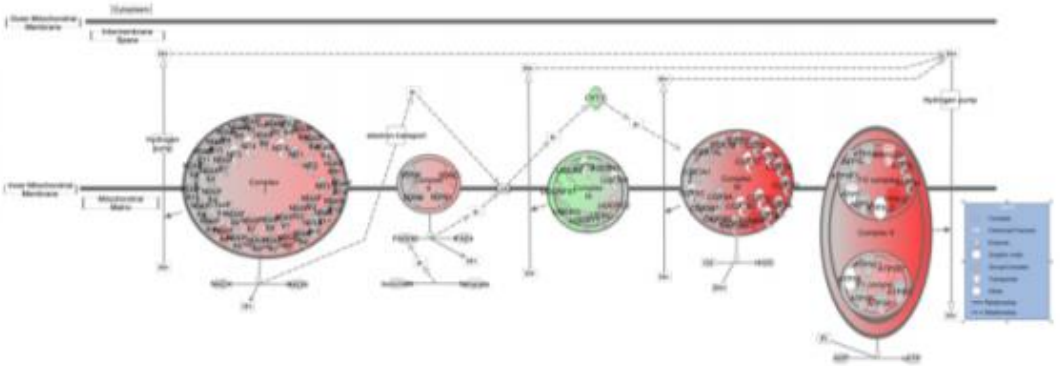
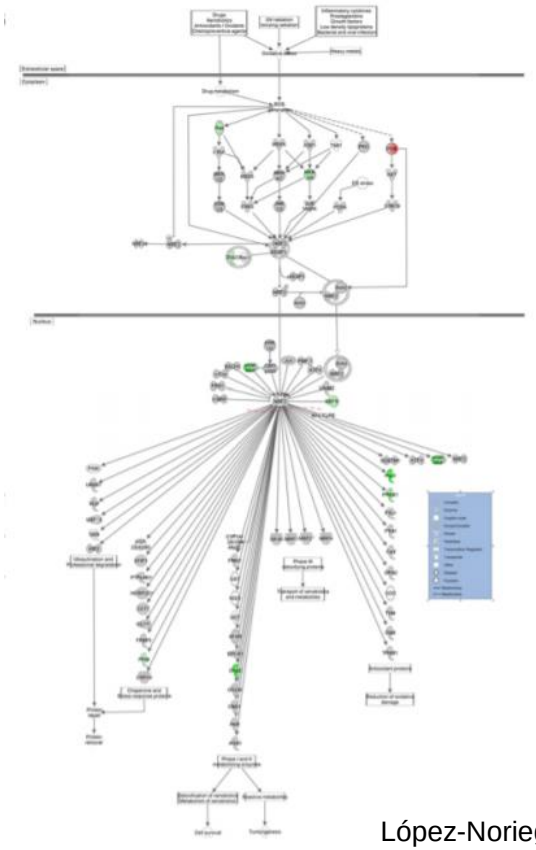
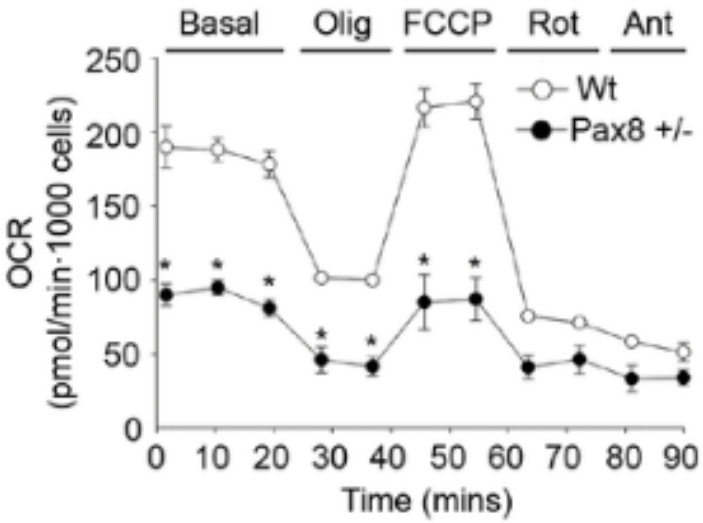


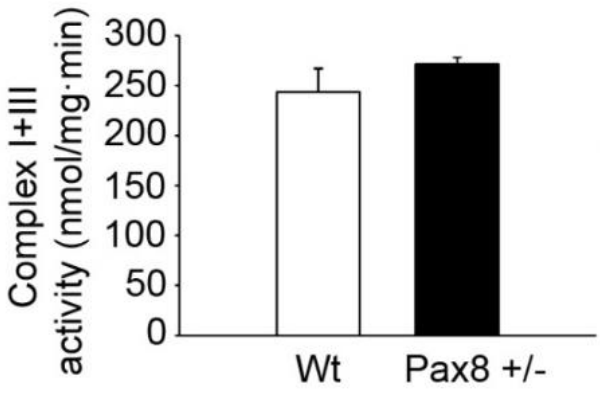


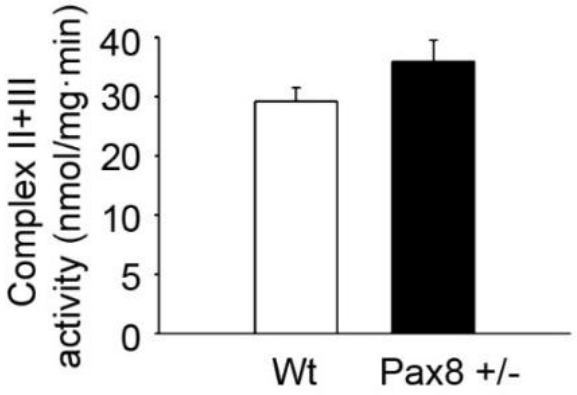


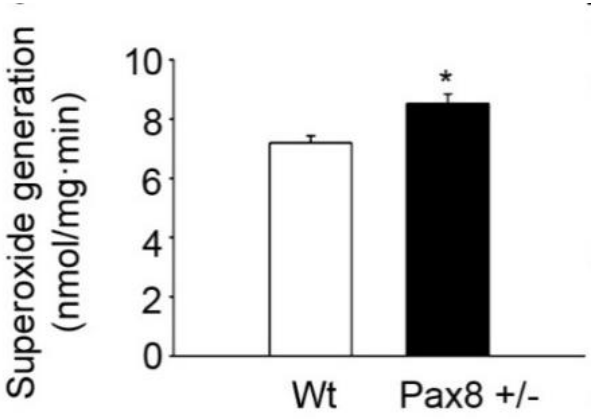
López-Noriega L. et al. Aging 2019

Mild hypothyroidism is associated to increased ROS generation



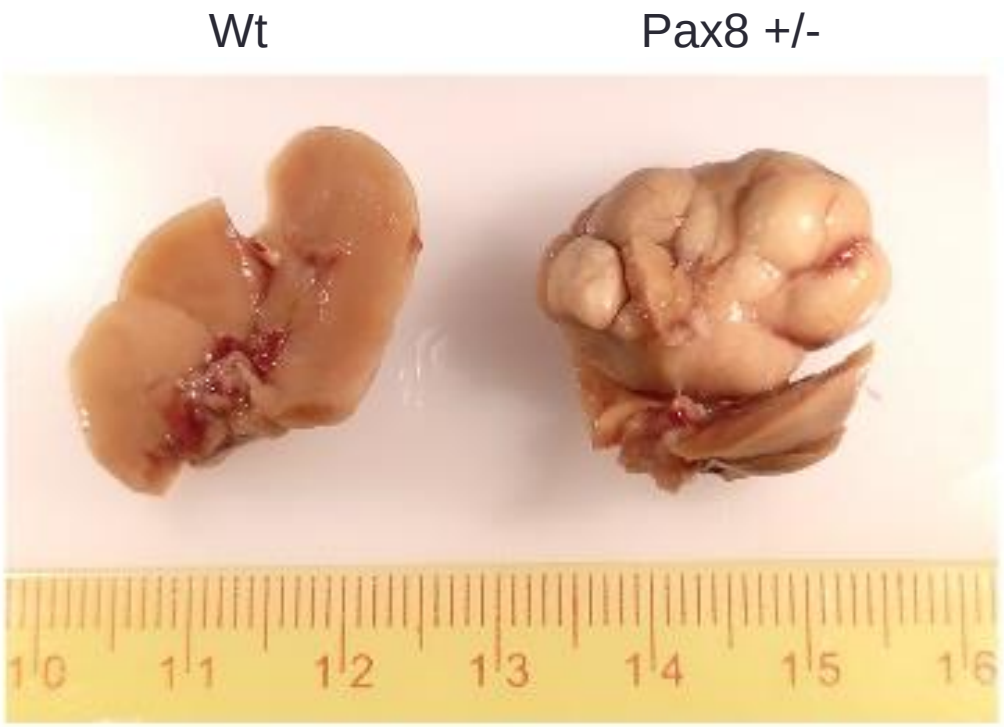


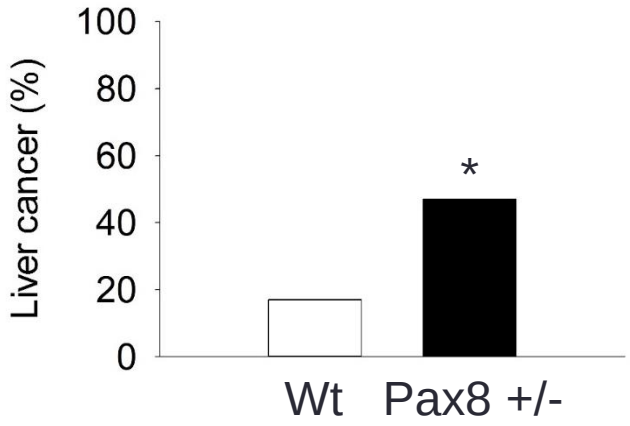




López-Noriega L. et al. Aging 2019

Hypothyroidism increases spontaneous liver carcinogenesis





López-Noriega L. et al. Aging 2019

The thyroid axis alter mechanisms of aging and cancer

Cell

Leading Edge
Review

The Hallmarks of Aging

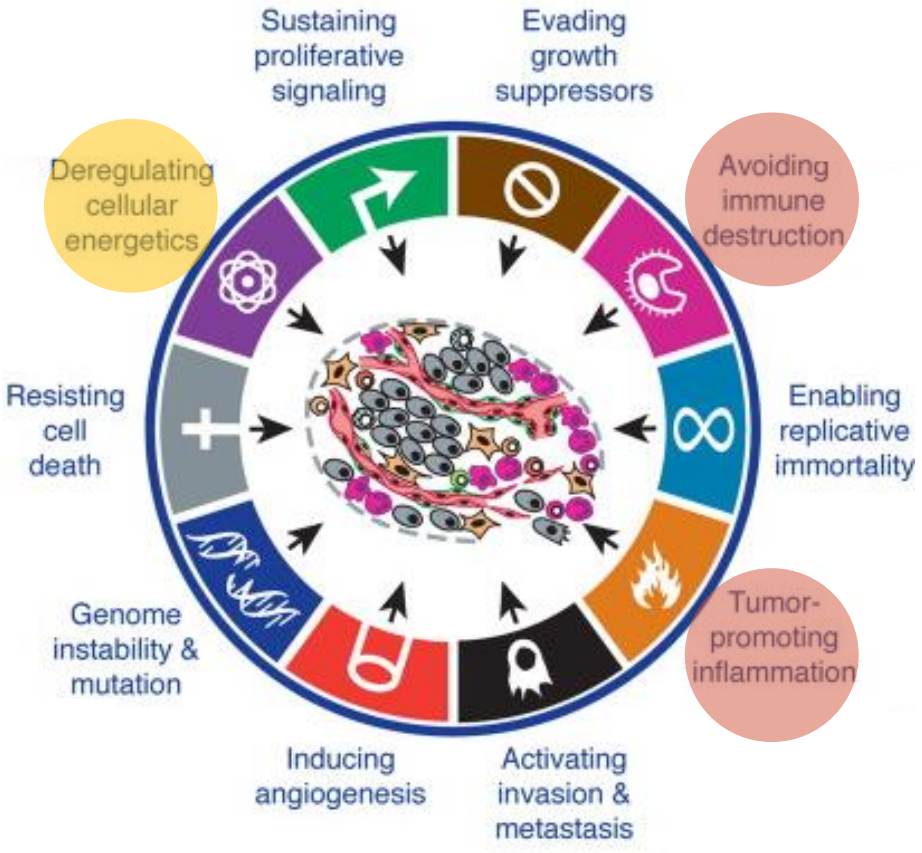
Carlos López-Otín,[1] Maria A. Blasco,[2] Linda Partridge,[3,4] Manuel Serrano,[5,*] and Guido Kroemer[6,7,8,9,10]

Cell

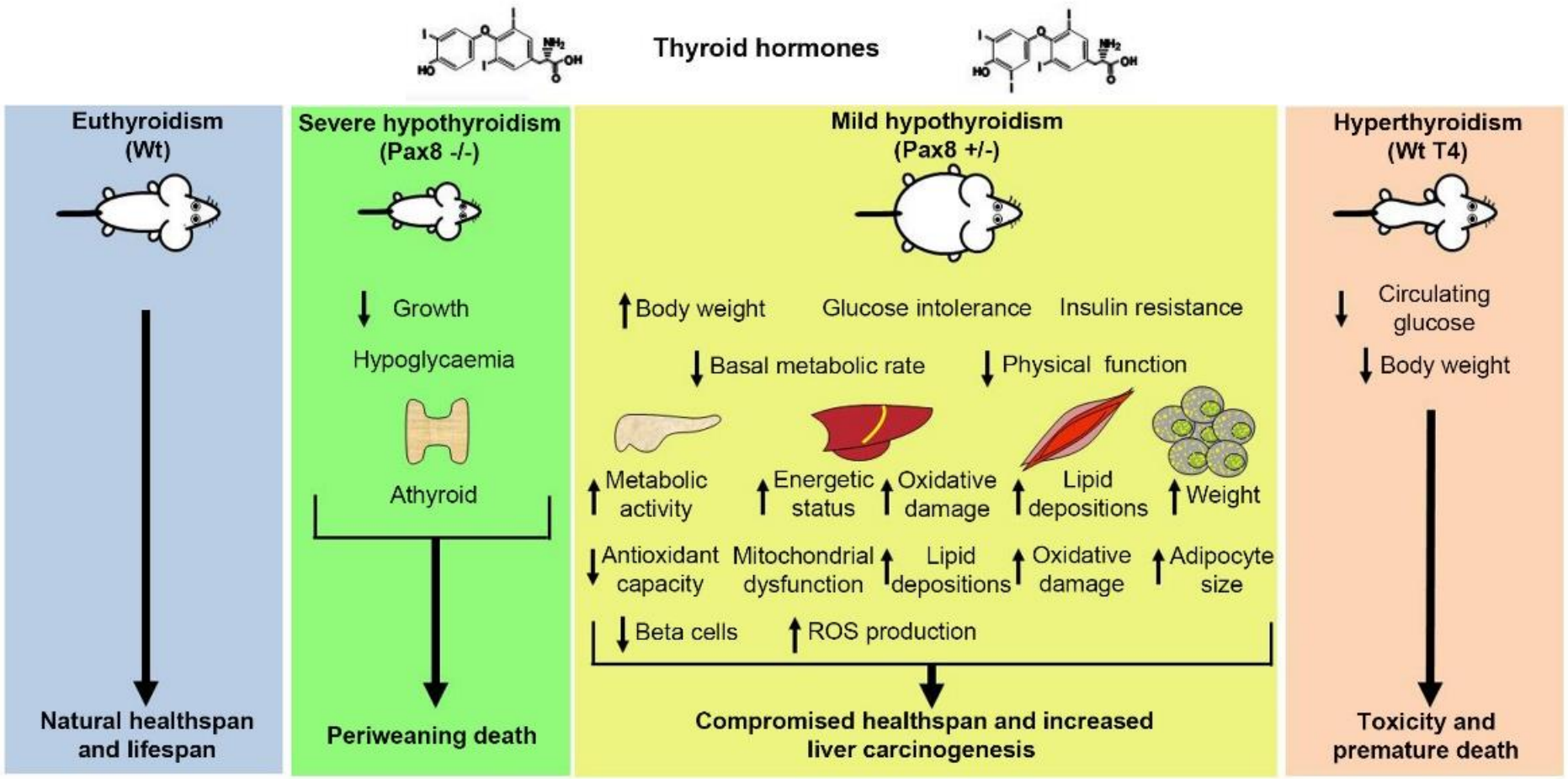
Leading Edge
Review

Hallmarks of Cancer: The Next Generation

Douglas Hanahan[1,2,*] and Robert A. Weinberg[3,*]



A delicate balance of thyroid function in health and survival



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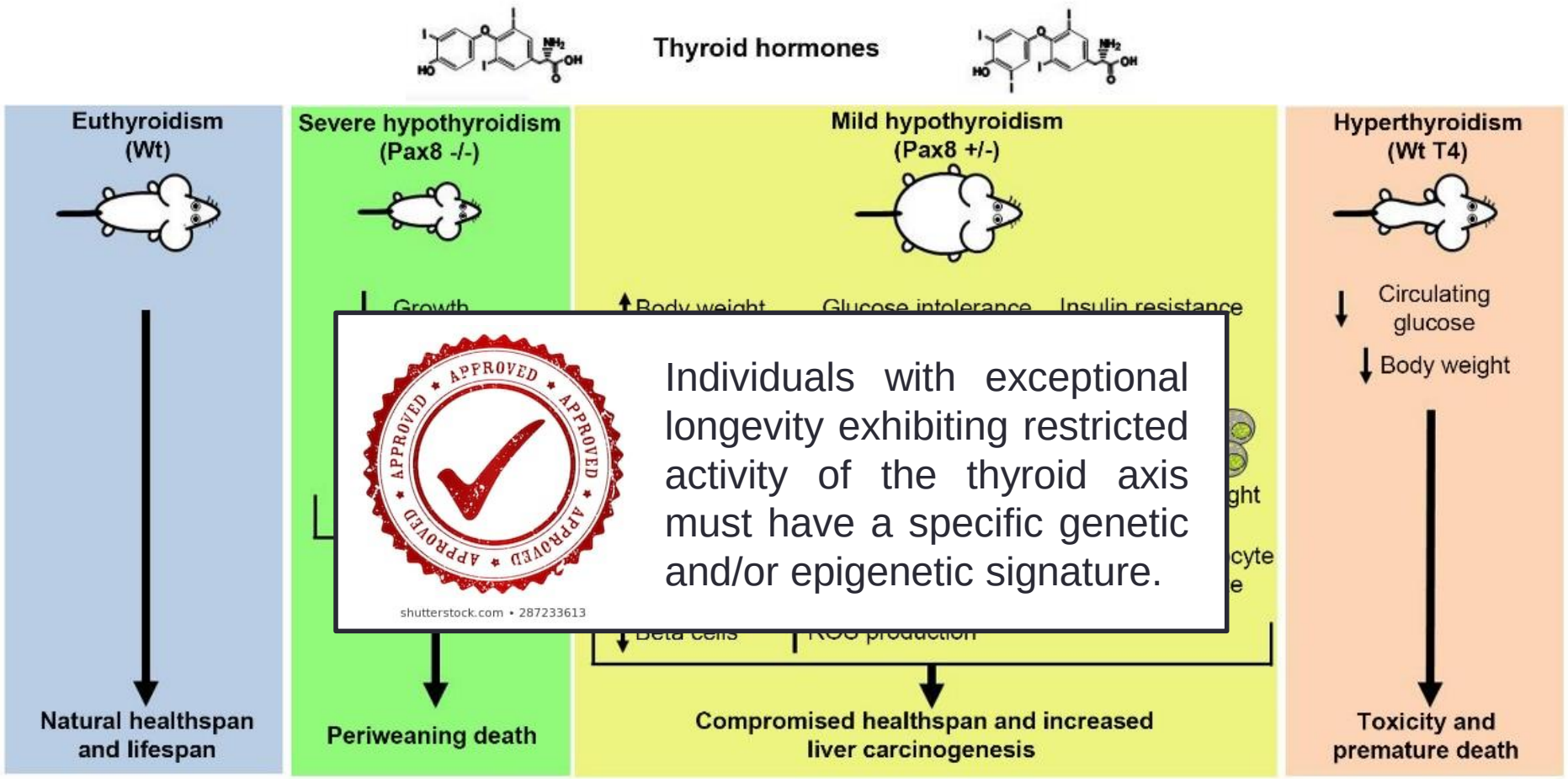
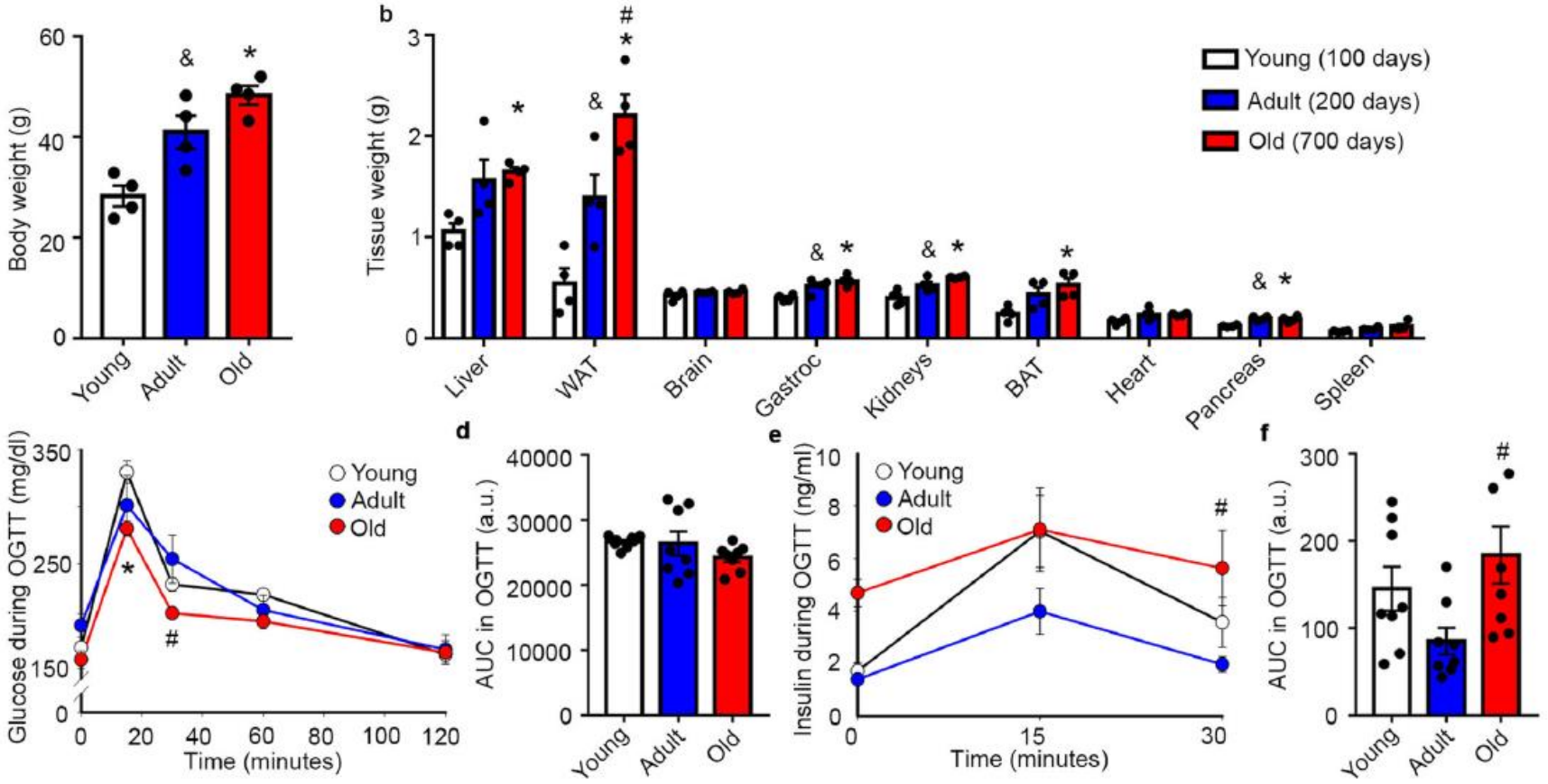


Another approach, what is wrong with aging?



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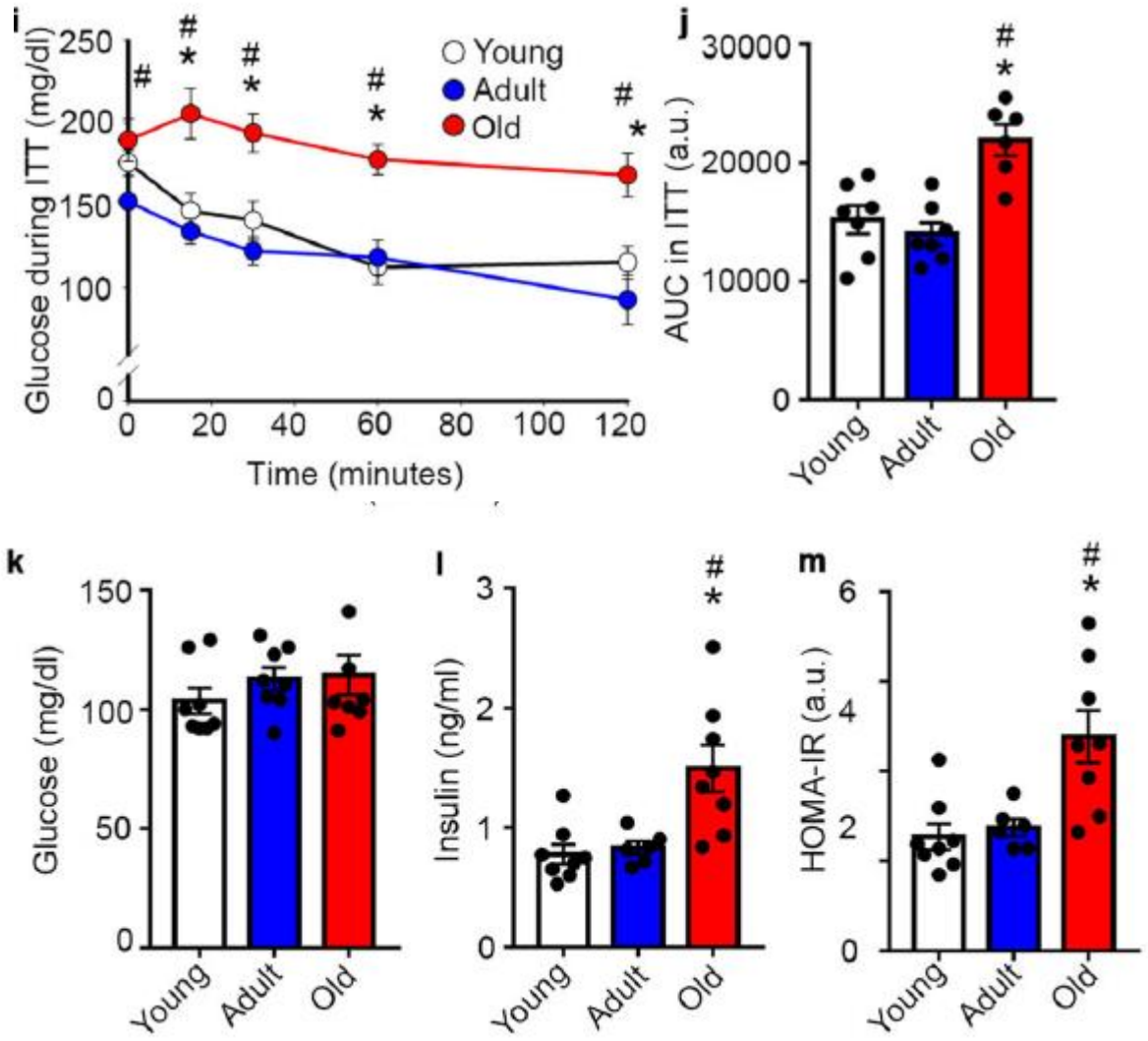
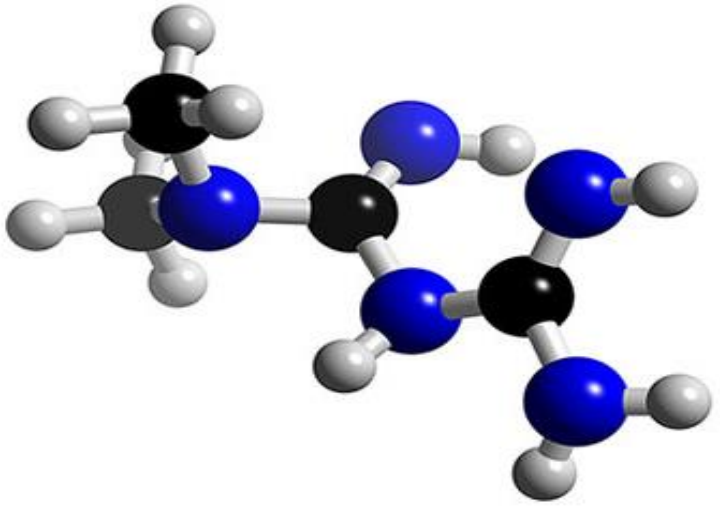


Metformin extends lifespan

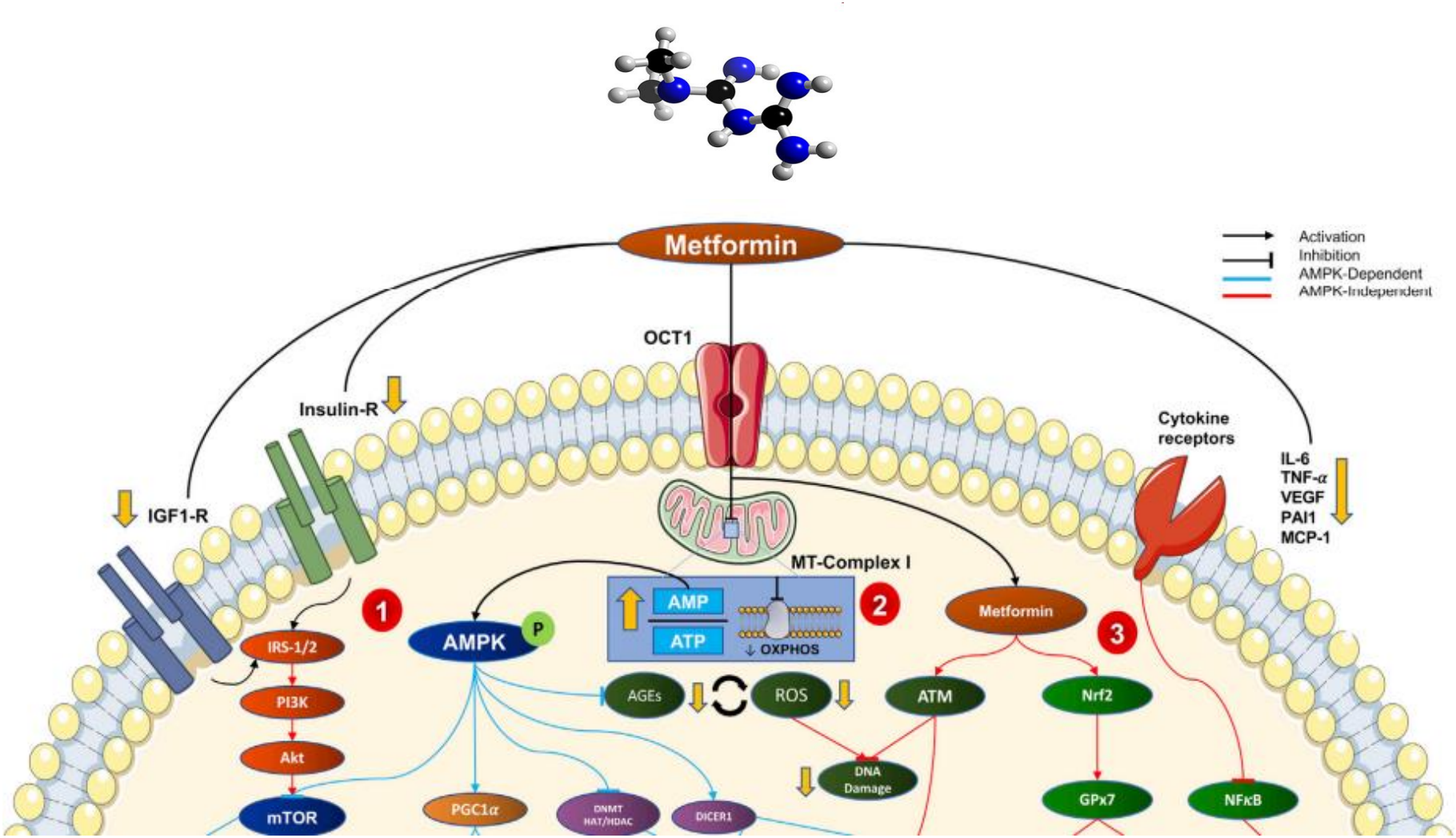
Metformin is the most widely prescribed antidiabetic drug.

Galega officinalis



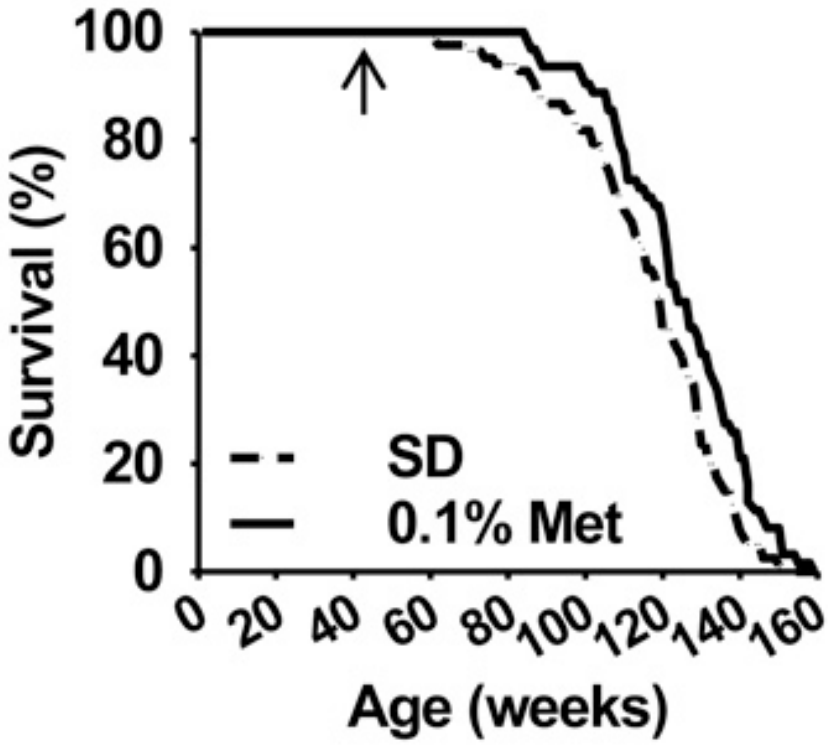
Metformin
$C_4H_{11}N_5$

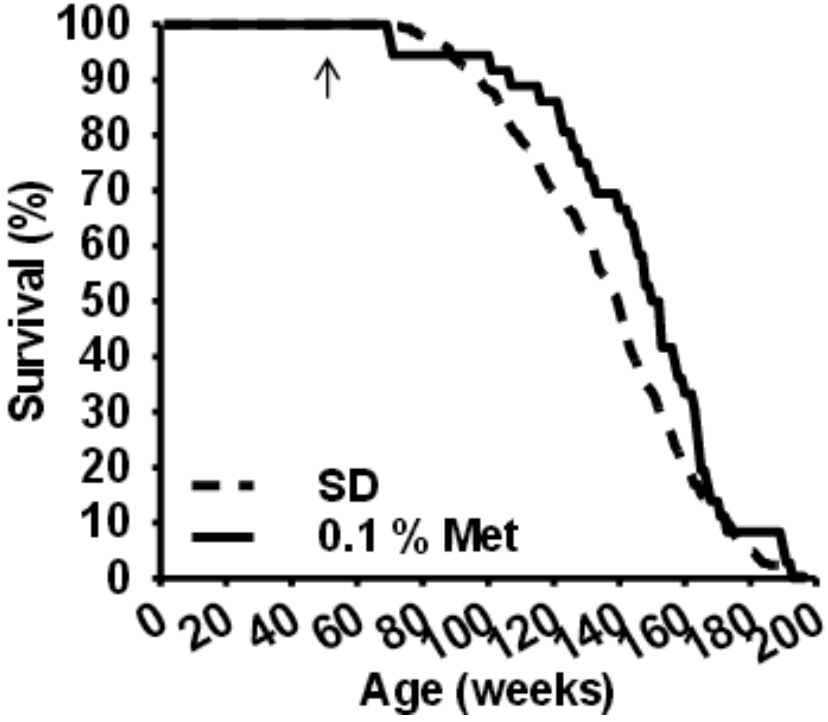
The mechanism of action of metformin: “cellular hunger”



Kulkarni et al. Cell Metabolism 2024.

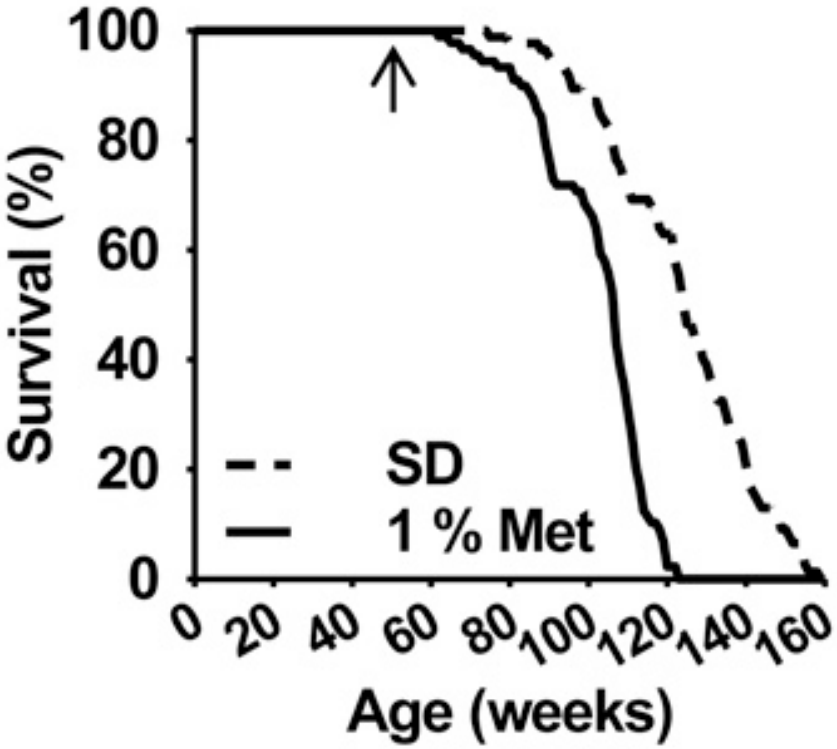
Metformin extends lifespan in mice

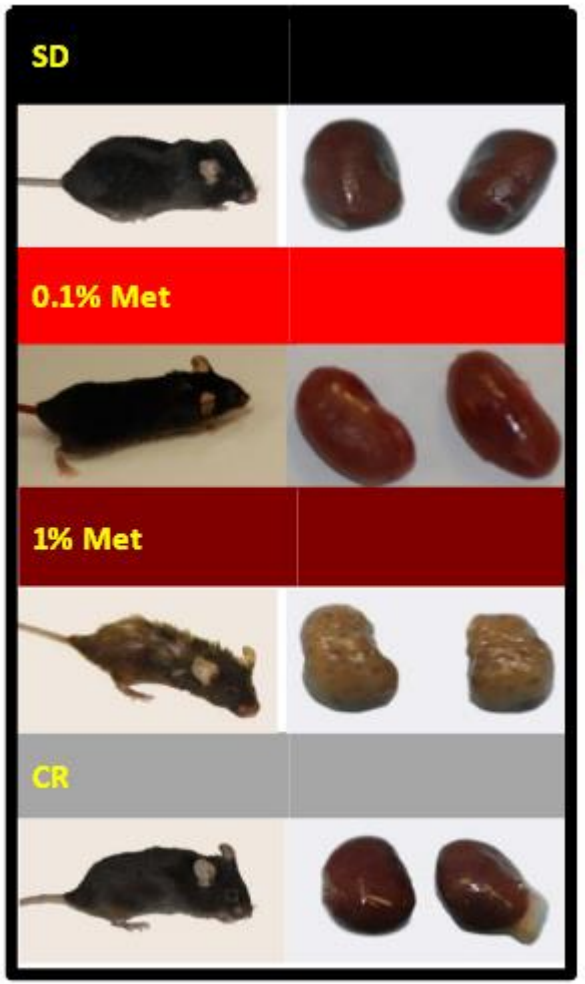




Martin-Montalvo A. et al. Nature Communications 2013

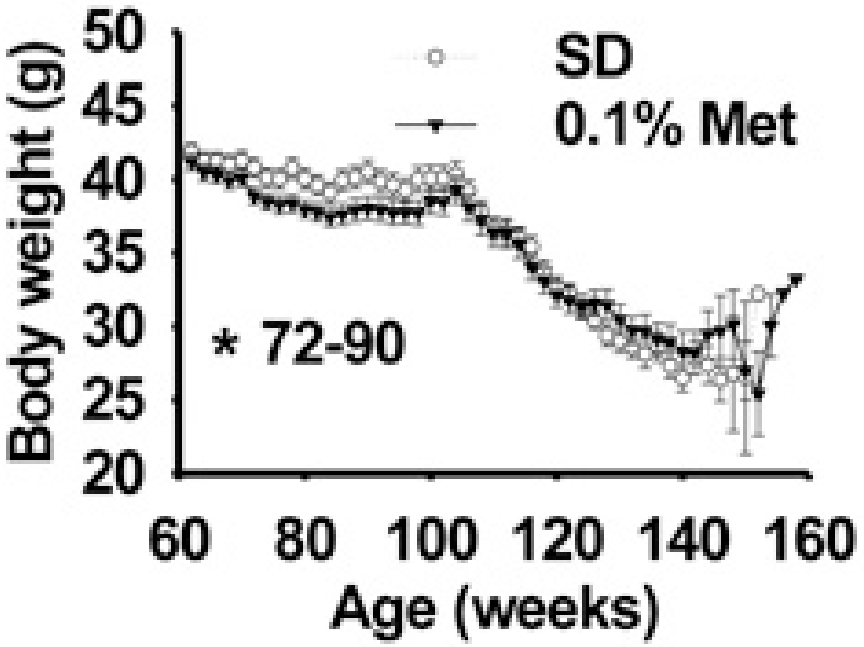
Less is more!

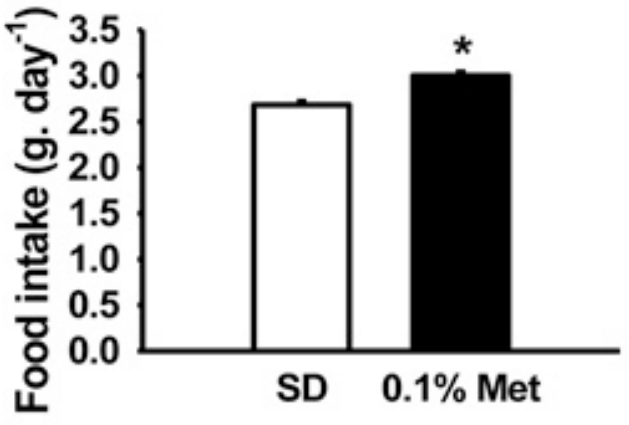


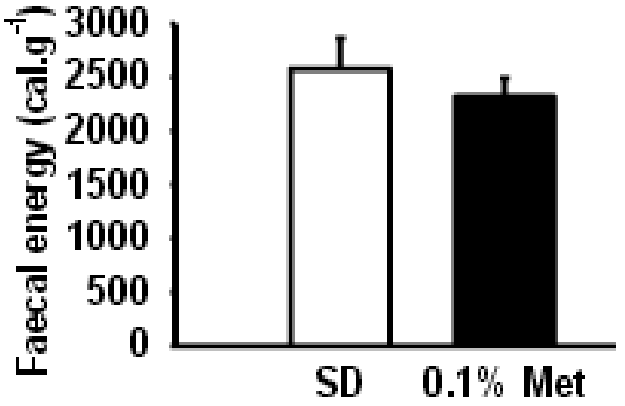


Martin-Montalvo A. et al. Nature Communications 2013

Metformin reduces body weight

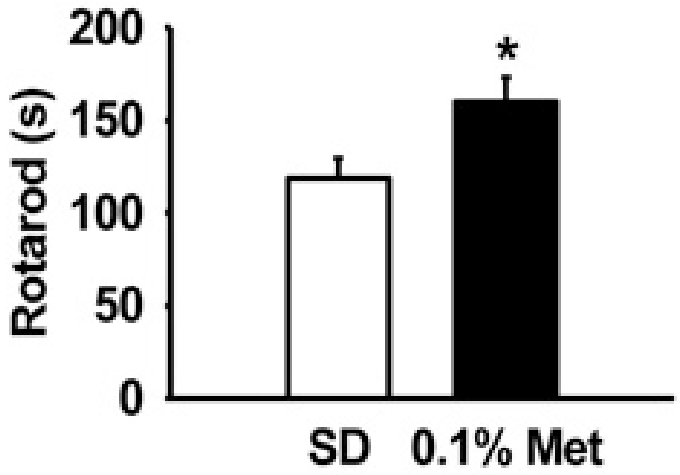


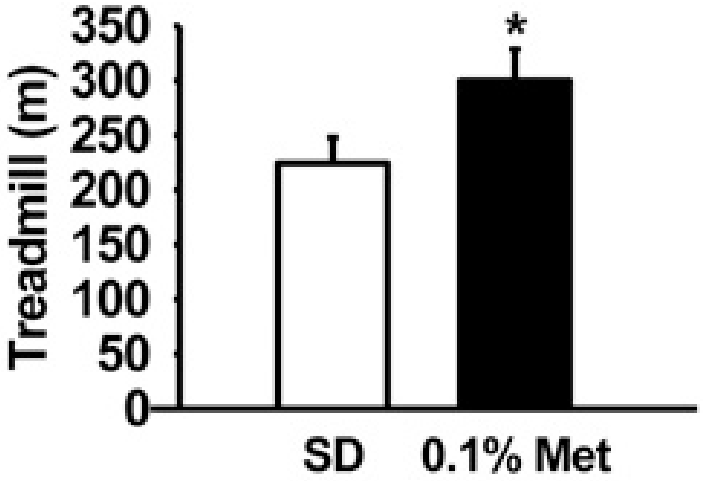


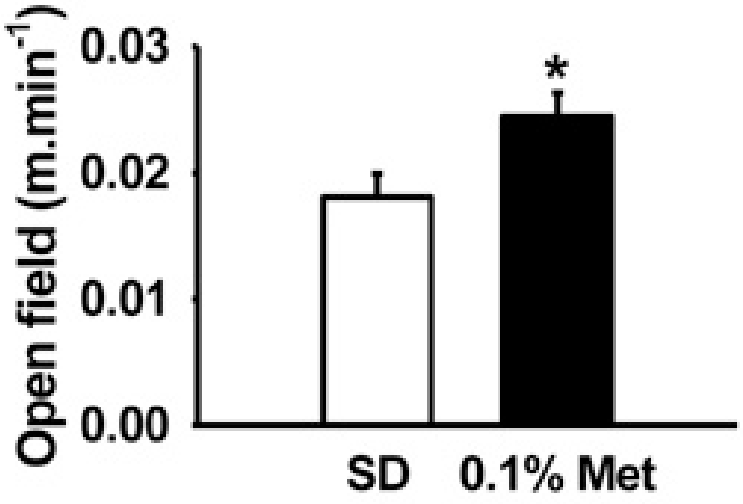


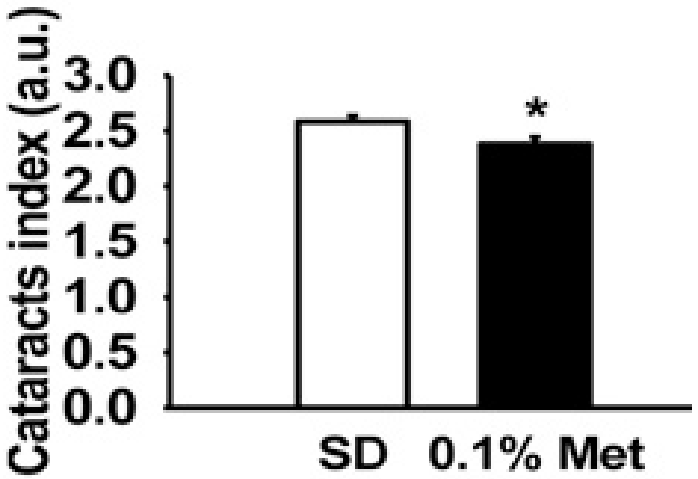
Martin-Montalvo A. et al. Nature Communications 2013

Metformin improves healthspan









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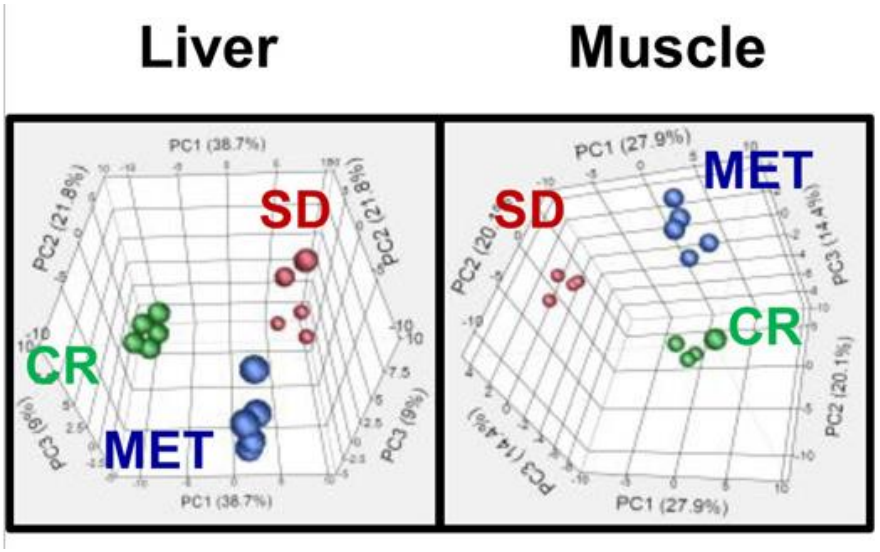
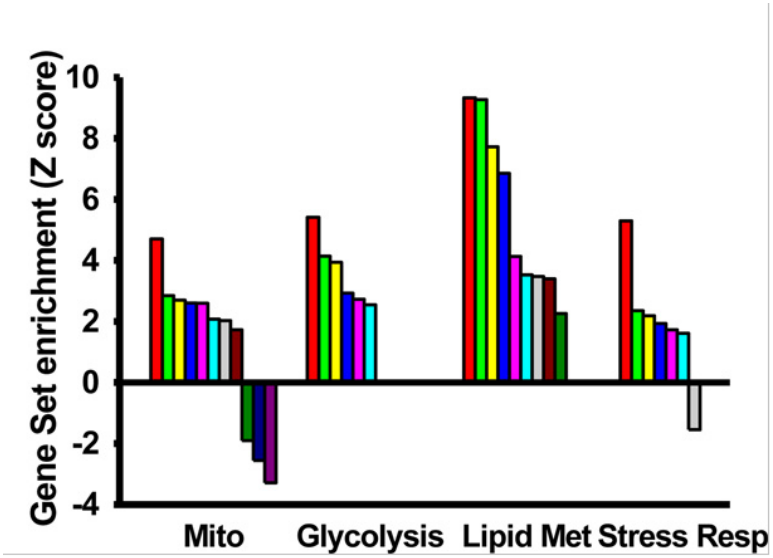
Metformin improves serum biomarkers

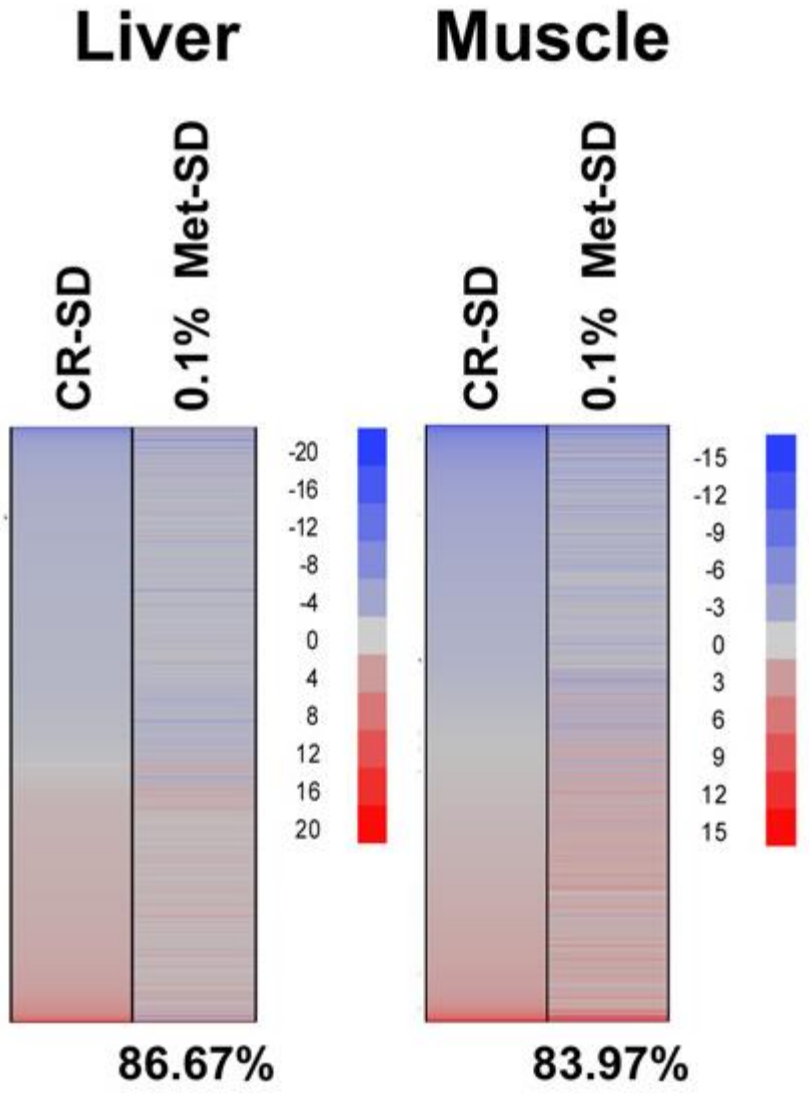
Parameter	Standard Diet (SD)	0.1% Metformin	CR
Ala aminotransferase (U/L)	90 ± 58	64 ± 29	50 ± 15
Cholesterol (mg/dl)	221 ± 30	143 ± 33*	101 ± 8*
Creatinine (mg/dl)	0.11 ± 0.01	0.13 ± 0.01*	0.27 ± 0.25
Lactate	573 ± 82	623 ± 165	443 ± 109
Dehydrogenase (u/L)			
Low Density	40 ± 10	17 ± 10*	16 ± 5*
Lipoprotein (mg/dl)			
Triglycerides (mg/dl)	106 ± 28	129 ± 50	45 ± 7*
Total protein (g/dl)	6.00 ± 0.39	6.04 ± 0.32	5.28 ± 0.04*
Glucose–fed (mM)	10.94 ± 0.35	11.33 ± 0.76	ND
Glucose–fasted (mM)	8.23 ± 0.65	8.80 ± 0.43	4.10 ± 0.42*
Insulin (pM)	428.08 ± 34.26	297.64 ± 29.72*	46.75 ± 16.76*
% HbA1c	6.33 ± 0.47	5.81 ± 0.57*	ND
HOMA-IR index	8.01 ± 0.57	5.87 ± 0.47*	0.84 ± 0.30*

Martin-Montalvo A. et al. Nature Communications 2013

Metformin mimics calorie restriction

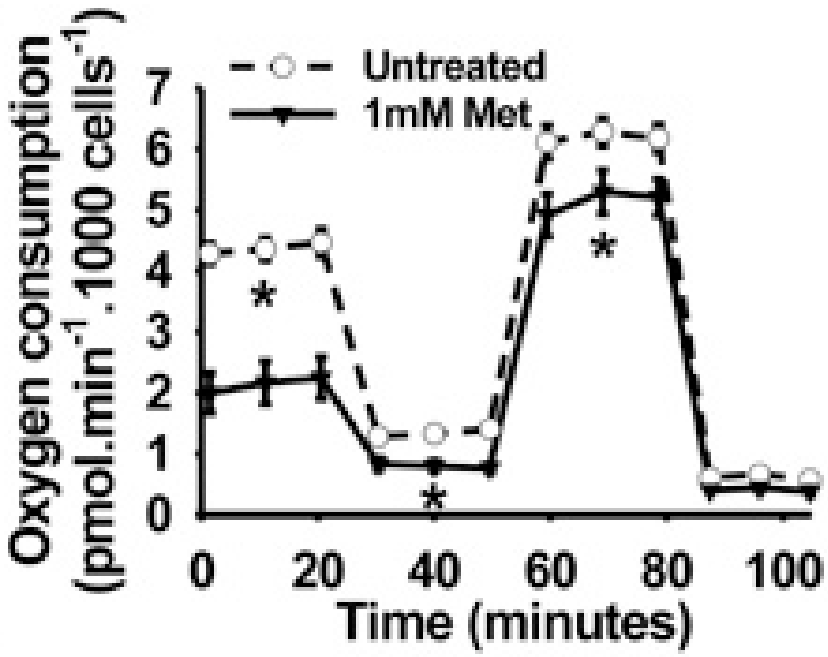


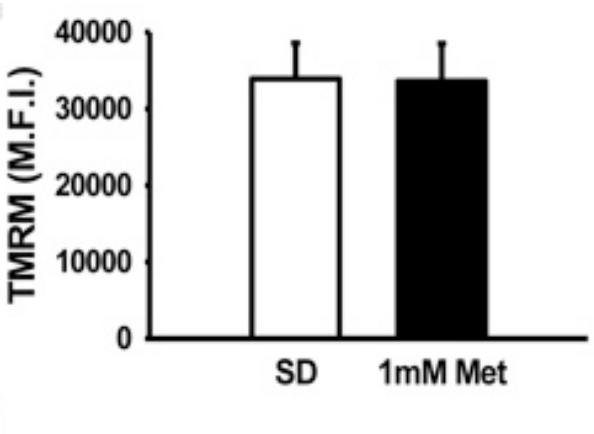


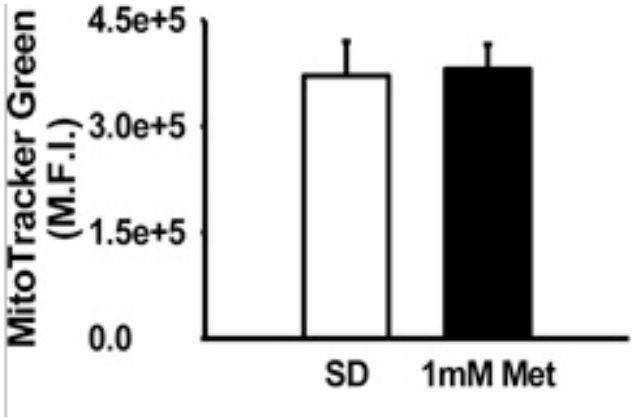


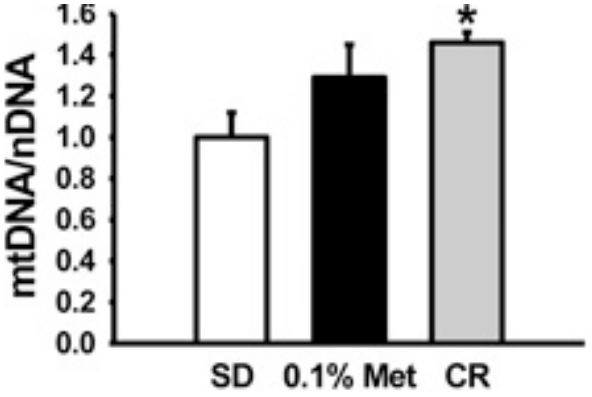
Martin-Montalvo A. et al. Nature Communications 2013

Metformin targets mitocondrial metabolism



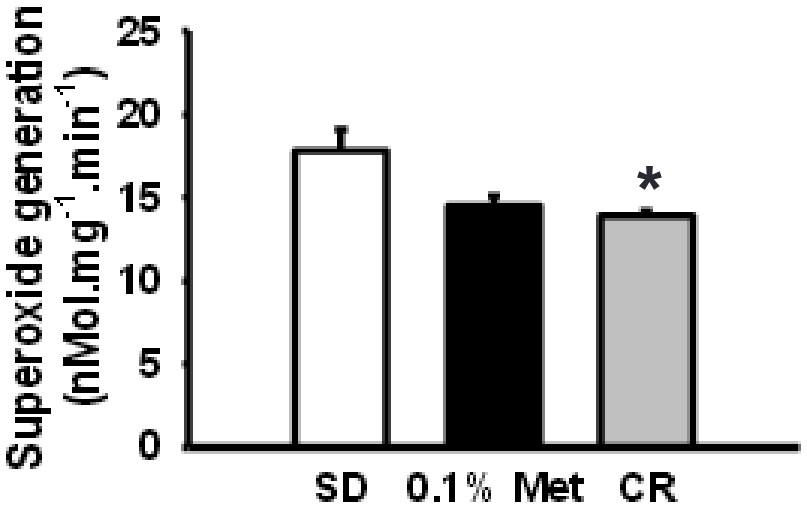


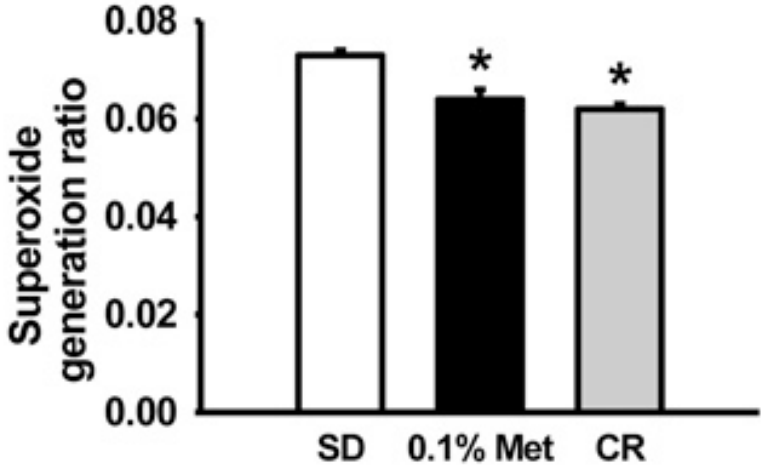


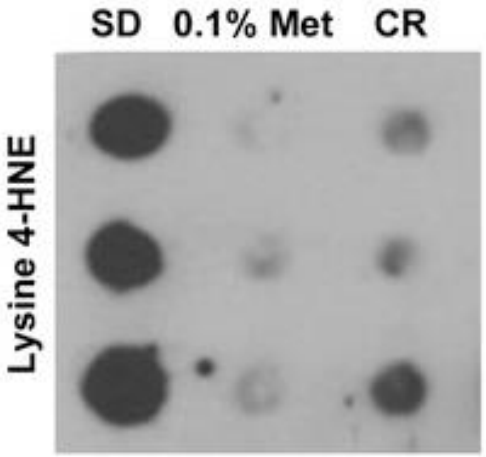


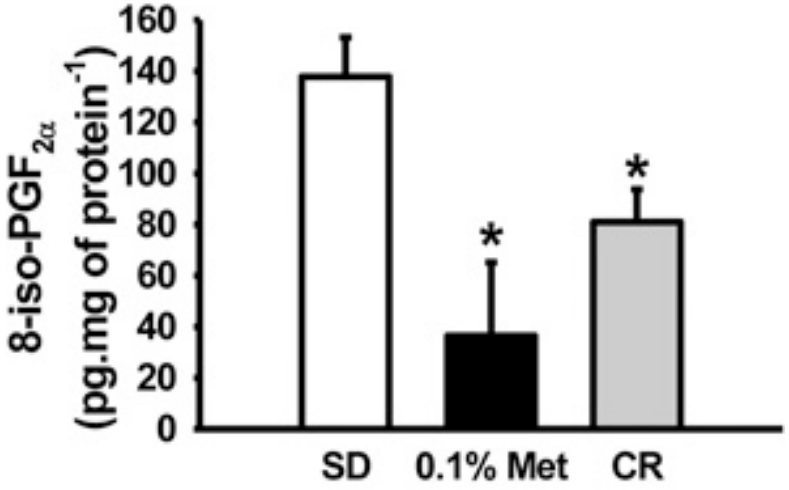
Martin-Montalvo A. et al. Nature Communications 2013

Metformin reduces oxidative damage









Martin-Montalvo A. et al. Nature Communications 2013

Effects of metformin on the hallmarks of cancer and aging

Cell

Leading Edge
Review

The Hallmarks of Aging

Carlos López-Otín,[1] Maria A. Blasco,[2] Linda Partridge,[3,4] Manuel Serrano,[5,*] and Guido Kroemer[6,7,8,9,10]

Cell

Leading Edge
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Hallmarks of Cancer: The Next Generation

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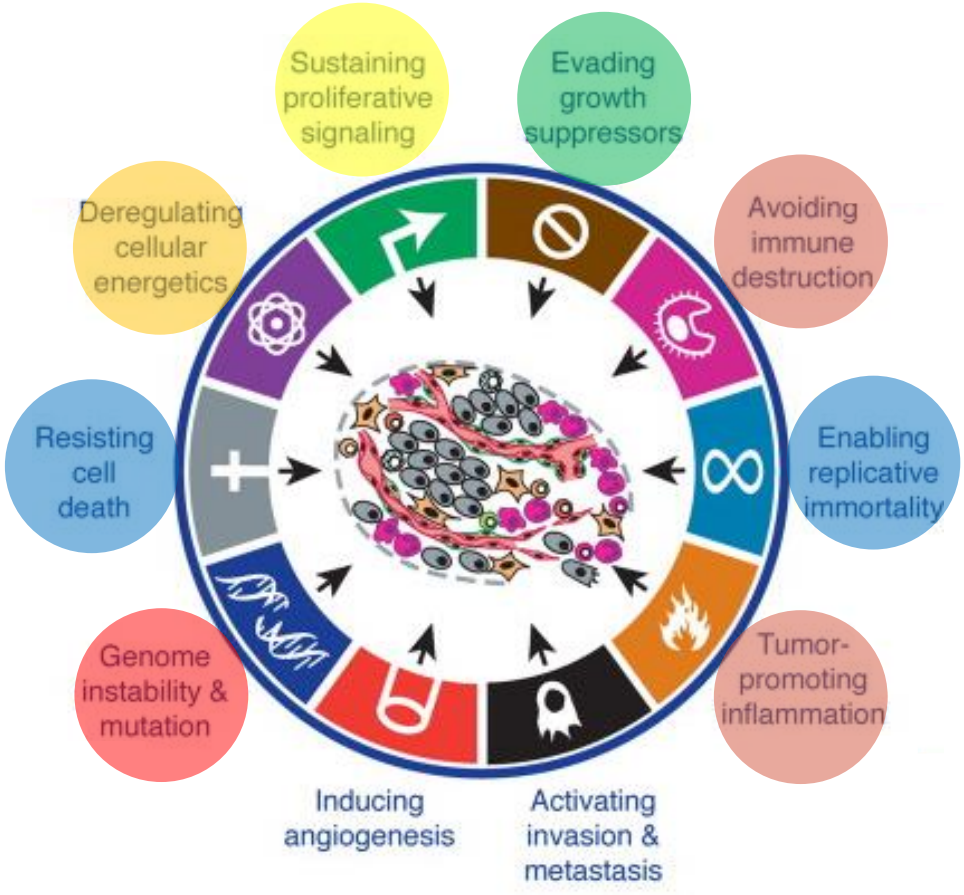
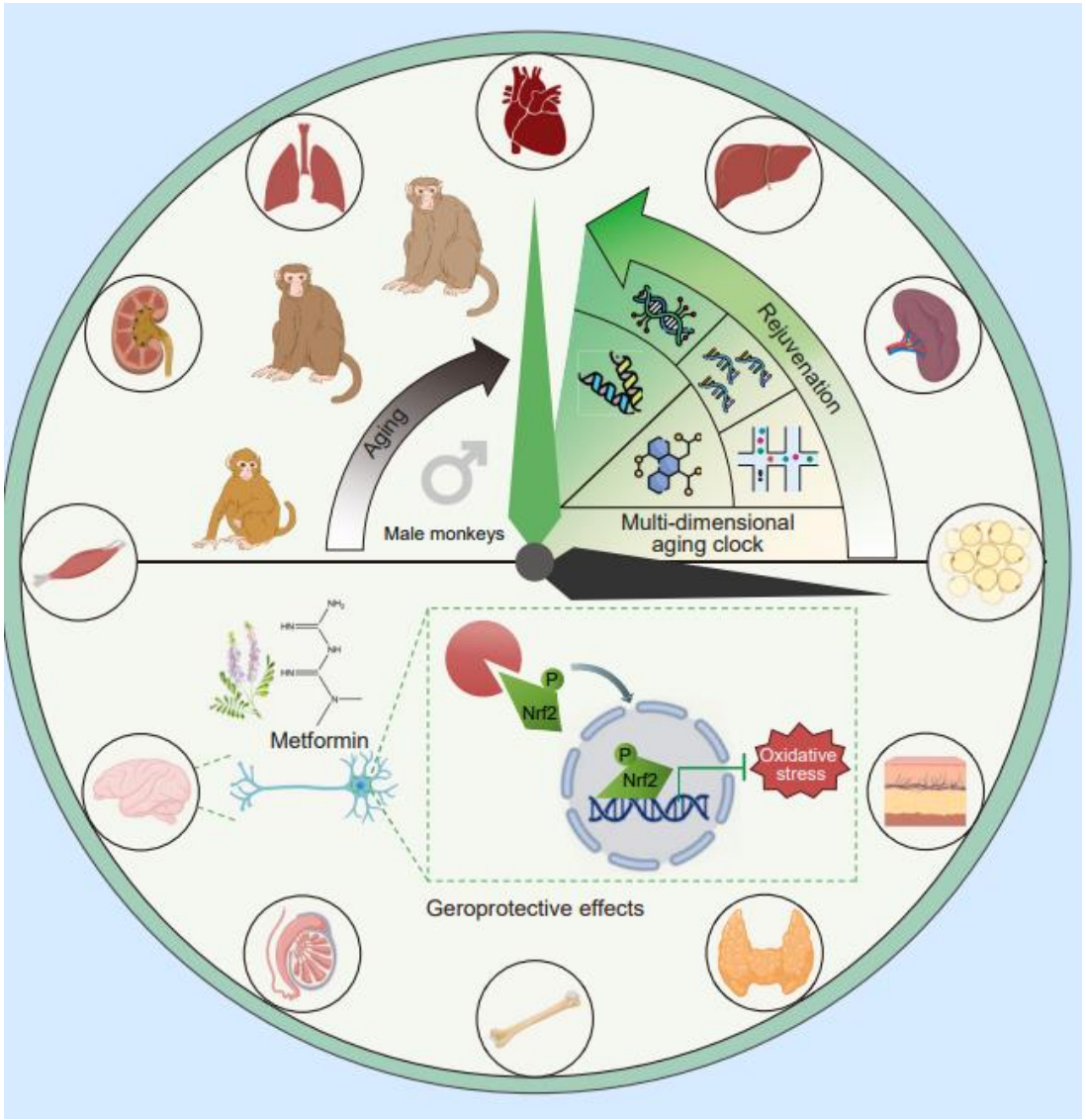
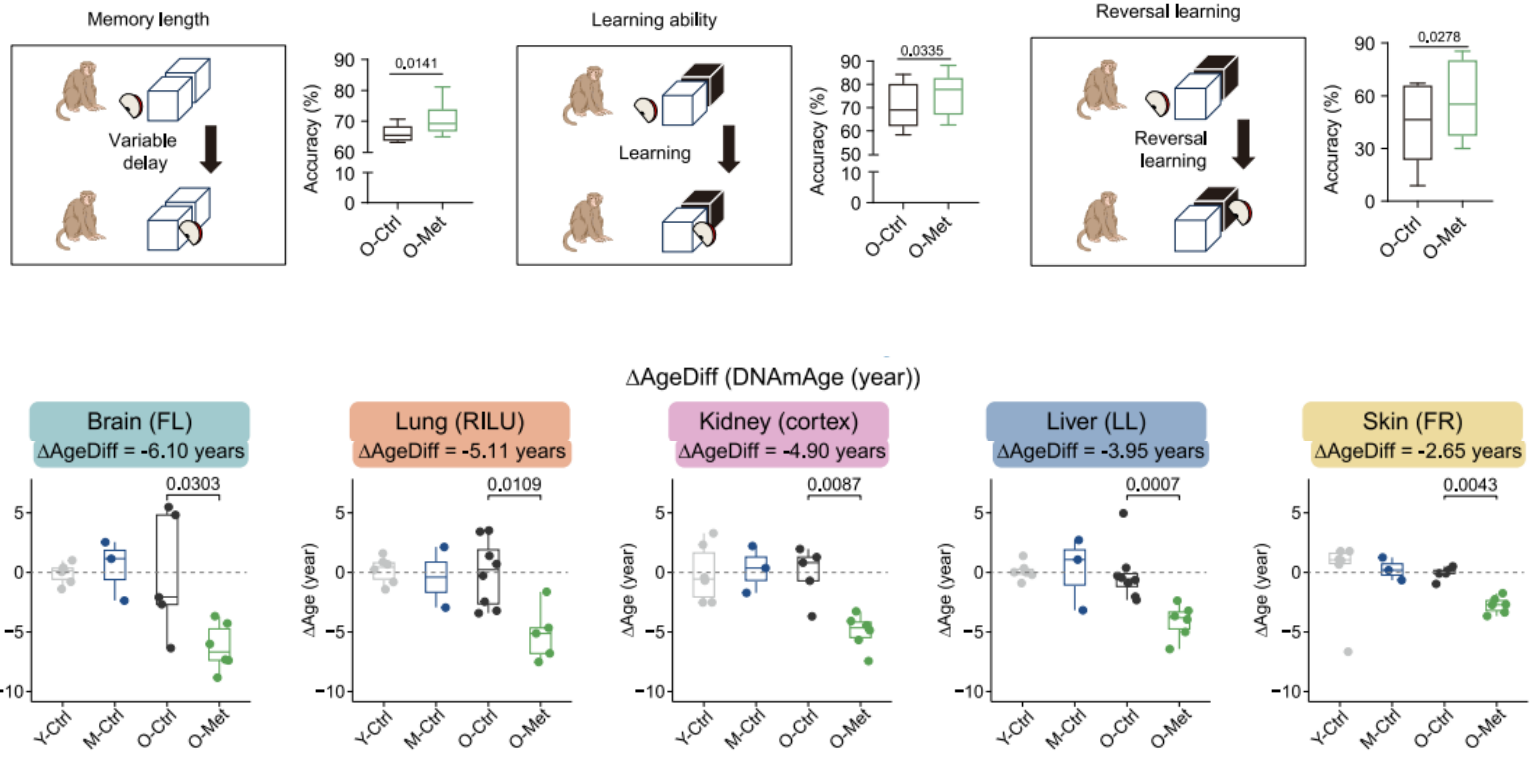


Metformin, a cheap molecule extensively used in humans



Yang et al. Cell 2024

Metformin resets the aging clock in monkeys



Yang et al. Cell 2024

Metformin reduces risk of cancer in diabetic patients

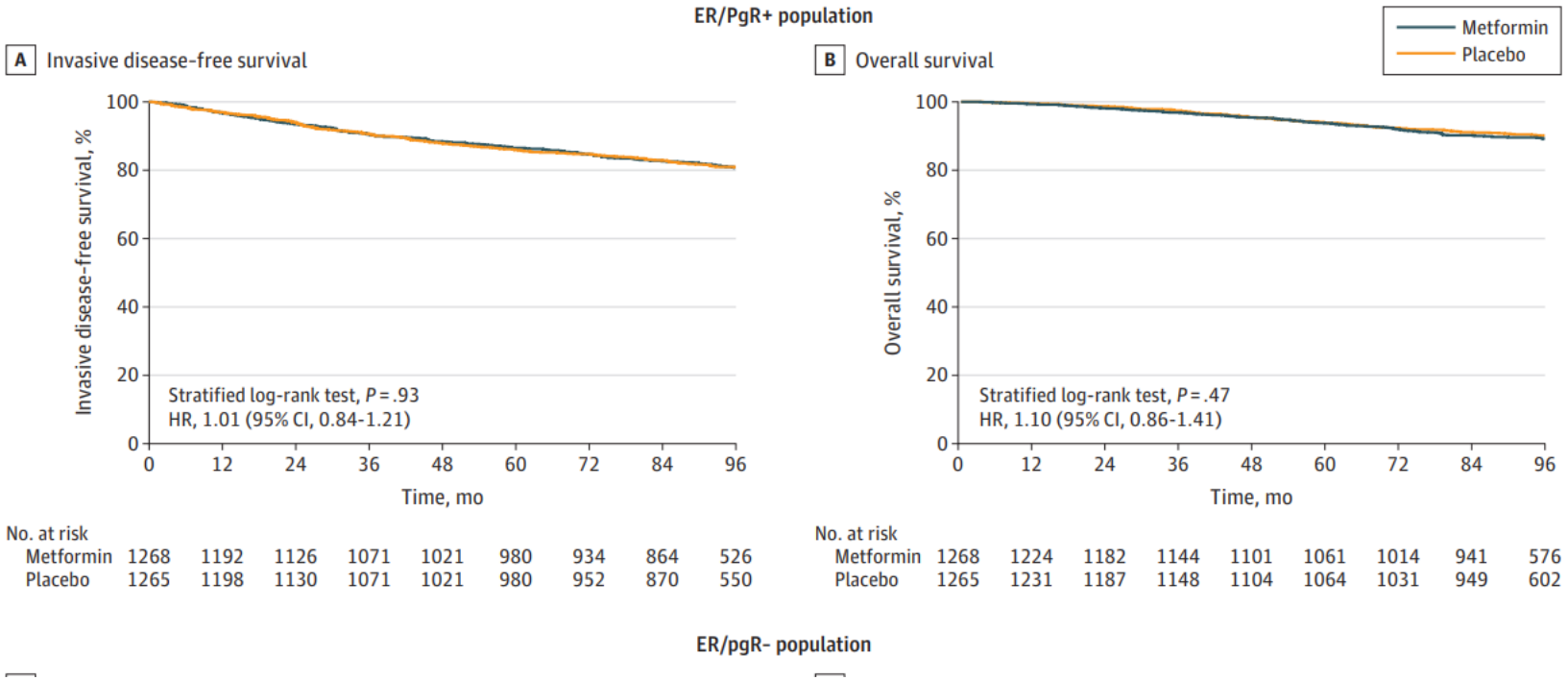
Metformin use in patients with type 2 diabetes and controls in Tayside, Scotland, 1993-2001

	No (%)			
	Cases (n=983)	Controls (n=1846)	Unadjusted odds ratios (95% CI)	Adjusted odds ratios (95% CI)
Exposure during year before index date:				
No	587 (63.6)	1114 (60.4)	1.00	1.00
Yes	336 (36.4)	732 (39.7)	0.86 (0.73 to 1.02)	0.85 (0.71 to 1.01)
Any exposure to metformin since January 1993:				
No	547 (59.3)	996 (54.0)	1.00	1.00
Yes	376 (40.7)	850 (46.0)	0.79 (0.67 to 0.93)	0.77 (0.64 to 0.92)
Duration (days):				
0	547 (59.3)	996 (54.0)	1.00	1.00
1-634	127 (13.8)	282 (15.3)	0.81 (0.64 to 1.02)	0.80 (0.62 to 1.02)
635-1806	143 (15.5)	273 (14.8)	0.93 (0.74 to 1.17)	0.92 (0.72 to 1.17)
>1806	106 (11.5)	295 (16.0)	0.62 (0.47 to 0.80)	0.56 (0.43 to 0.74)
Total prescriptions dispensed:				
0	547 (59.3)	996 (54.0)	1.00	1.00
1-11	127 (13.8)	282 (15.3)	0.82 (0.65 to 1.04)	0.82 (0.64 to 1.04)
12-31	122 (13.2)	281 (15.2)	0.77 (0.61 to 0.99)	0.75 (0.58 to 0.97)
>31	127 (13.8)	291 (15.8)	0.76 (0.60 to 0.98)	0.73 (0.56 to 0.94)
Total amount of metformin dispensed (mg):				
0	547 (59.3)	996 (54.0)	1.00	1.00
14 000-672 000	130 (14.1)	279 (15.1)	0.84 (0.67 to 1.06)	0.83 (0.65 to 1.06)
673 000-964 000	138 (15.0)	279 (15.1)	0.88 (0.69 to 1.10)	0.86 (0.68 to 1.10)
>964 000	108 (11.7)	292 (15.8)	0.63 (0.49 to 0.82)	0.57 (0.43 to 0.75)

Evans JMM et al. BMJ 2005

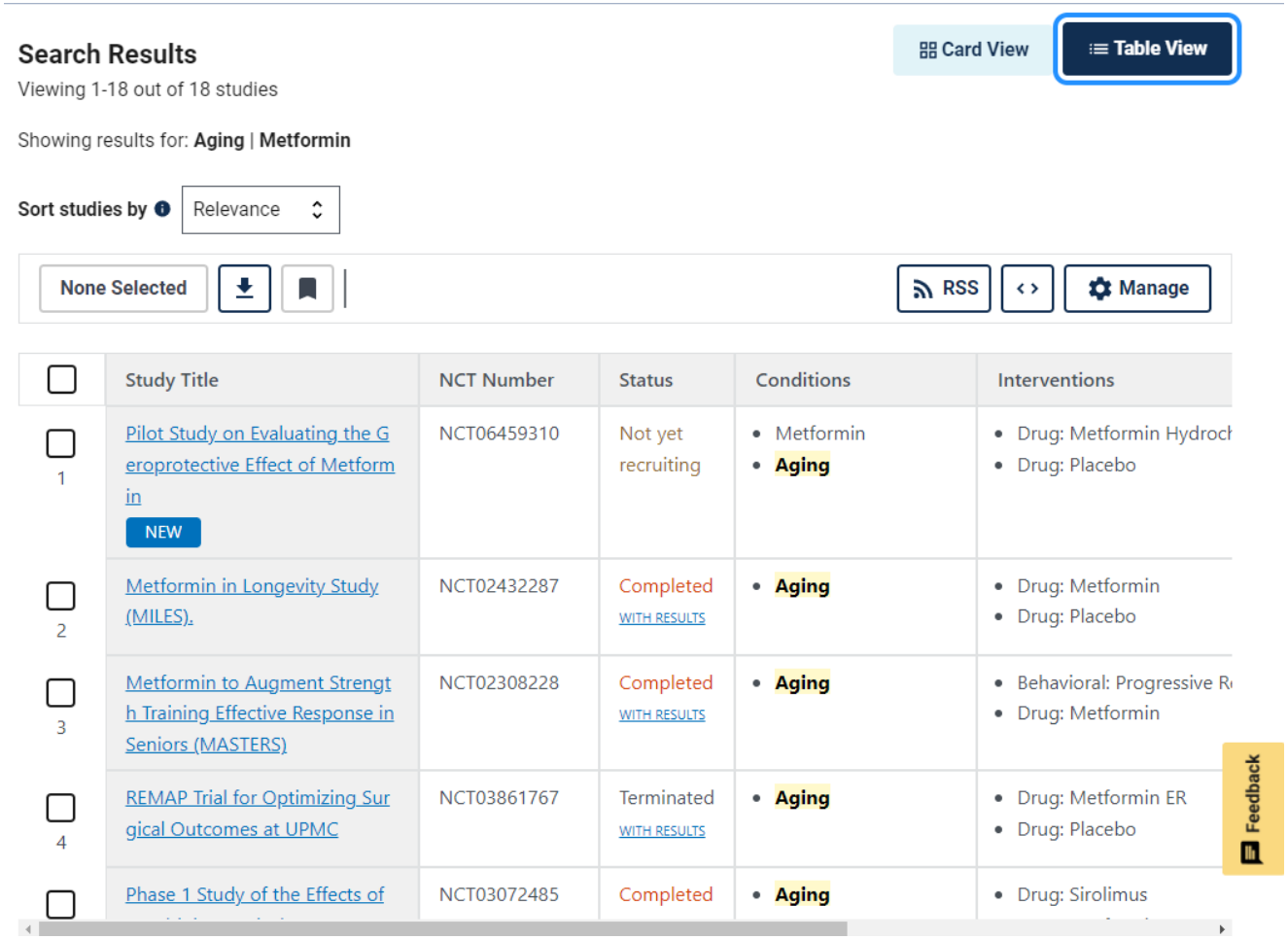
Metformin does not affect survival in patients with breast cancer

Figure 2. Effect of Metformin vs Placebo on Invasive Disease–Free Survival and Overall Survival



Goodwin PJ etr al. JAMA 2022

The need to do more research: performing clinical trials targeting aging with Metformin



Search Results

Viewing 1-18 out of 18 studies

Showing results for: **Aging | Metformin**

Card View | Table View

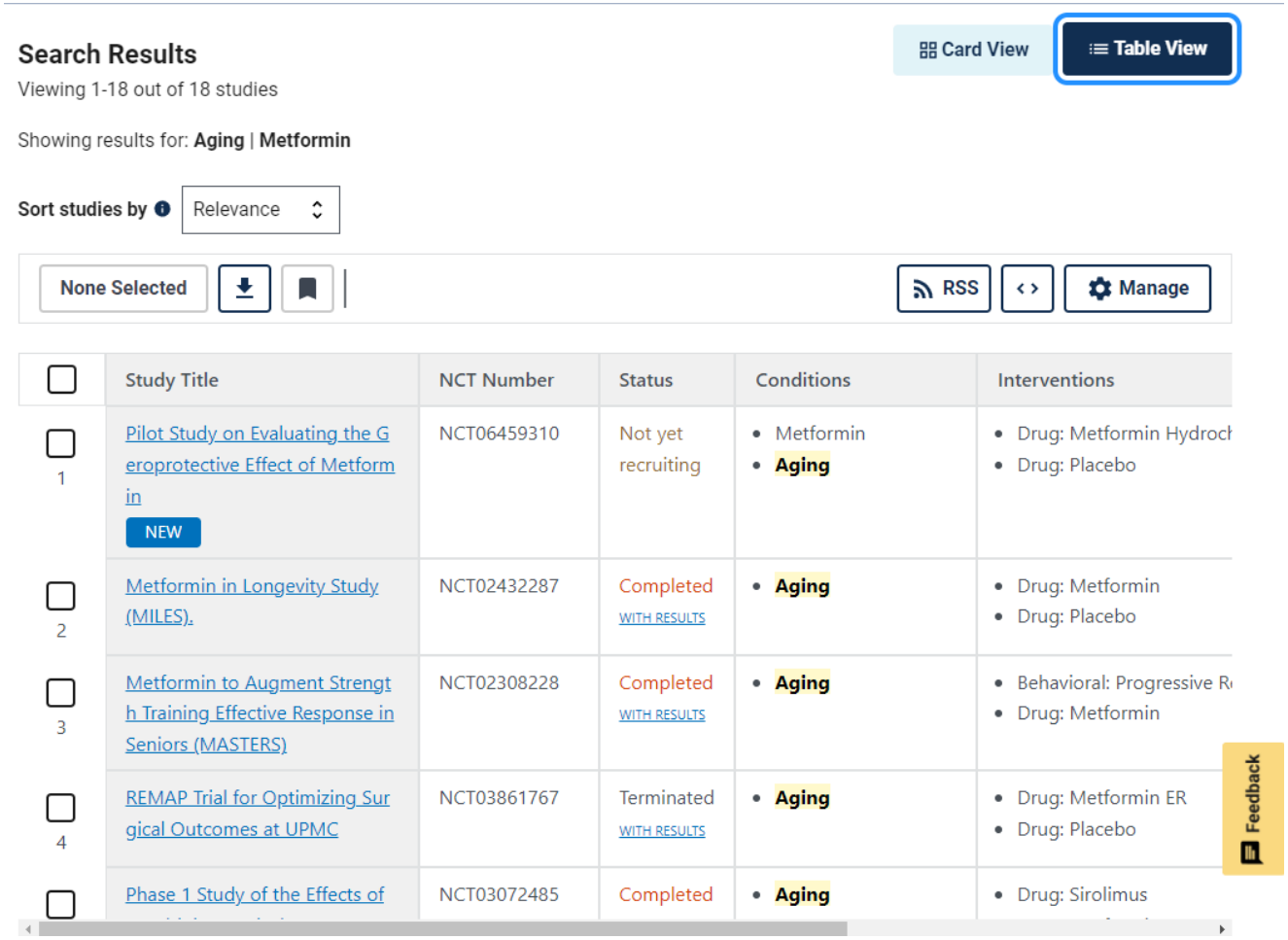
Sort studies by: Relevance

None Selected | RSS | Manage

	Study Title	NCT Number	Status	Conditions	Interventions
1	Pilot Study on Evaluating the Geroprotective Effect of Metformin NEW	NCT06459310	Not yet recruiting	• Metformin • **Aging**	• Drug: Metformin Hydroch • Drug: Placebo
2	Metformin in Longevity Study (MILES).	NCT02432287	Completed WITH RESULTS	• **Aging**	• Drug: Metformin • Drug: Placebo
3	Metformin to Augment Strength Training Effective Response in Seniors (MASTERS)	NCT02308228	Completed WITH RESULTS	• **Aging**	• Behavioral: Progressive R • Drug: Metformin
4	REMAP Trial for Optimizing Surgical Outcomes at UPMC	NCT03861767	Terminated WITH RESULTS	• **Aging**	• Drug: Metformin ER • Drug: Placebo
	Phase 1 Study of the Effects of	NCT03072485	Completed	• **Aging**	• Drug: Sirolimus

Feedback

The need to do more research: performing clinical trials targeting aging with Metformin



Search Results

Viewing 1-18 out of 18 studies

Showing results for: **Aging | Metformin**

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	Study Title	NCT Number	Status	Conditions	Interventions
1	Pilot Study on Evaluating the Geroprotective Effect of Metformin NEW	NCT06459310	Not yet recruiting	• Metformin • **Aging**	• Drug: Metformin Hydroch • Drug: Placebo
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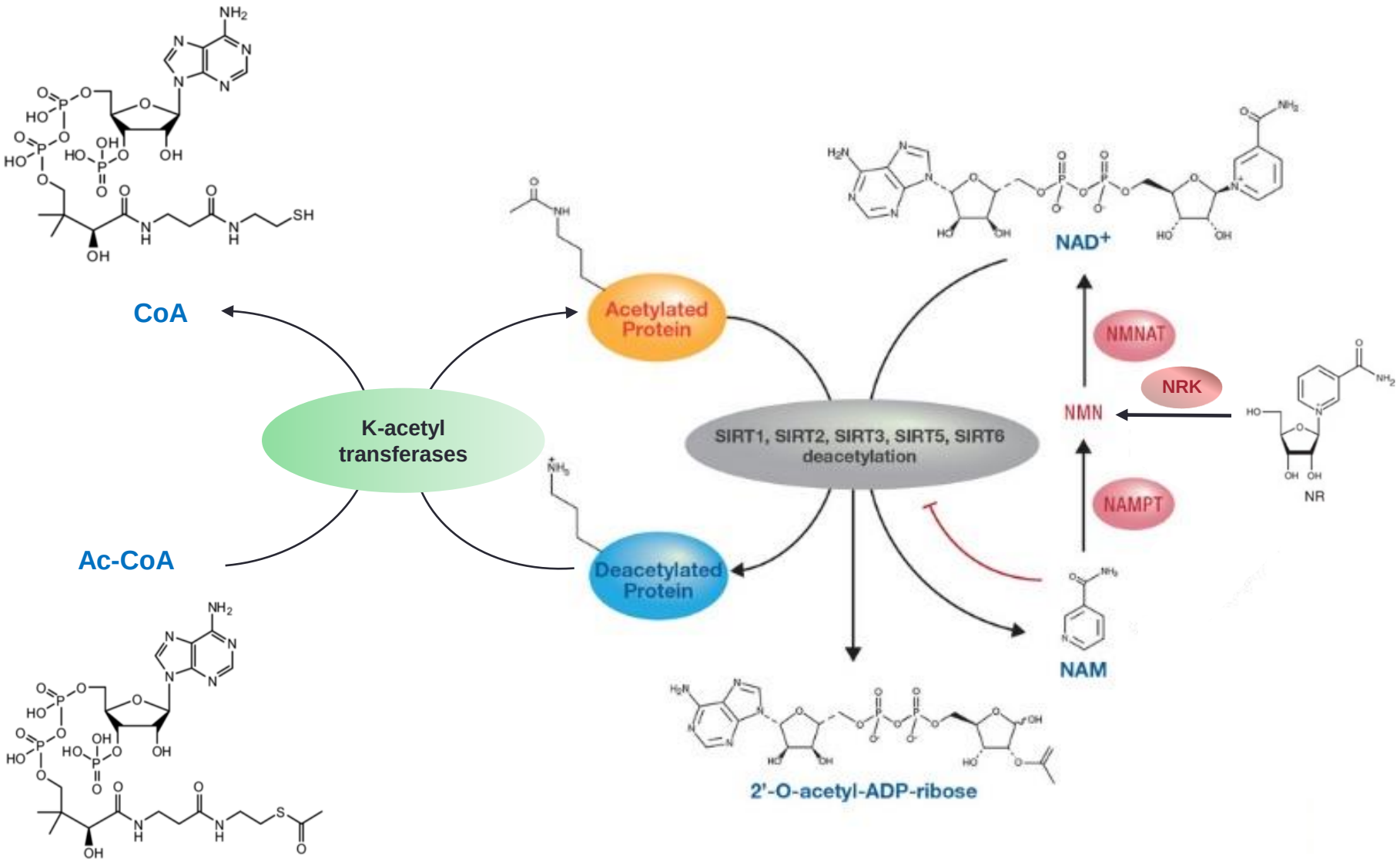
	Phase 1 Study of the Effects of	NCT03072485	Completed	• **Aging**	• Drug: Sirolimus

Feedback

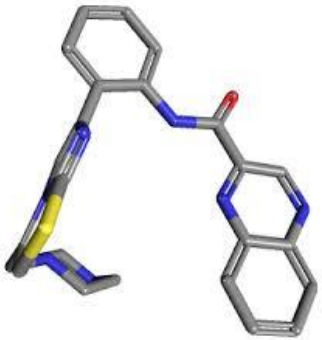
Metformin should not be taken without medical prescription

Another approach, the activation of sirtuins



Sirtuin activation extends lifespan

Resveratrol



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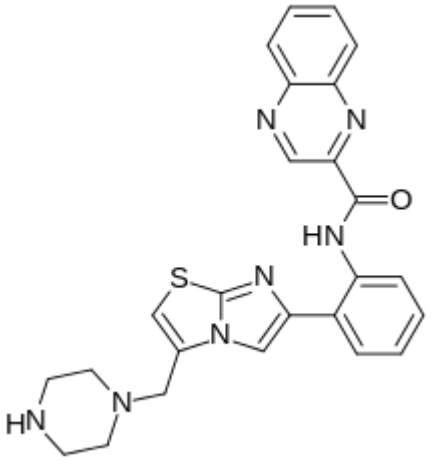

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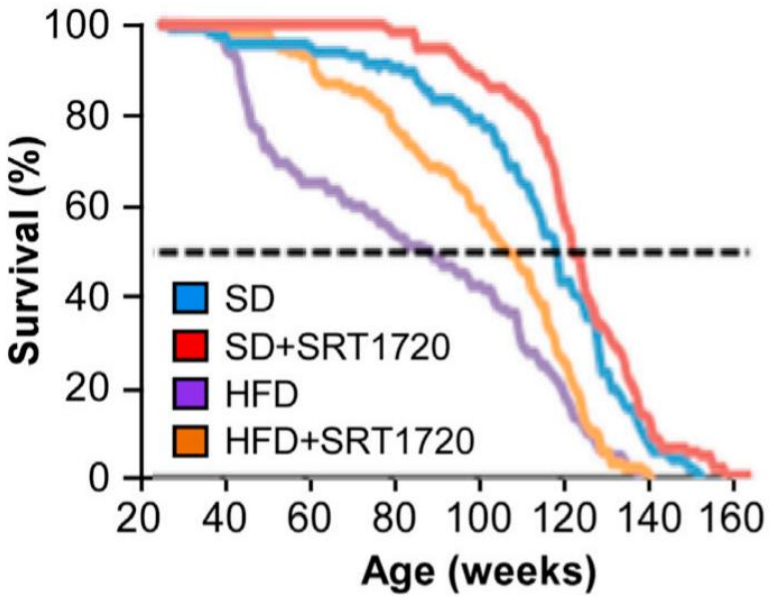
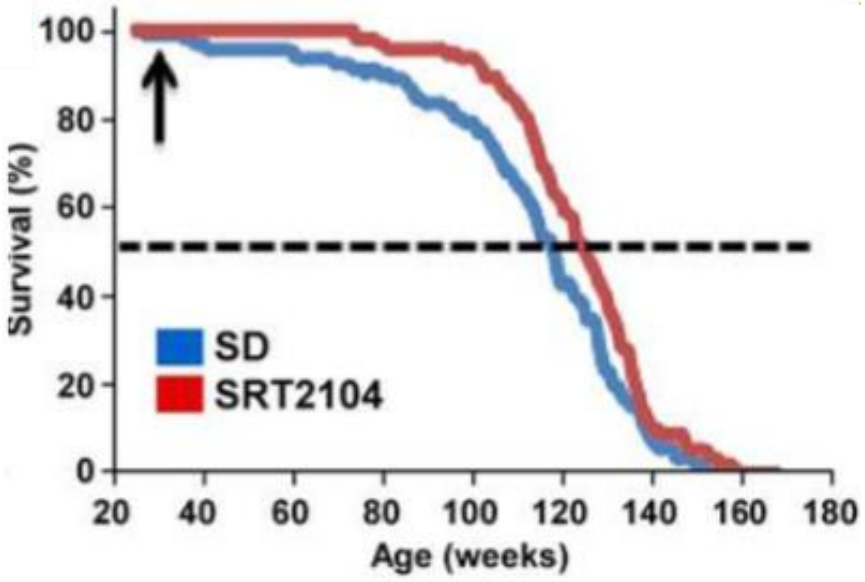
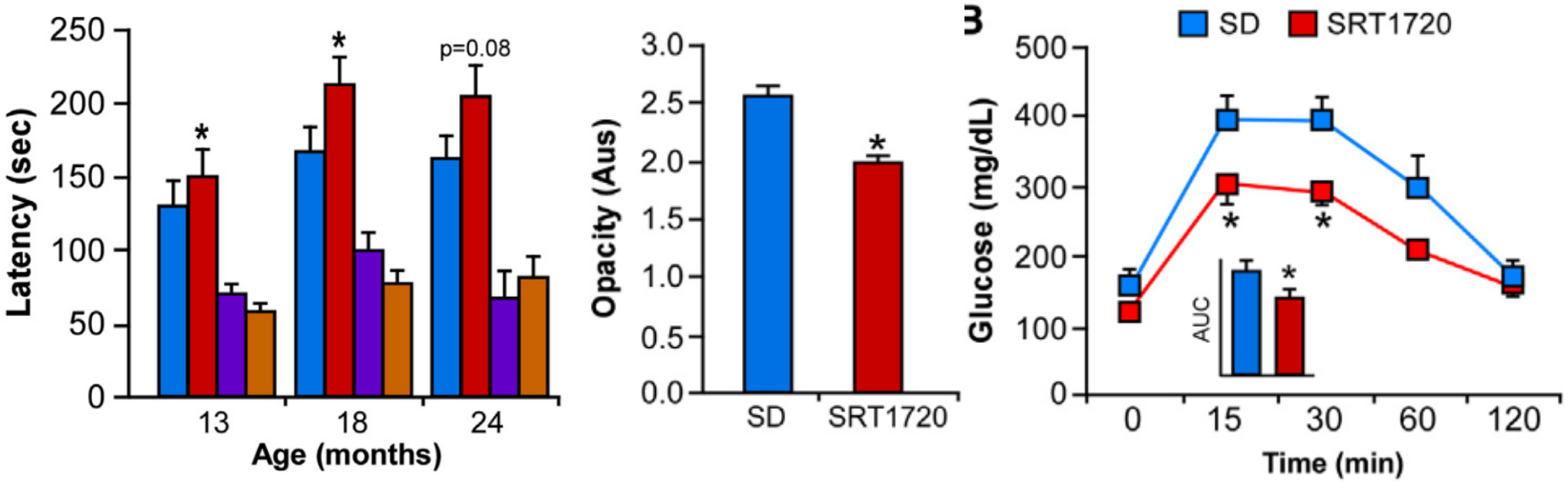




Mercken EM et al. Aging Cell 2014

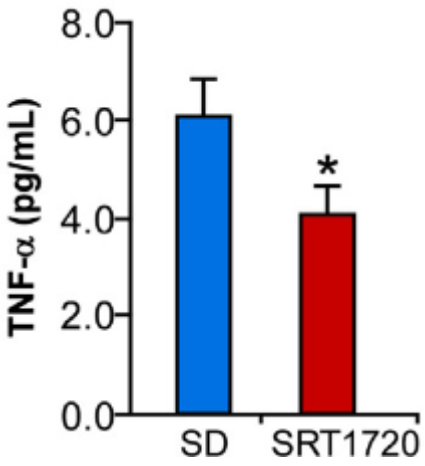
Mitchell SJ*, Martín-Montalvo A* et al Cell Reports 2014

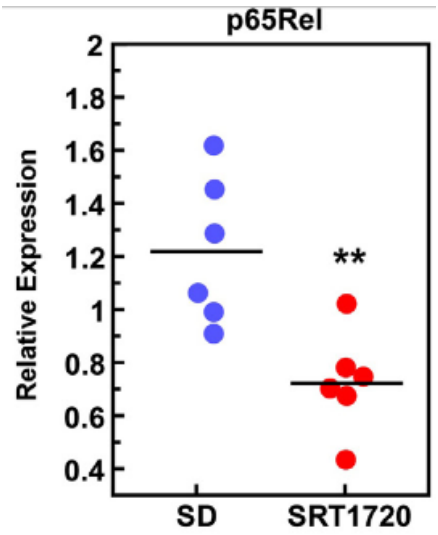
Sirtuin activation improves lifespan

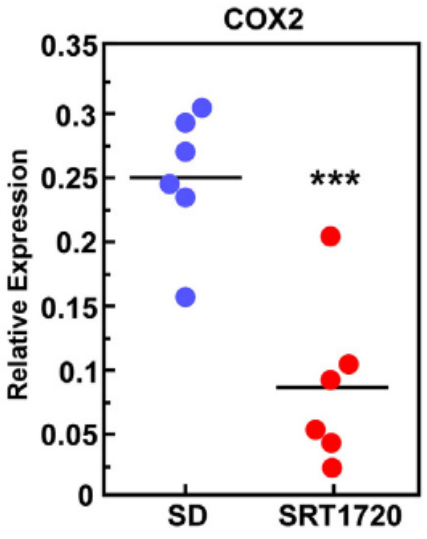


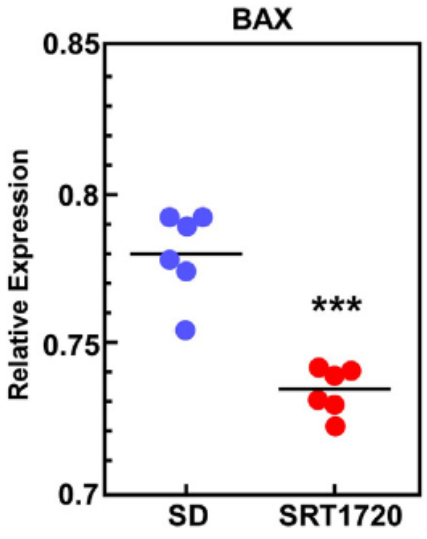
Mitchell SJ*, Martin-Montalvo* et al. Cell Reports 2014

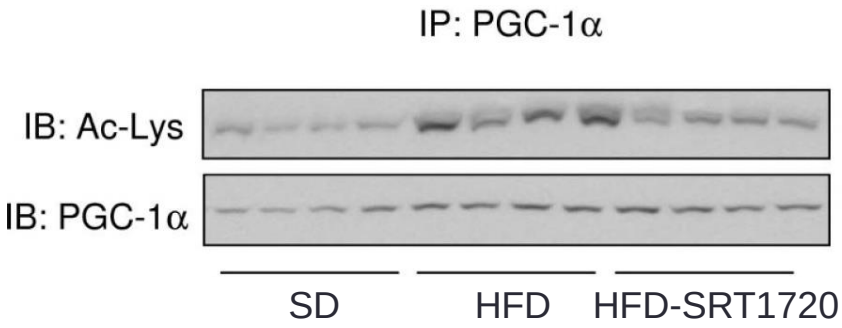
Sirtuin activation reduces inflammation

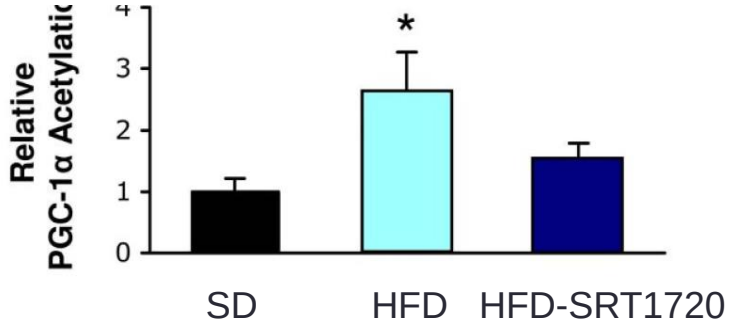






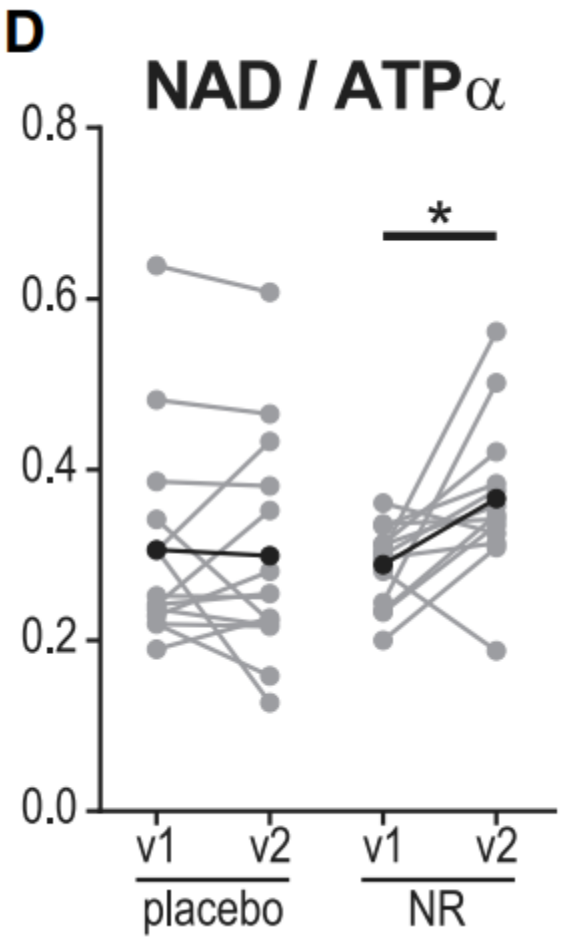


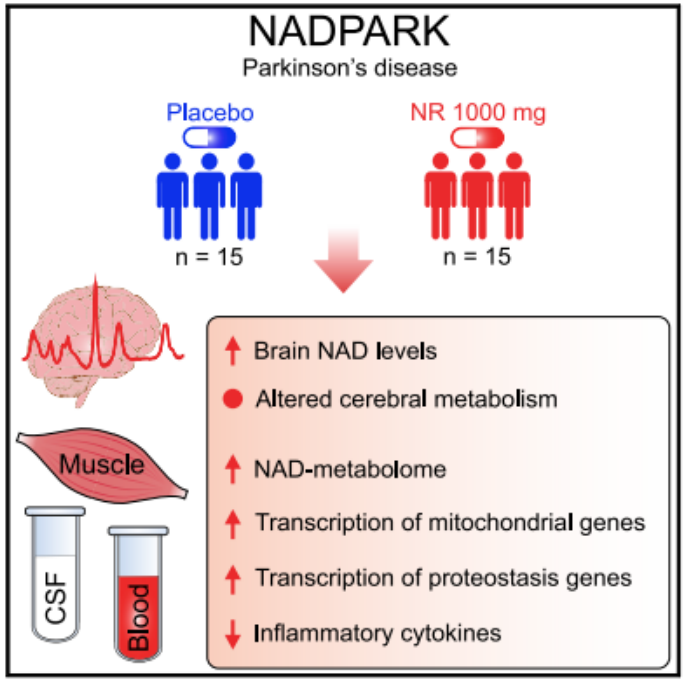




Minor R. et al. Scientifi Reports 2011
Mitchell SJ*, Martin-Montalvo* et al. Cell Reports 2014

Nicotinamide riboside produces clinical improvements in Parkinson´s disease



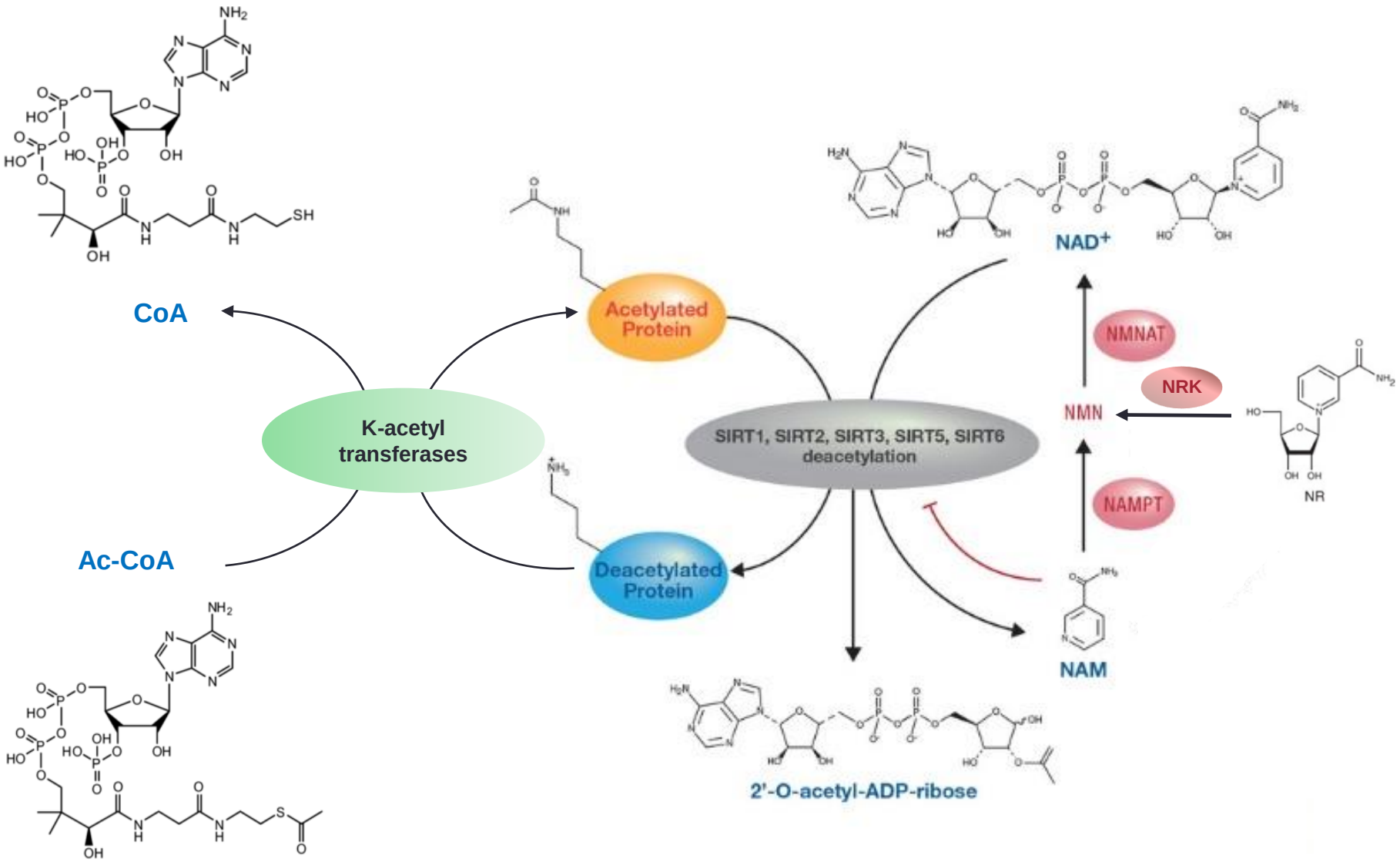


Highlights

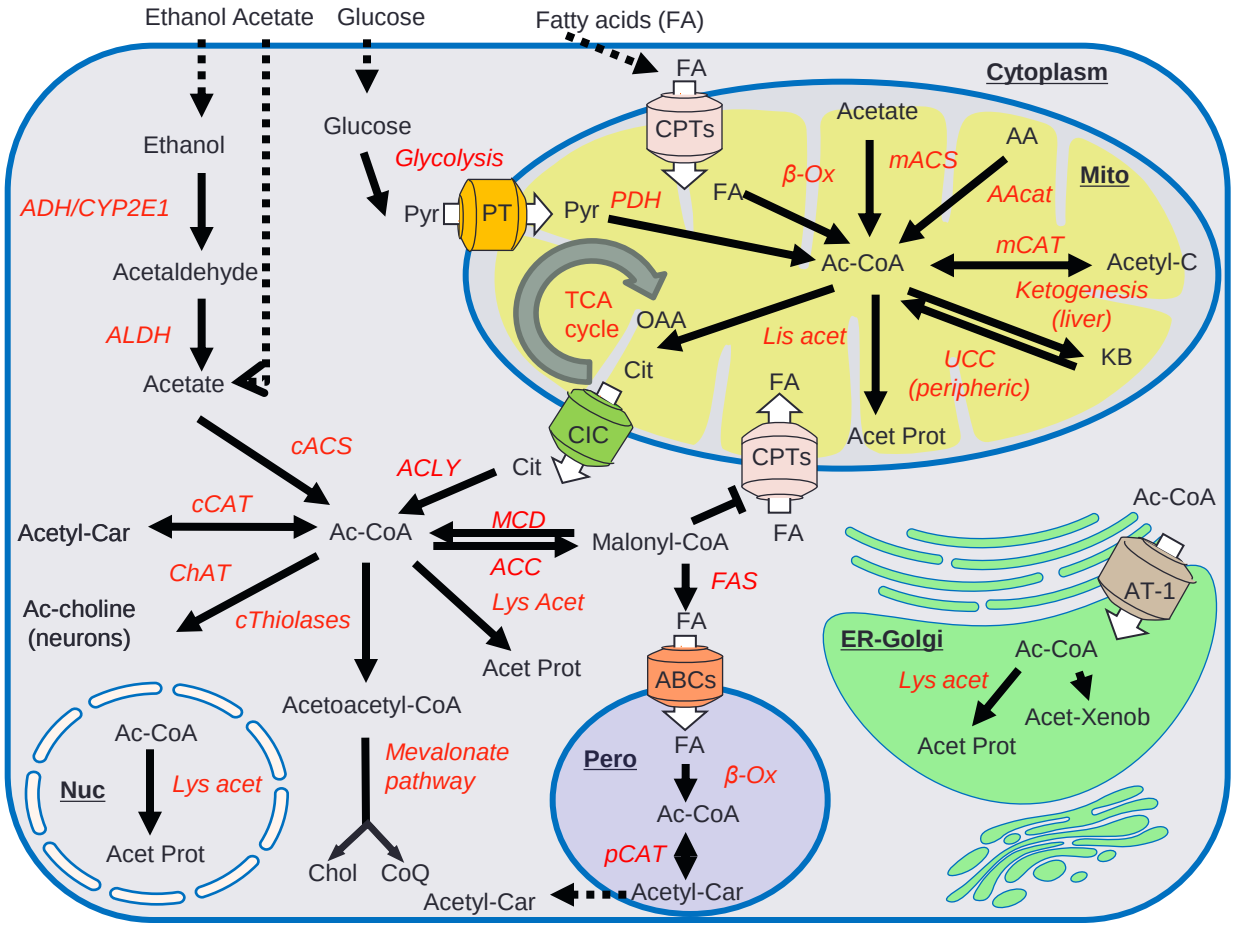
- Oral NR increases brain NAD levels in individuals with Parkinson's disease
- NR intake alters cerebral metabolism in Parkinson's disease
- Cerebral NAD increase is associated with clinical improvement in Parkinson's disease
- NR induces transcription of mitochondrial, lysosomal, and proteasomal pathways

Brakedal et al. Cell Metabolism 2022

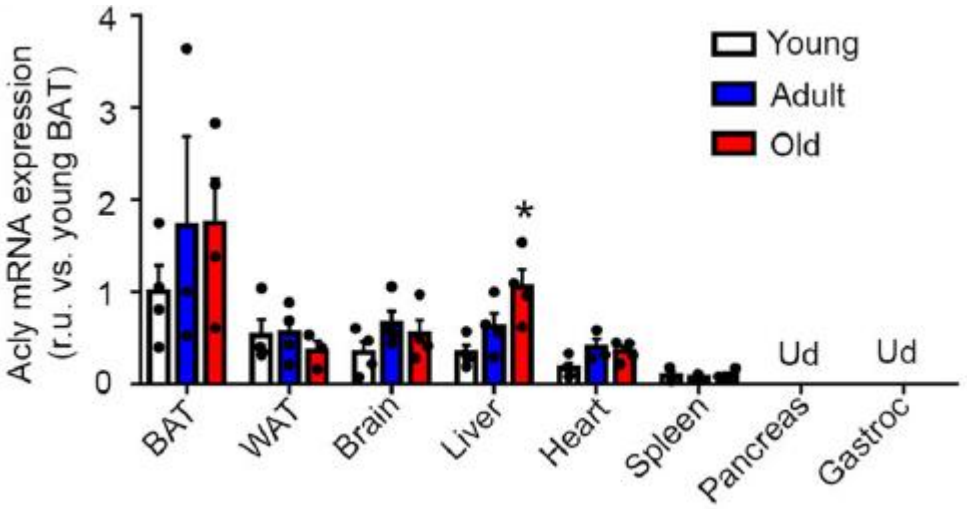
An alternative, could we mimic the activation of all sirtuins?

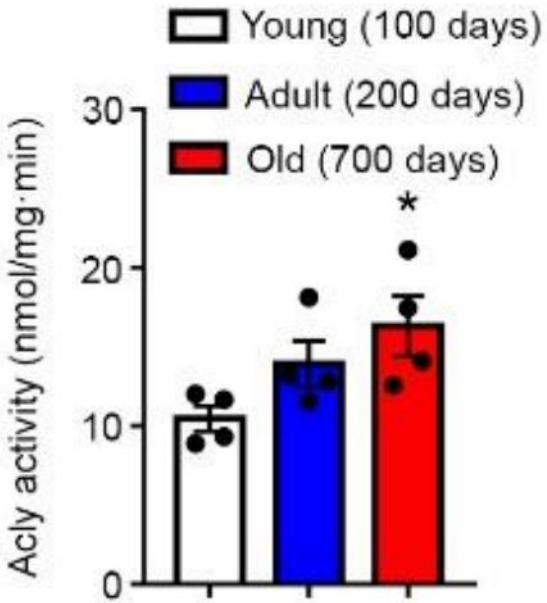


The main players in Ac-CoA metabolism



ATP-citrate lyase expression increases in liver with age

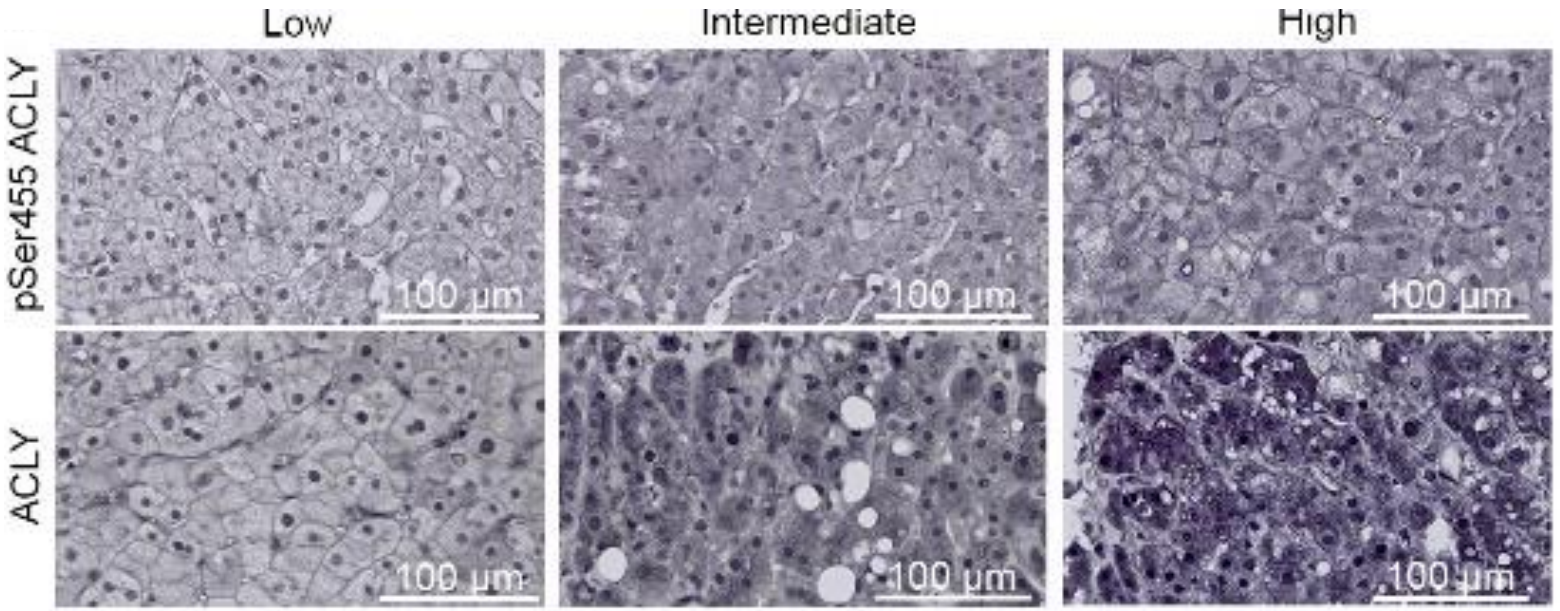


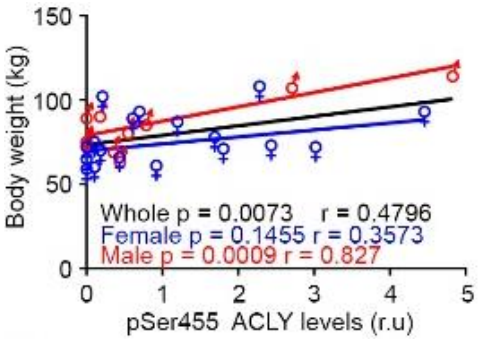


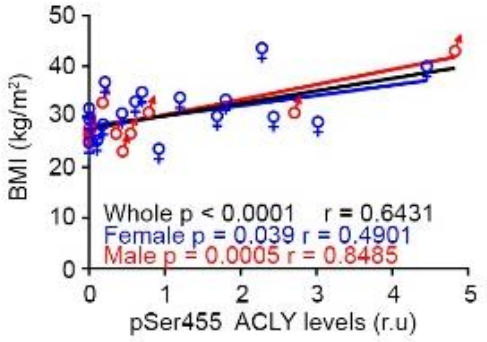
Sola-García et al. Comm. Biol 2023

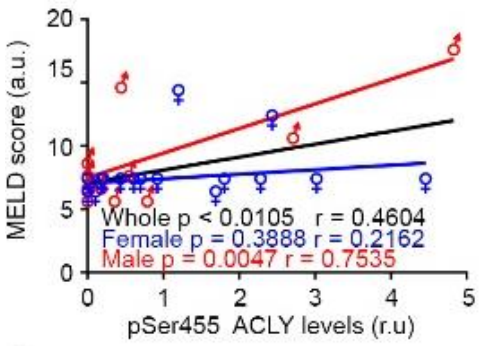
Sola-Garcia A. Comm. Biology 2023

pSer455 ACLY levels correlate with BMI and MELD in humans









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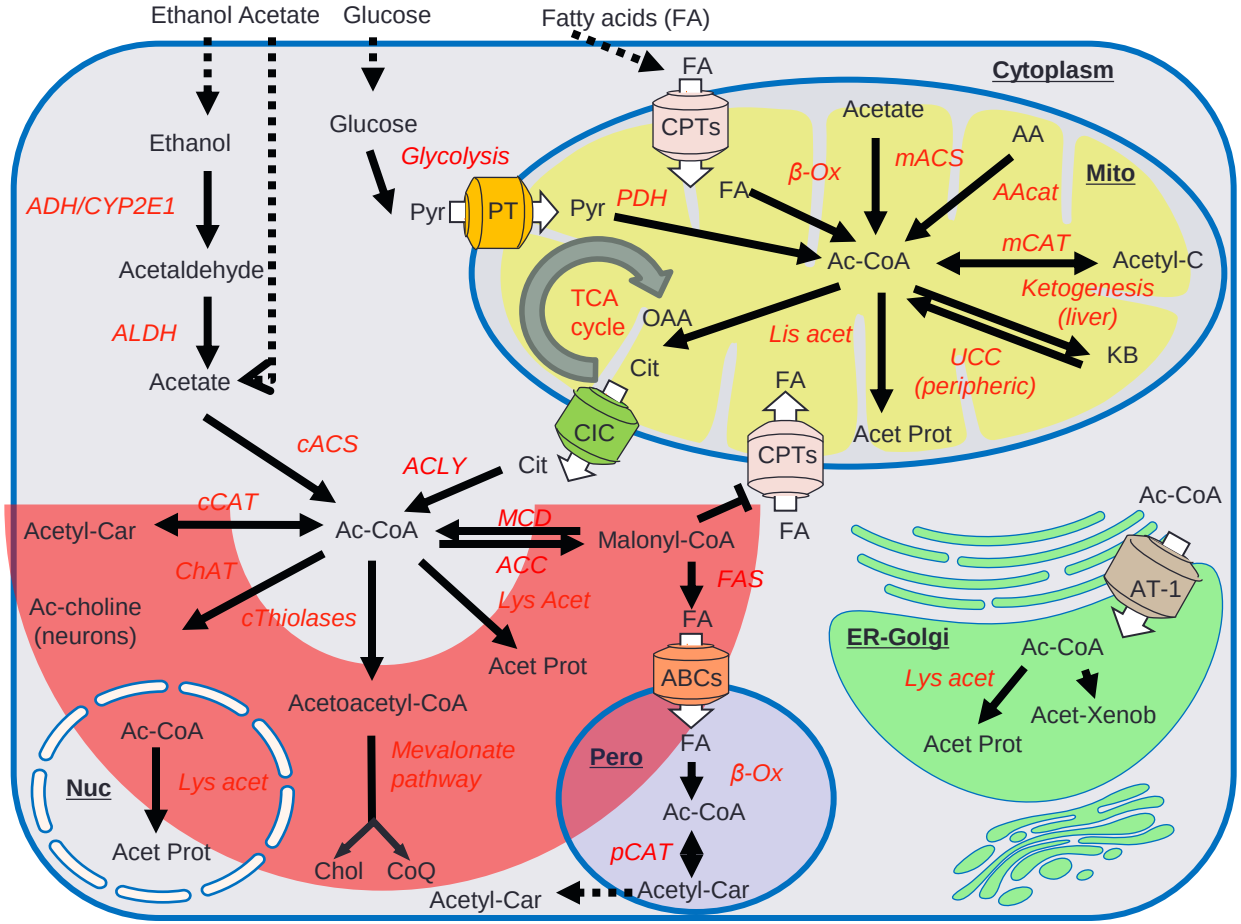
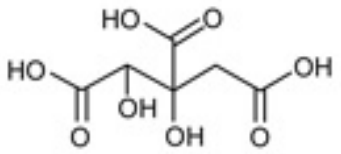
The relevance of Ac-CoA and ACLY inhibitors

- **Fatty acid synthesis**
- **β-oxidation of fatty acid**
- **Cholesterogenesis**
- **Acetyation of acetylatable proteins**

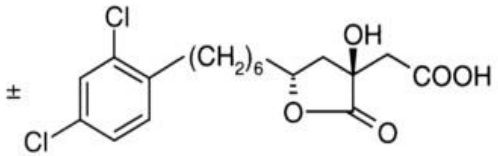


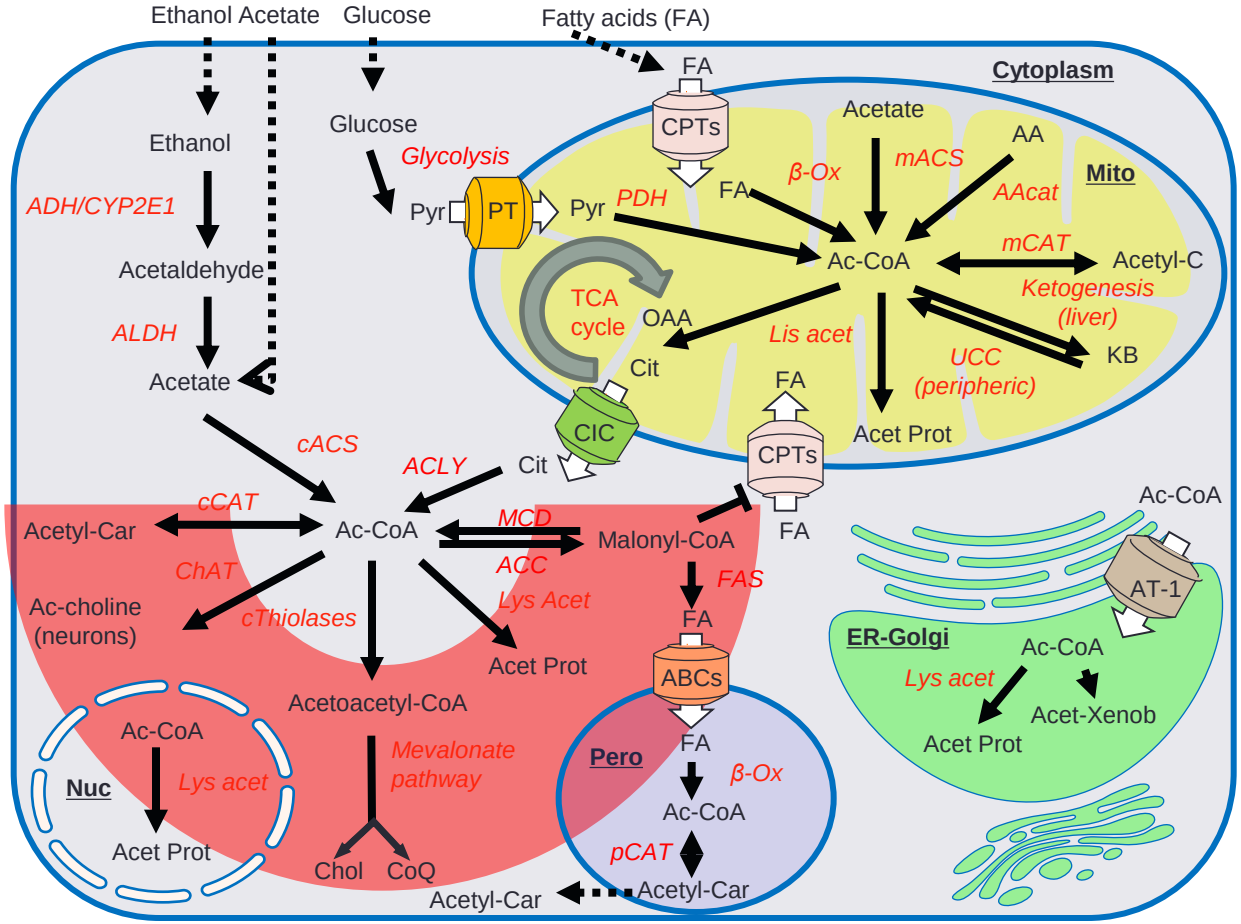
ACLY inhibitors to intervene in glucose metabolism and aging

Hydroxycitrate

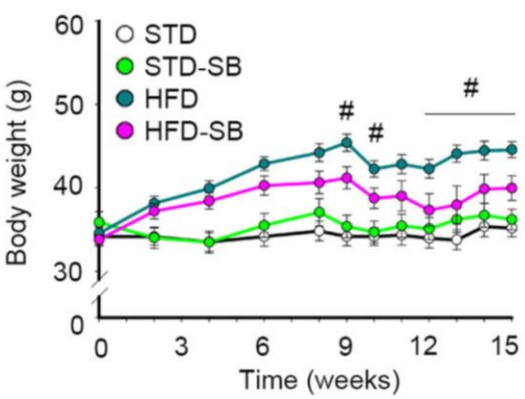


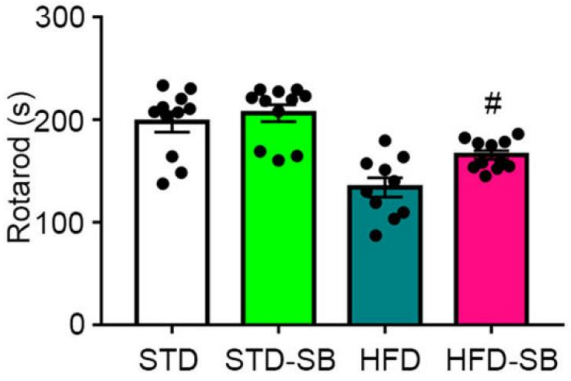
SB-204990

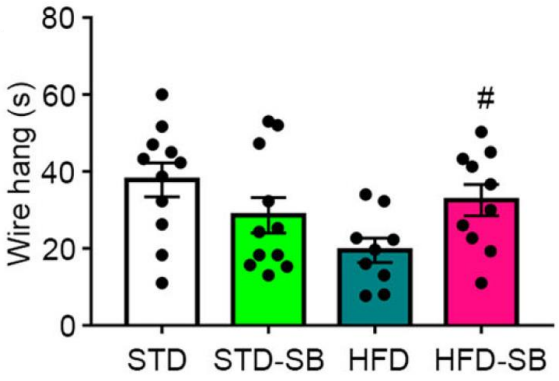




SB-204990 improves locomotor function in high fat diet

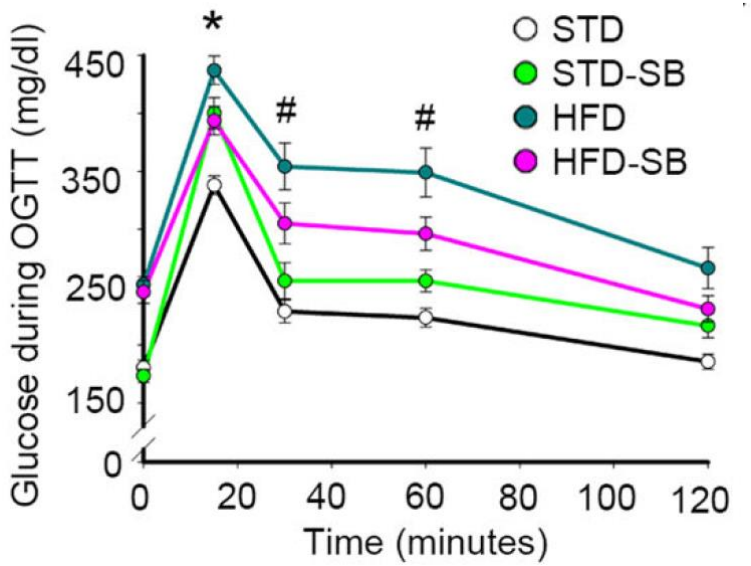


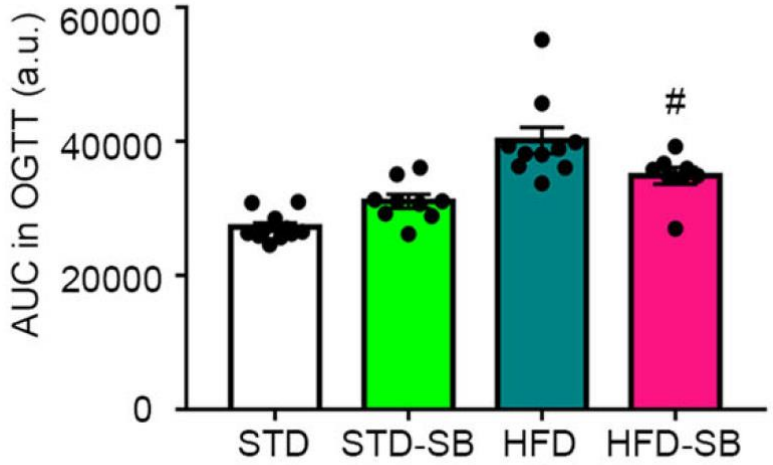


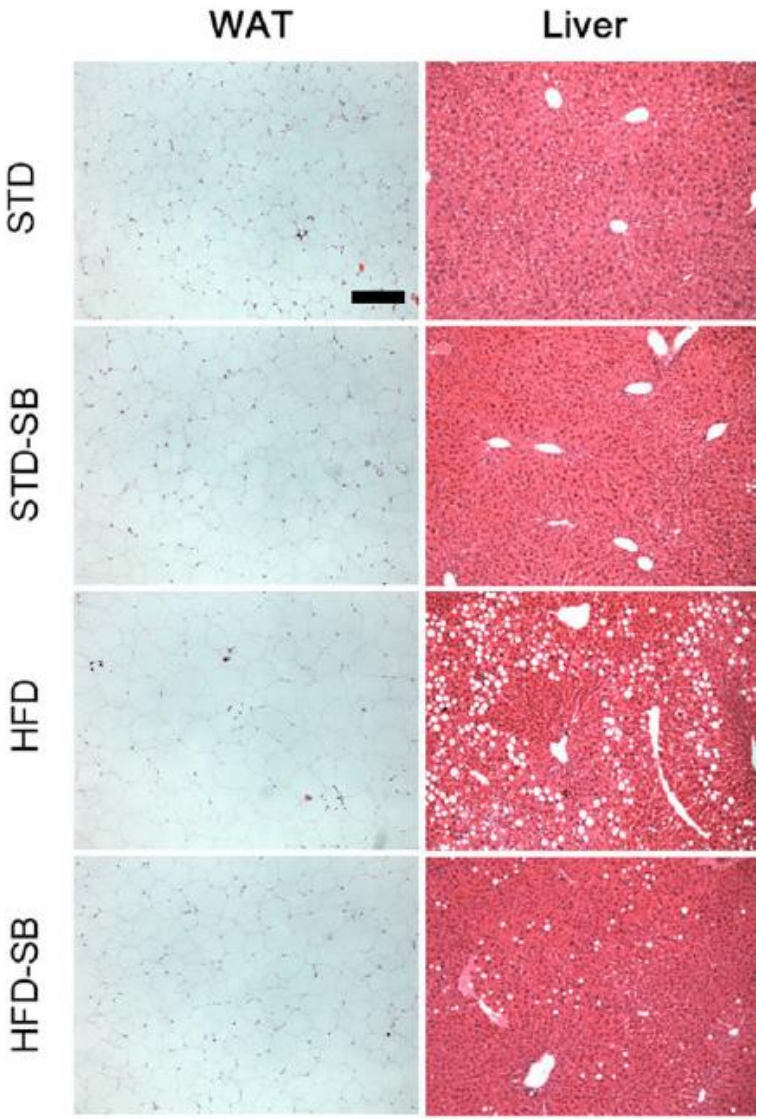


Sola-Garcia A. Comm. Biology 2023

SB-204990 reduces lipid inflantration in high fat diet







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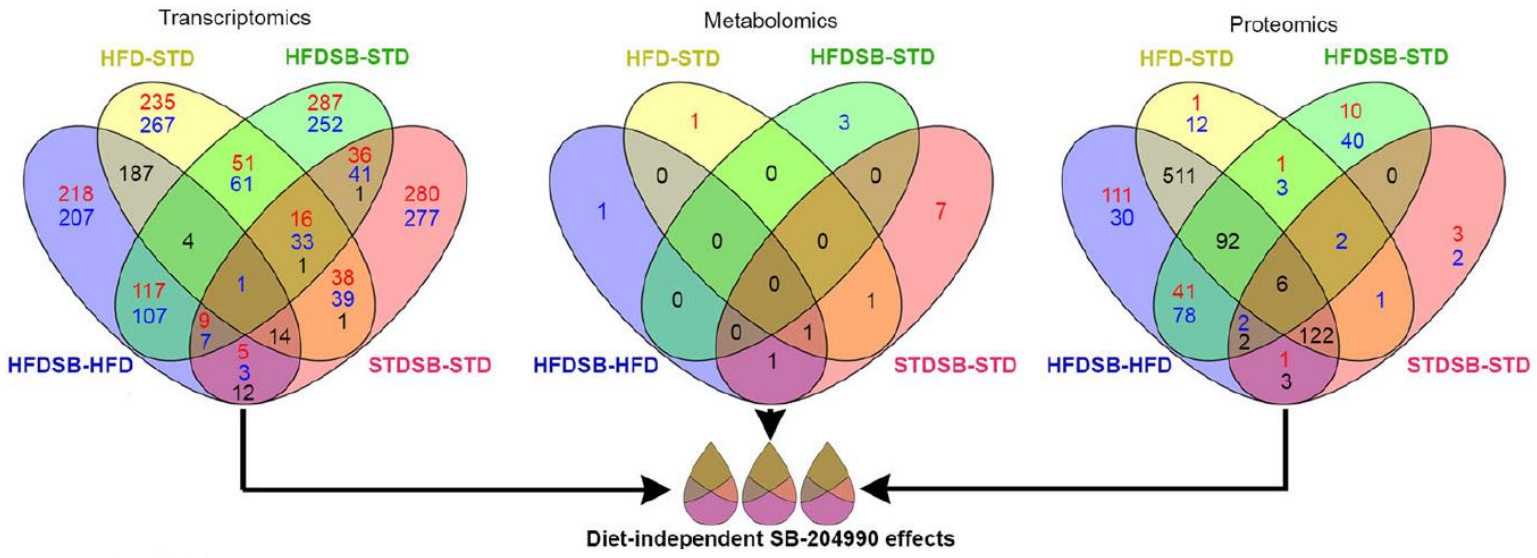
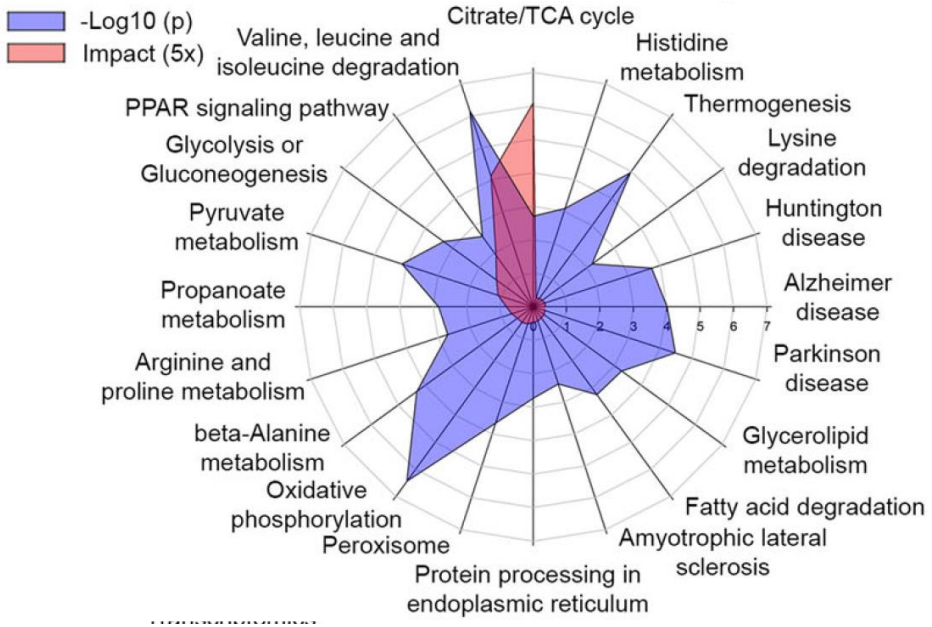
SB-204990 modulates mechanisms of aging





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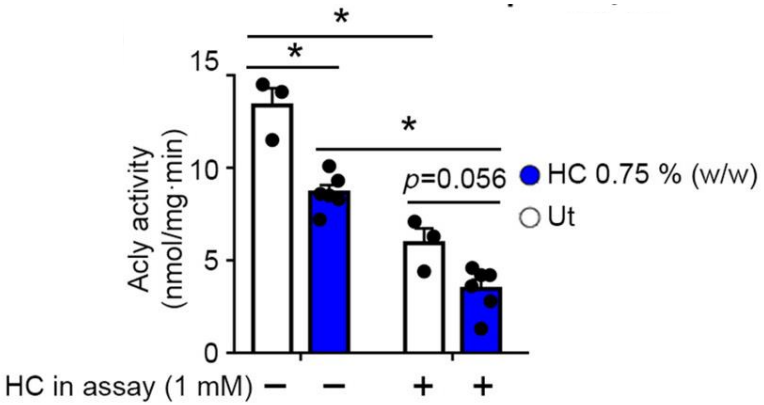
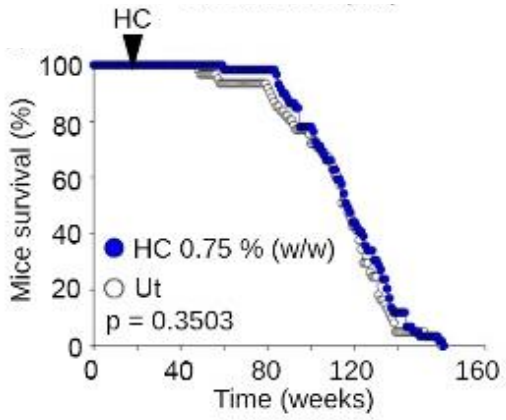
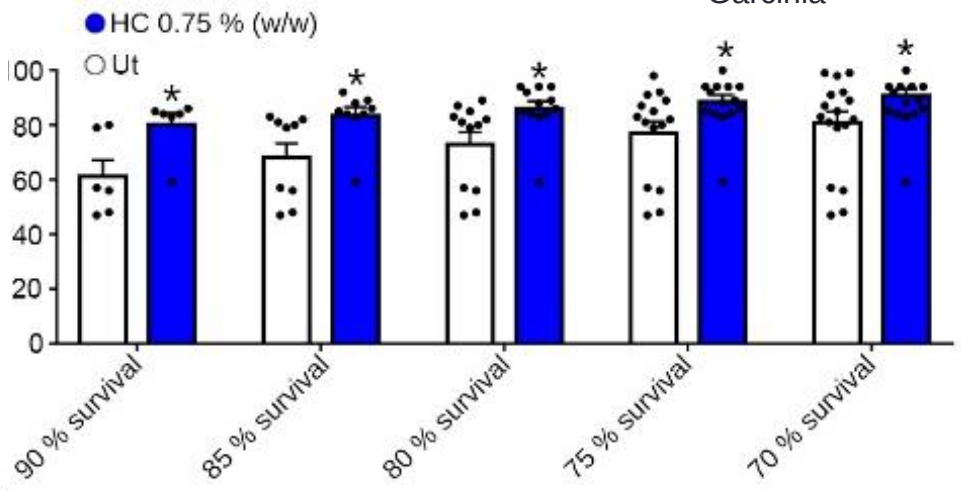
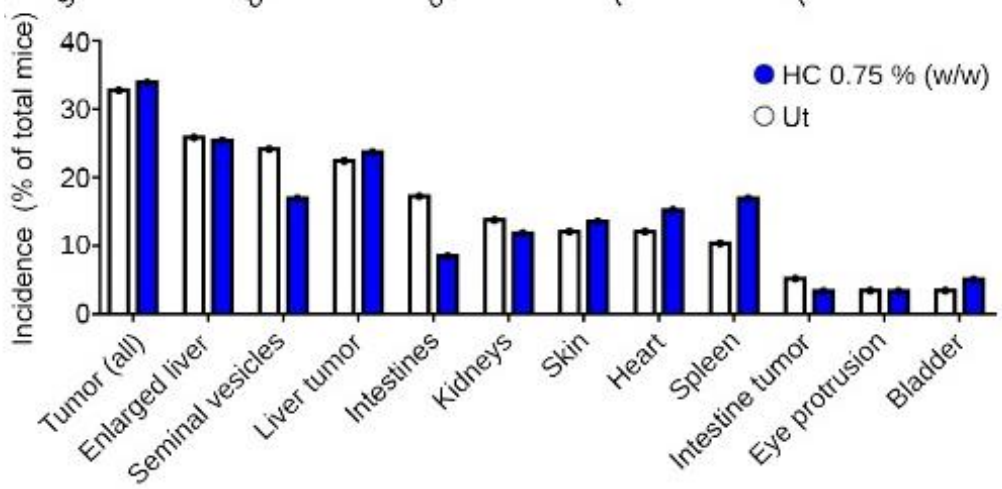
Hydroxycitrate delays early mortality

Garcinia



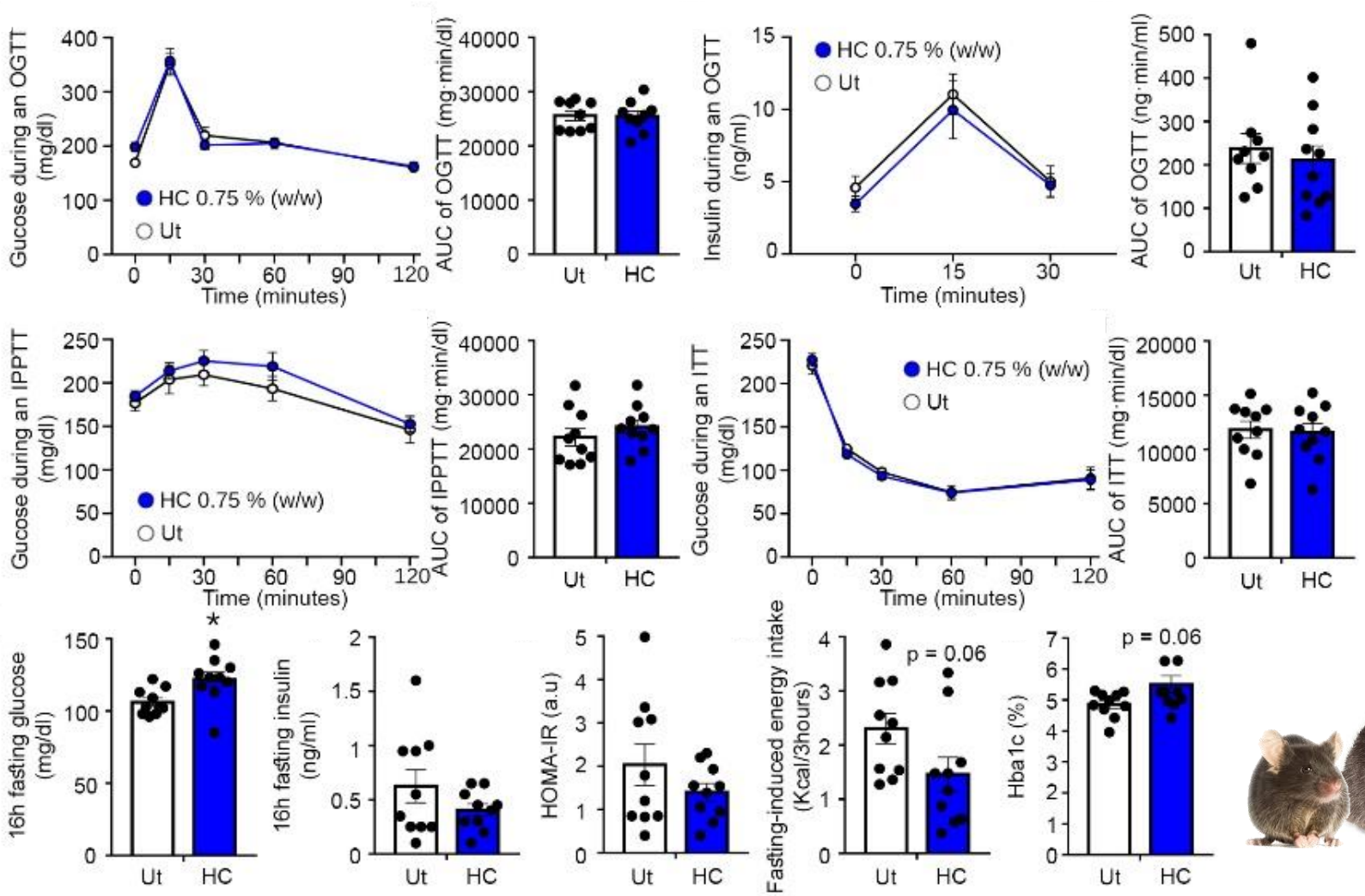






Espadas I. Aging Cell 2024

Hydroxycitrate has minor glucoregulatory in healthy-fed mice



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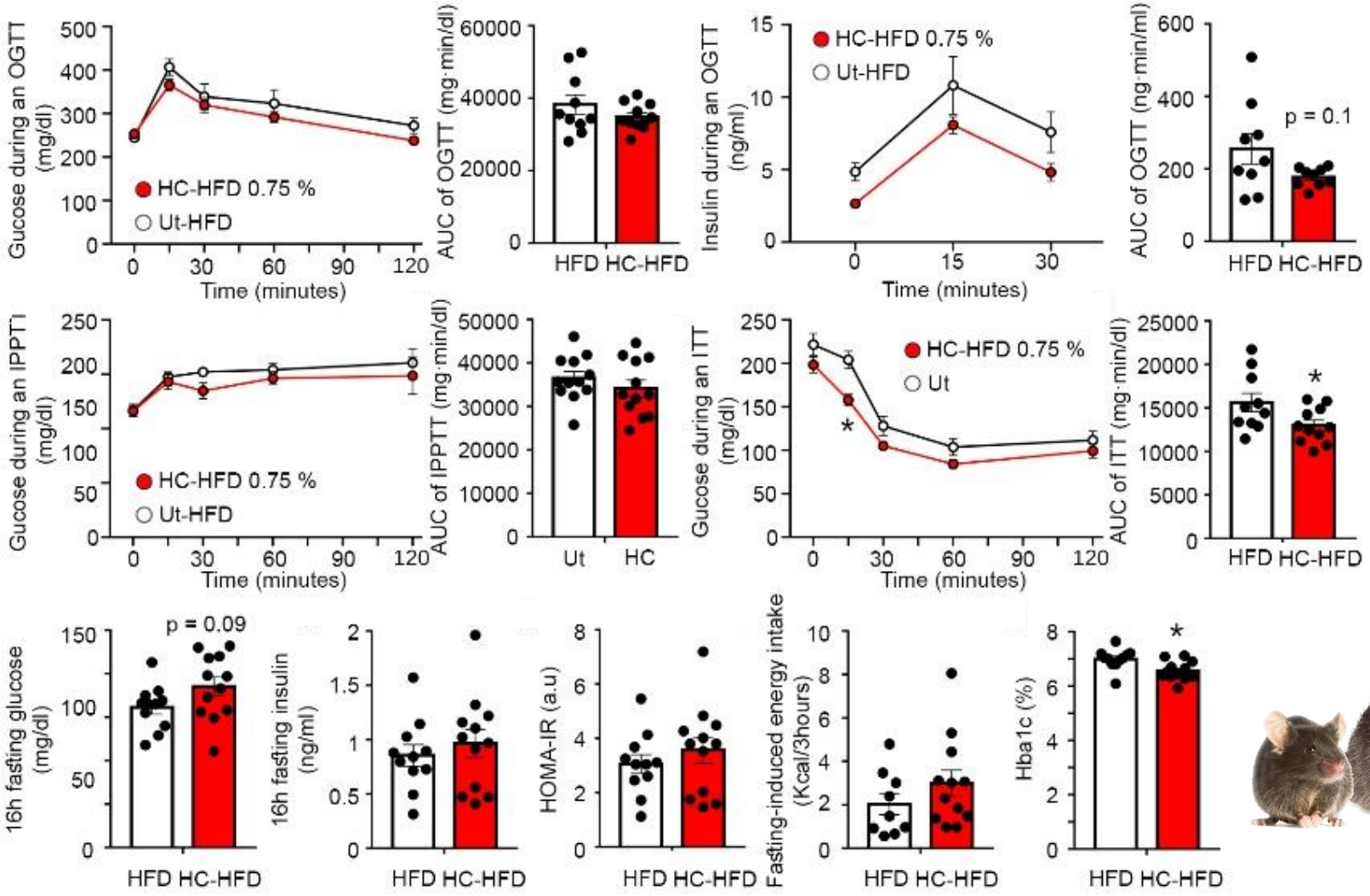
Hydroxycitrate confers improvements in glucoregulation in HFD



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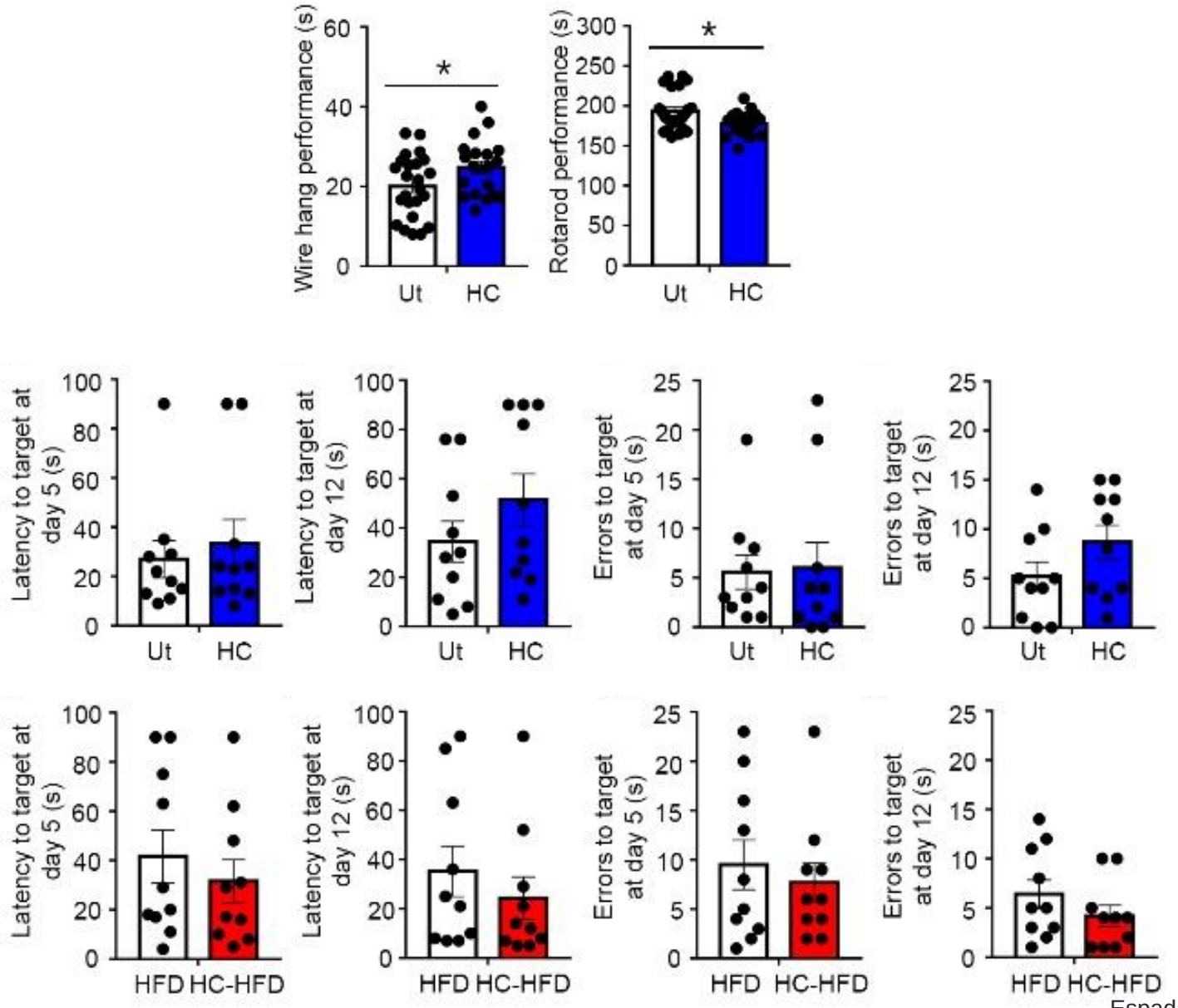
Hydroxycitrate does not alter neurocognitive function, and alters locomotor function



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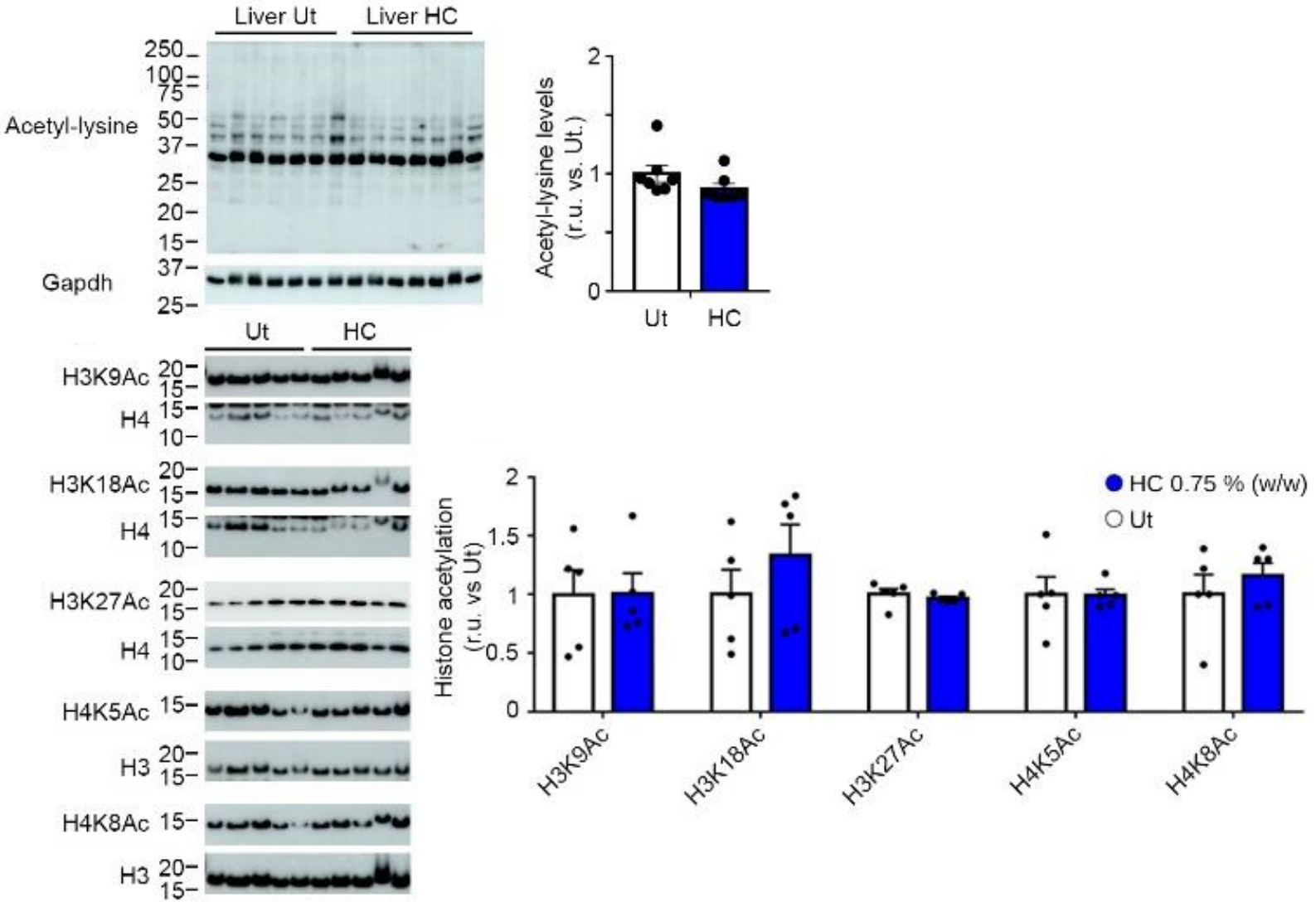
Hydroxycitrate does not alter protein acetylation levels



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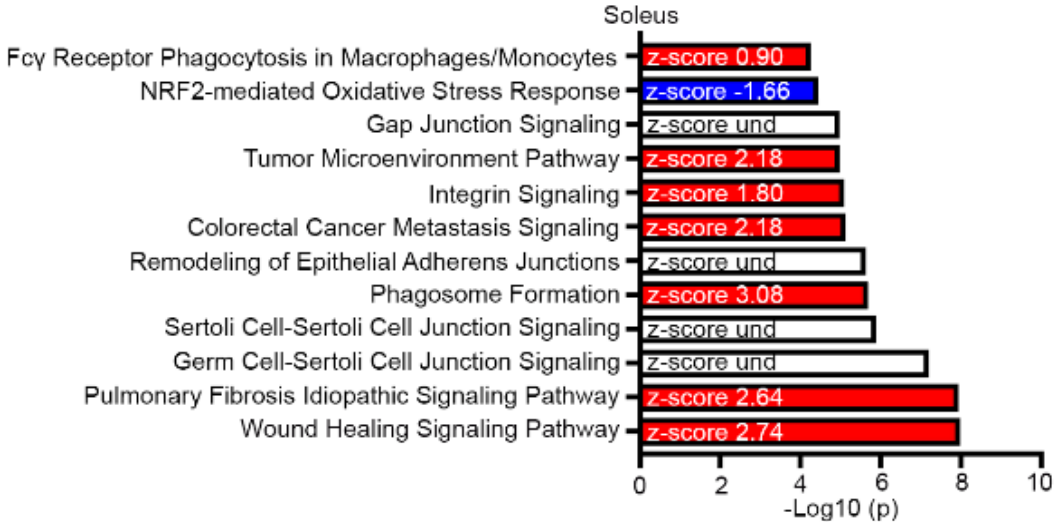
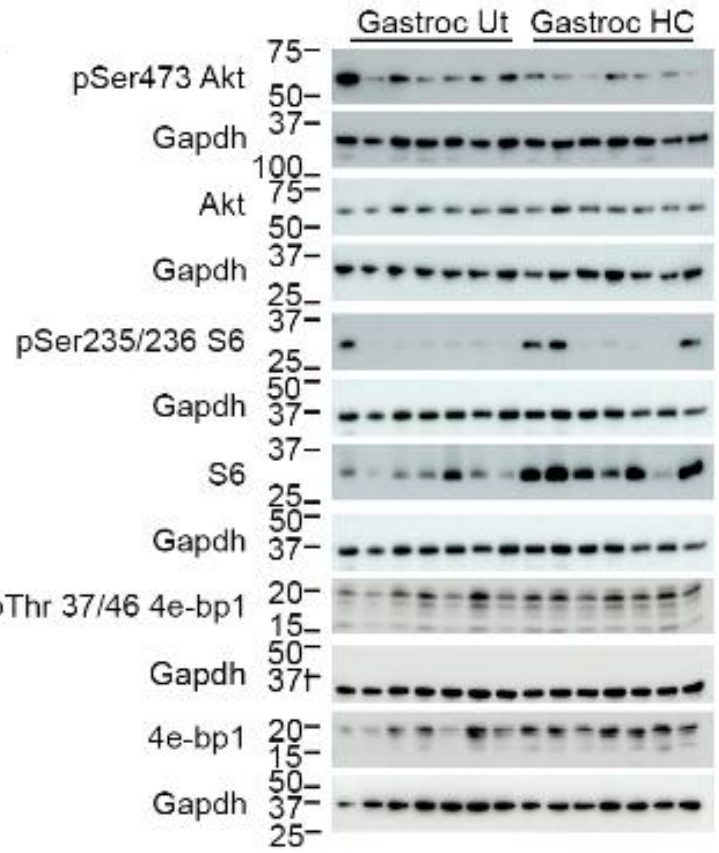
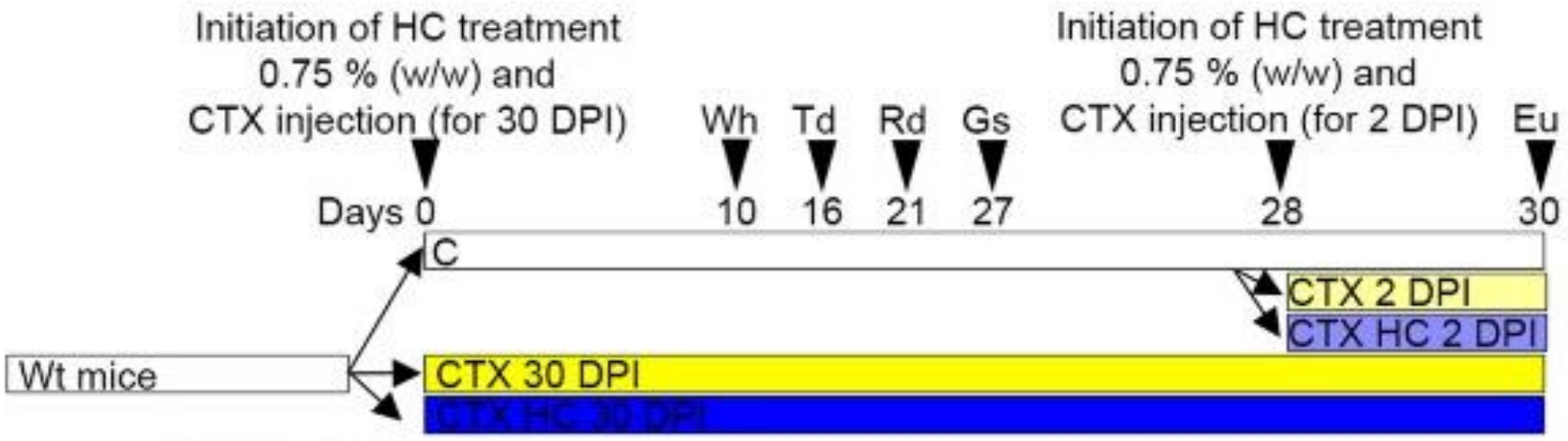
Hydroxycitrate enhances pathways related to muscle regeneration





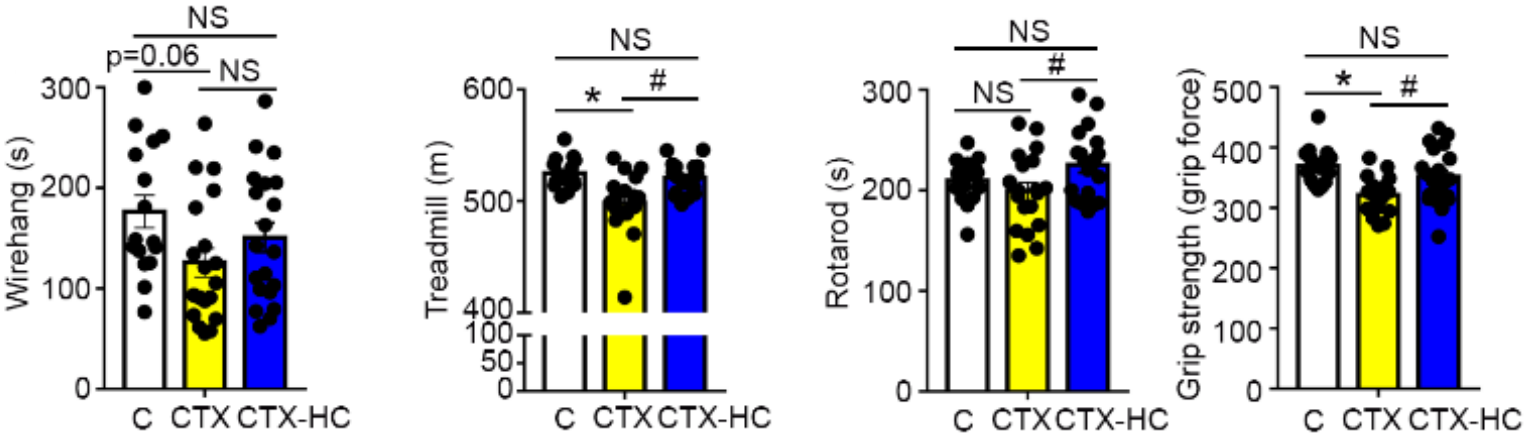
Espadas I. Aging Cell 2024

Hydroxycitrate in muscle de- and re-generation using CTX



Espadas I. Aging Cell 2024

Hydroxycitrate improves physical function in CTX- treated mice



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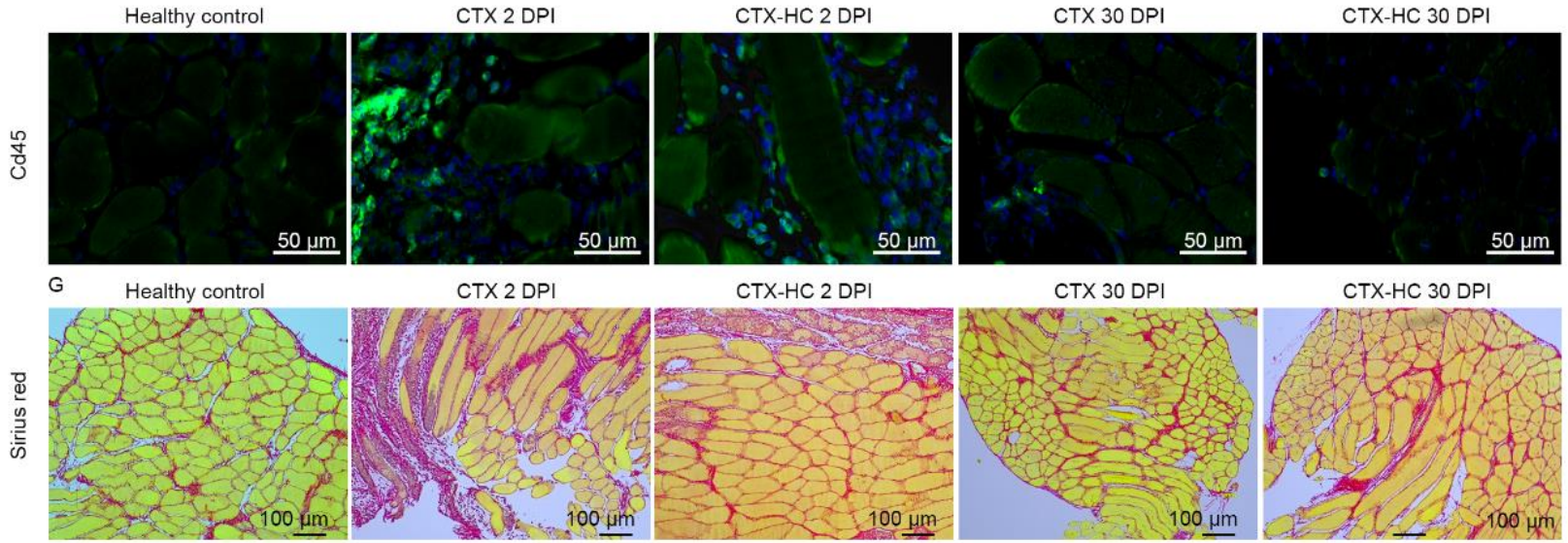
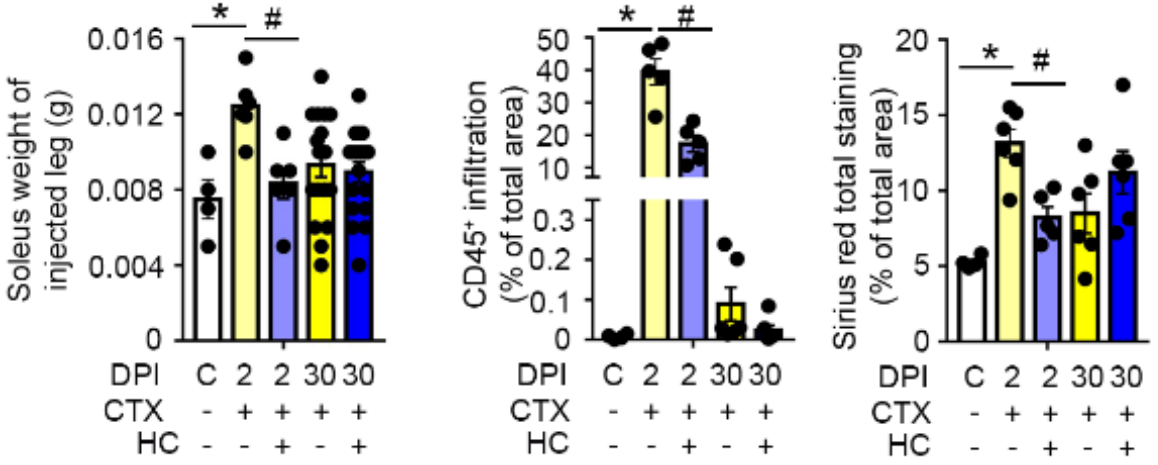
Hydroxycitrate reduces muscle swelling in mice treated with CTX





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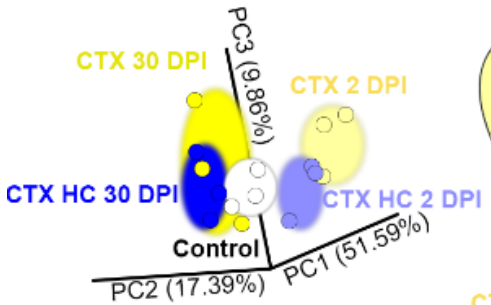
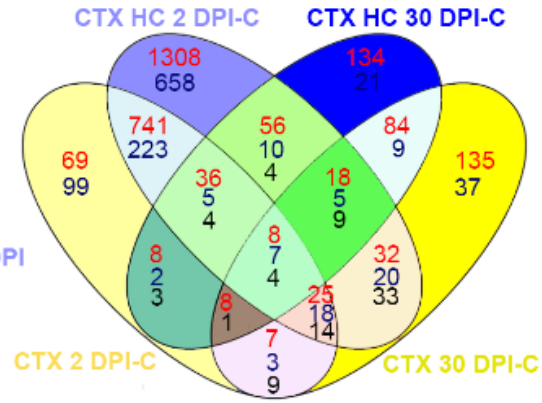
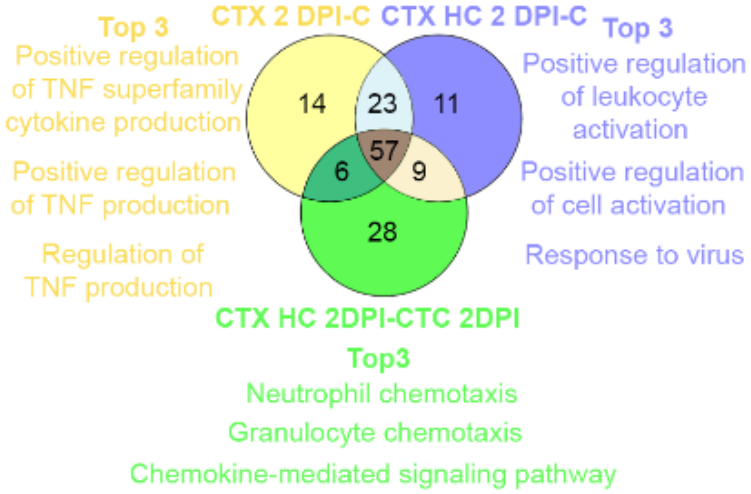
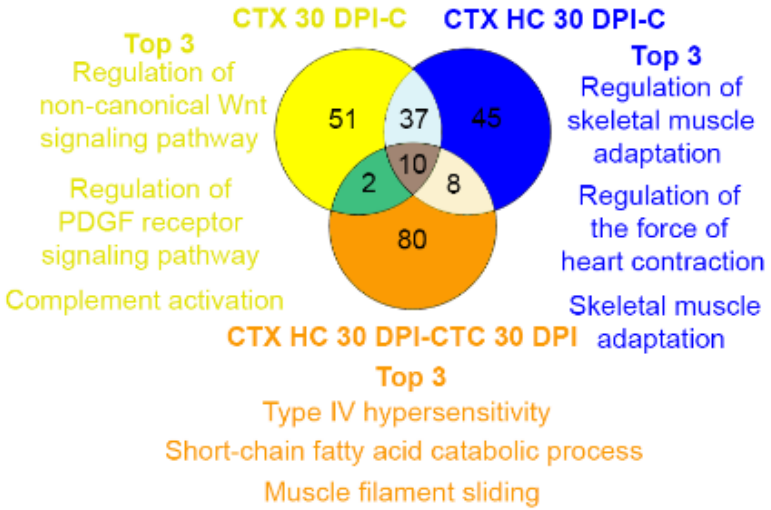
Hydroxycitrate enhances mechanisms of muscle regeneration









Espadas I. Aging Cell 2024

ACLY inhibition did not alter epigenetic alterations

Cell

Leading Edge
Review

The Hallmarks of Aging

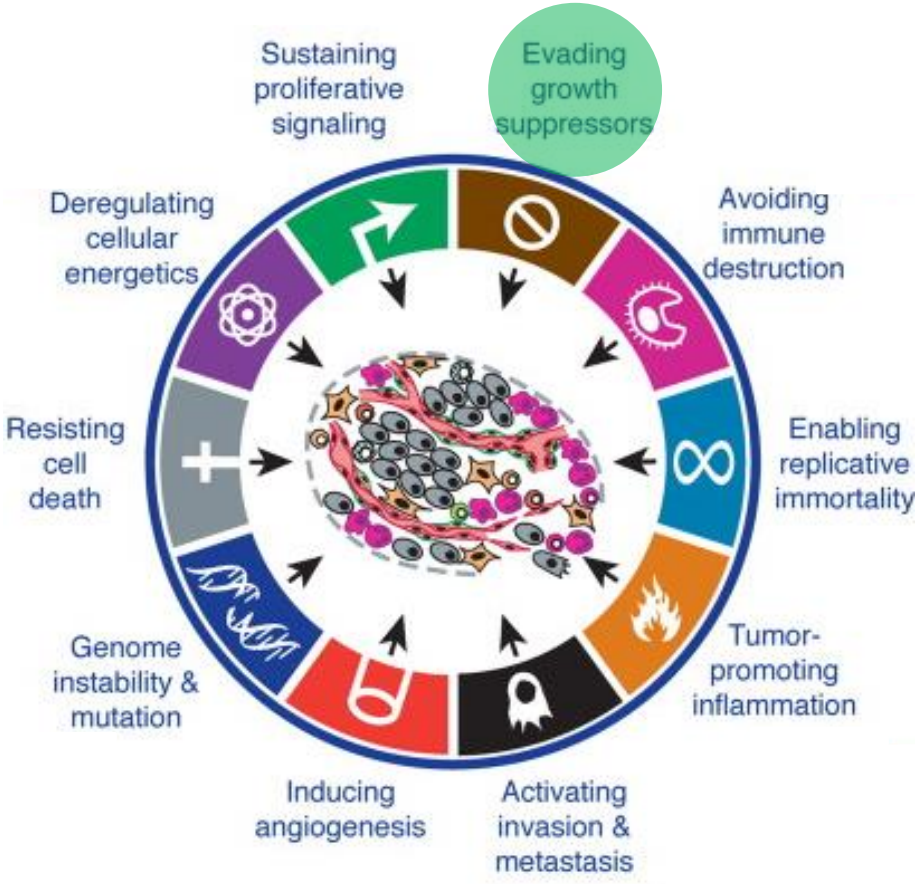
Carlos López-Otín,[1] Maria A. Blasco,[2] Linda Partridge,[3,4] Manuel Serrano,[5,*] and Guido Kroemer[6,7,8,9,10]

Cell

Leading Edge
Review

Hallmarks of Cancer: The Next Generation

Douglas Hanahan[1,2,*] and Robert A. Weinberg[3,*]



ACLY inhibition altered other hallmarks of aging

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Leading Edge
Review

The Hallmarks of Aging

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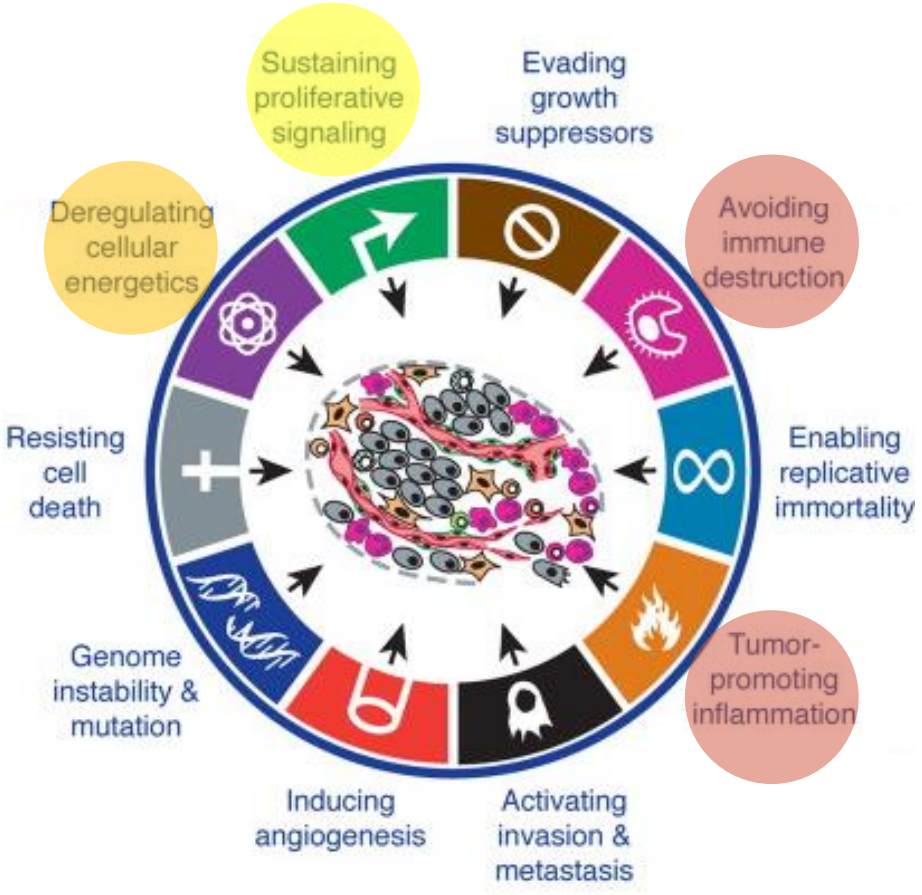
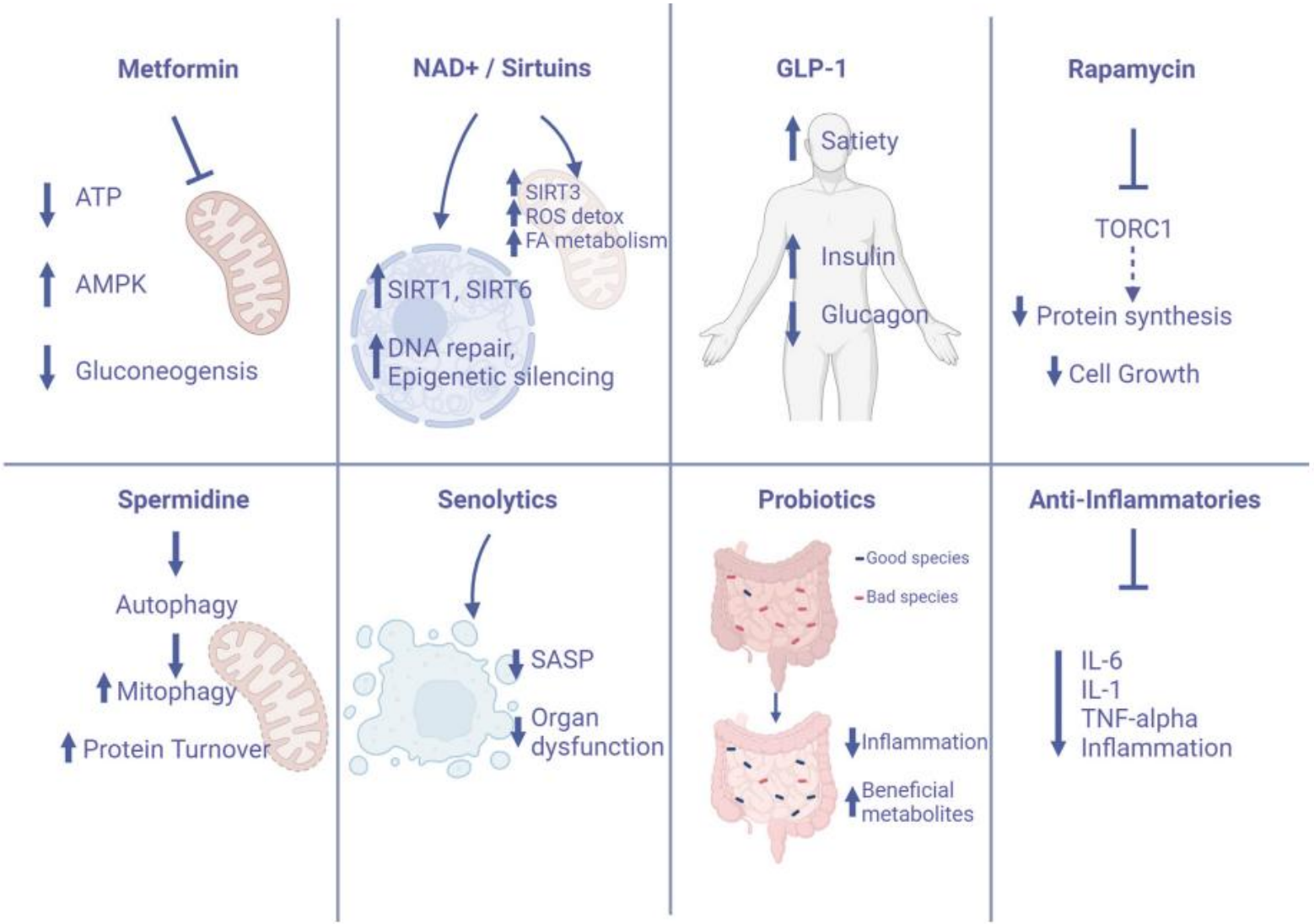
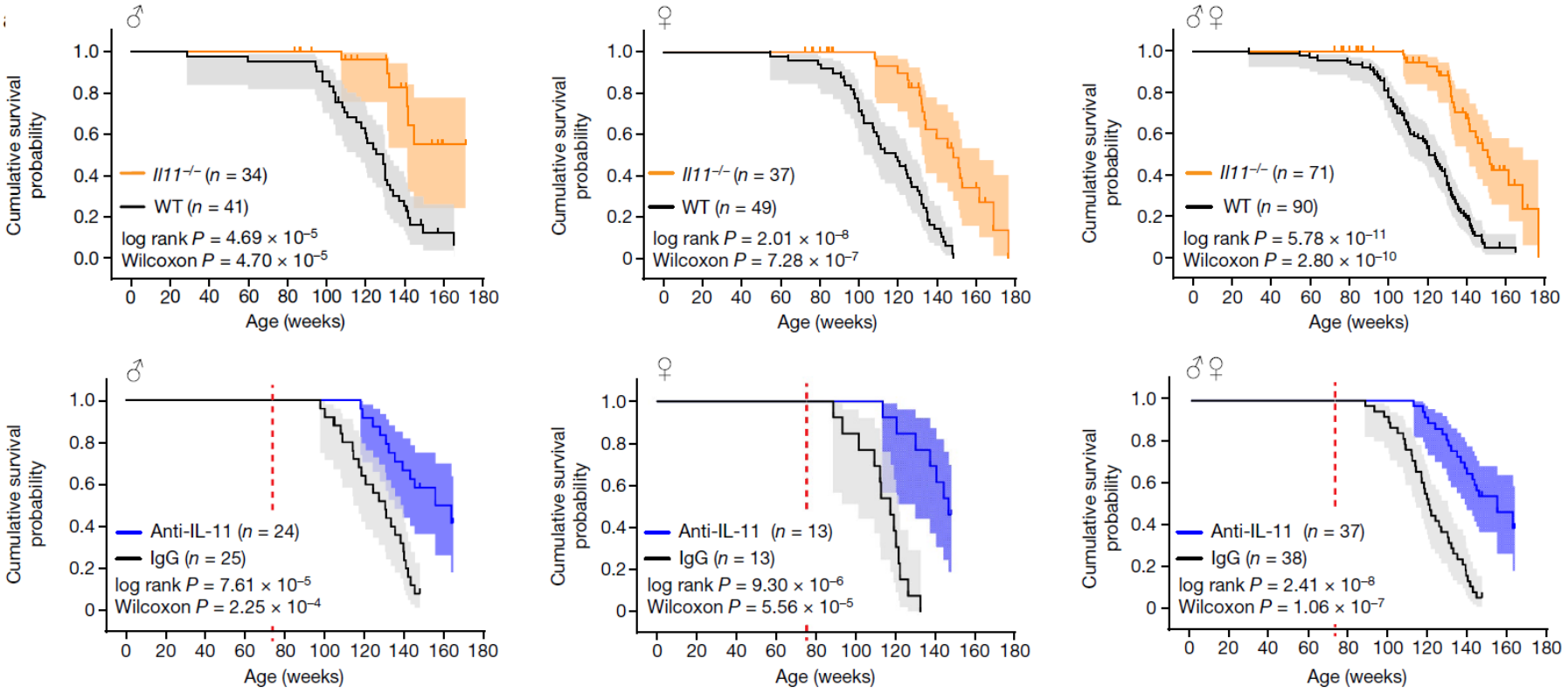


Other clinical trials targeting the aging process



Guarente L. et al. Cell 2024

Aging research is young but grows fast: IL-11 inhibition on lifespan



Widjaja AA. et al. Nature 2024

There is hope to age well!!!

Physical activity, mental activity, stress management and healthy diet

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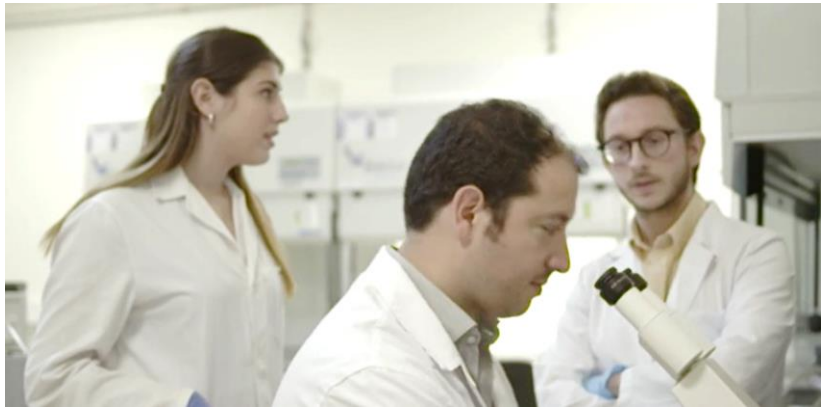

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Dr. Alfaro-Cerbelló, Dr. Martí-Aguado Clinic ***University Hospital Valencia***