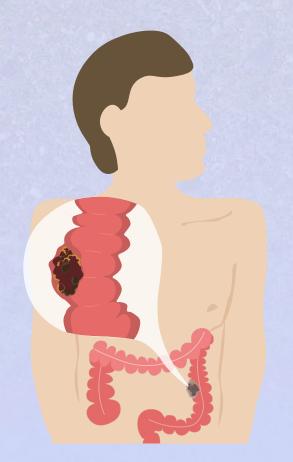
Primary prevention: Physical activity as a protective factor for cancer onset



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Do I have a lower risk of cancer if I am physically active?

	Studies,	Cases,			P Value	
Cancer	No.	No.	HR (95% CI)		Trend	Heterogeneity
Esophageal adenocarcinoma	5	899	0.58 (0.37-0.89)		.01	.01
Gallbladder	6	382	0.72 (0.51-1.01)		.06	.29
Liver	10	1384	0.73 (0.55-0.98)		.04	.02
Lung	12	19133	0.74 (0.71-0.77)	-	<.001	.47
Kidney	11	4548	0.77 (0.70-0.85)	-	<.001	.40
Small intestine	7	503	0.78 (0.60-1.00)		.05	.85
Gastric cardia	6	790	0.78 (0.64-0.95)		.02	.99
Endometrial	9	5346	0.79 (0.68-0.92)		.003	.001
Esophageal squamous	6	442	0.80 (0.61-1.06)		.12	.78
Myeloid leukemia	10	1692	0.80 (0.70-0.92)		.002	.78
Myeloma	9	2161	0.83 (0.72-0.95)		.008	.36
Colon	12	14160	0.84 (0.77-0.91)	-	<.001	.01
Head and neck	11	3985	0.85 (0.78-0.93)	-	<.001	.45
Rectum	12	5531	0.87 (0.80-0.95)	- ■-	.001	.38
Bladder	12	9073	0.87 (0.82-0.92)	-	<.001	.84
Breast	10	35178	0.90 (0.87-0.93)	.	<.001	.30
Non-Hodgkin lymphoma	11	6953	0.91 (0.83-1.00)		.05	.18
Thyroid	11	1829	0.92 (0.81-1.06)	-= :	.26	.48
Gastric noncardia	7	1428	0.93 (0.73-1.19)		.56	.09
Soft tissue	10	851	0.94 (0.67-1.31)		70	.03
Pancreas	10	4186	0.95 (0.83-1.08)		.40	.14
Lymphocytic leukemia	10	2160	0.98 (0.87-1.11)	- - - - - - - - - - - - -	.73	.99
Ovary	9	2880	1.01 (0.91-1.13)	-	.81	.98
Brain	10	2110	1.06 (0.93-1.20)	-	.41	.43
Prostate	7	46890	1.05 (1.03-1.08)		<.001	.90
Malignant melanoma	12	12438	1.27 (1.16-1.40)	-	<.001	.02
				0.3 1.0 Hazard Ratio (95% CI)	1.5	



Leisure-time physical activity is associated with lower risk of 13 different cancers

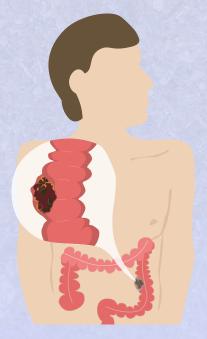
Moore et al. 2016; JAMA Intern Med







Do I have a lower risk of cancer if I am physically active?



Studies,	Cases,			P Value	
No.	No.	HR (95% CI)	:	Trend	Heterogeneitya
12	5531	0.87 (0.80-0.95)		.001	.38
12	14160	0.84 (0.77-0.91)		<.001	.01
			0.3	1.5	
	No.	No. No.	No. No. HR (95% CI) 12 5531 0.87 (0.80-0.95)	No. No. HR (95% CI) 12 5531 0.87 (0.80-0.95) 12 14160 0.84 (0.77-0.91) 0.3 1.0	No. No. HR (95% CI) 12 5531 0.87 (0.80-0.95) 12 14160 0.84 (0.77-0.91) <.001



Leisure-time physical activity is associated with a ~15% lower risk of colorectal cancer

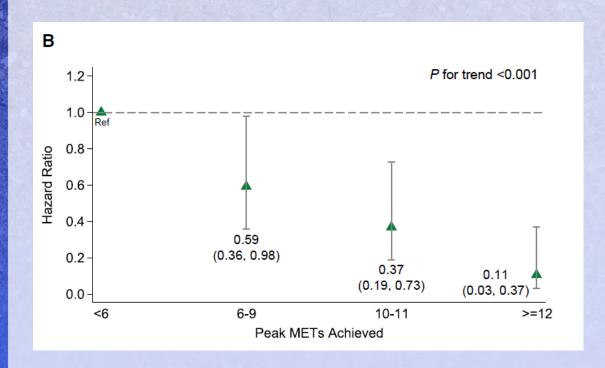
Moore et al. 2016; JAMA Intern Med

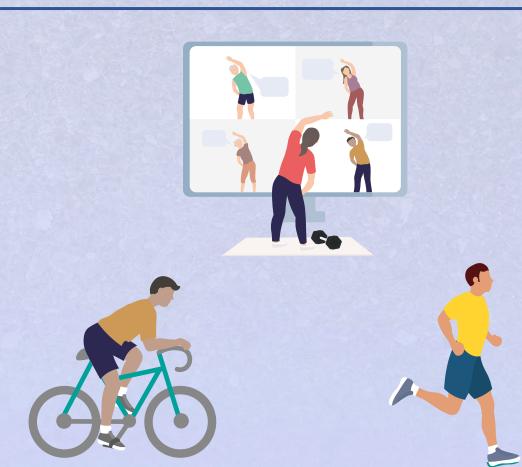






Do fit individuals have a lower risk of colorectal cancer?





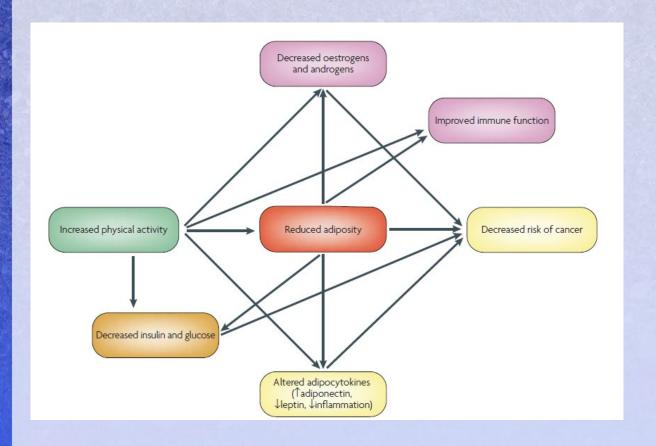
Marshall et al. 2019, Cancer







Physical activity and reduced adiposity



A prevailing hypothesis is that physical activity reduces the risk of cancer through weight loss

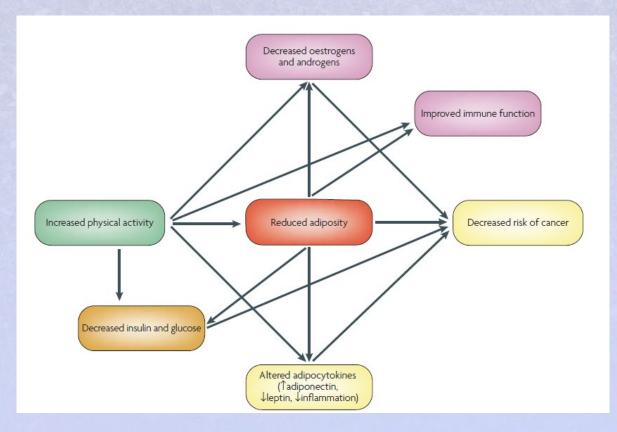
McTiernan 2008, Nat Rev Cancer; Moore et al. 2016, JAMA Intern Med







Physical activity and reduced adiposity



A prevailing hypothesis is that physical activity reduces the risk of cancer through weight loss

	HR (95% CI)	- Difference	
Cancer ^c	Not BMI Adjusted	BMI Adjusted	in HR, %
Colon	0.84 (0.77-0.91)	0.87 (0.80-0.94)	3.6
Rectum	0.87 (0.80-0.95)	0.88 (0.81-0.96)	1.1

But the effect of physical activity is still strong after adjustment for BMI.

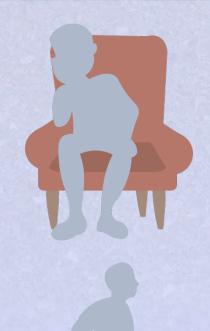
McTiernan 2008, Nat Rev Cancer; Moore et al. 2016, JAMA Intern Med

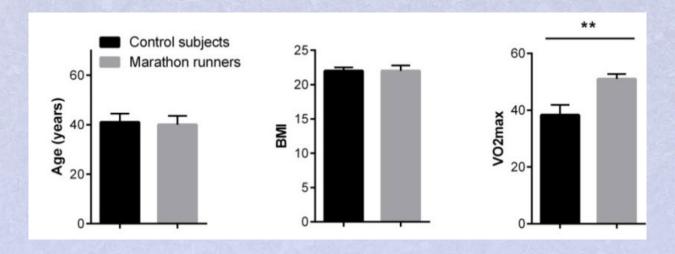






Training status does not affect cancer cell proliferation





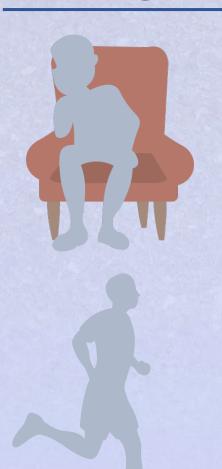
Dethlefsen et al. 2017, Cancer Res

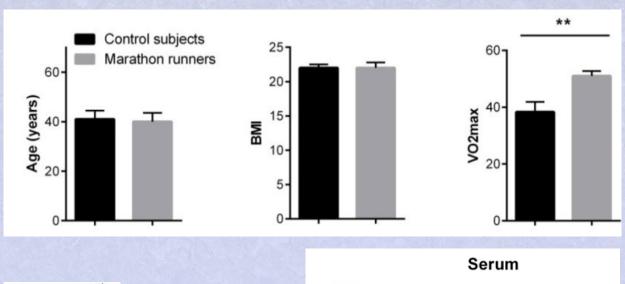


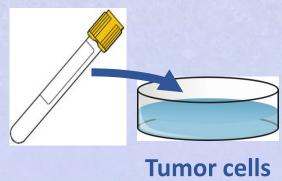


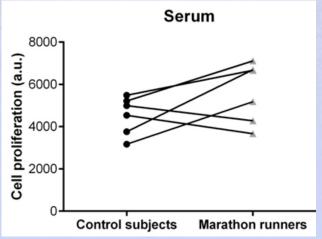


Training status does not affect cancer cell proliferation









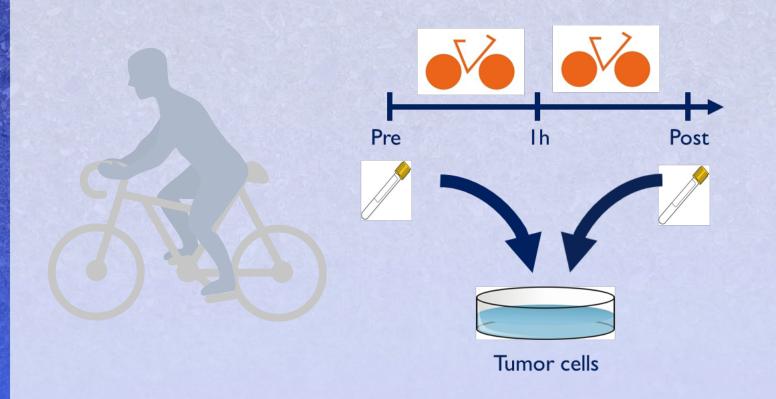
Dethlefsen et al. 2017, Cancer Res

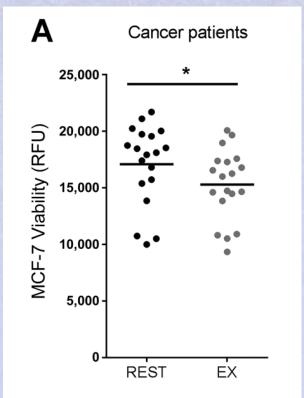






Exercise-conditioned serum reduces cancer cell viability





Dethlefsen et al. 2017, Cancer Res



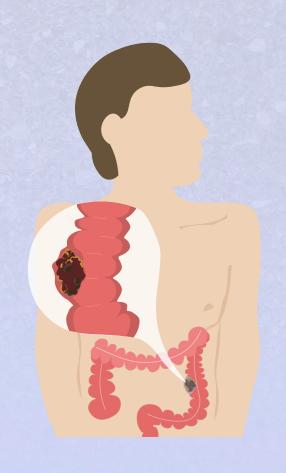




The exercise factor

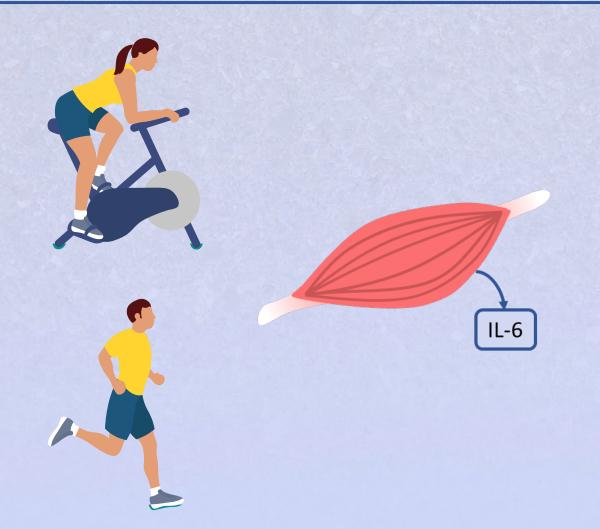


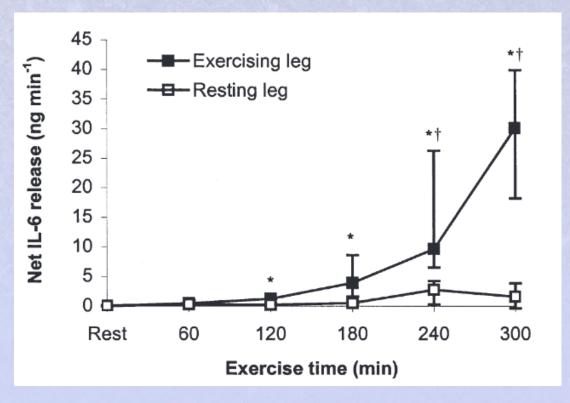
What happens when we are physically active that can help explain the lower risk of developing cancer?





Skeletal muscles are endocrine organs





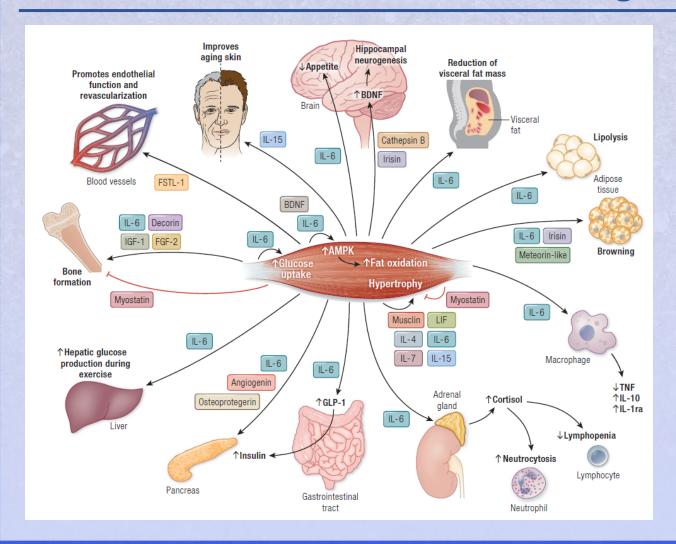
Stensberg et al. 2000, J Phys







Skeletal muscles are endocrine organs



Every time we are physically active, our muscles produce and release "myokines" that can mediate the communication between skeletal muscles and other organs.

Some of these myokines have "anti-cancer effects"

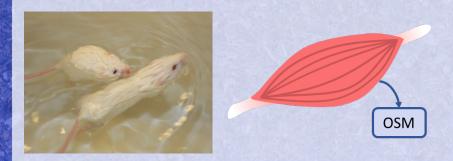
Severinsen and Pedersen 2020, Endocr Rev

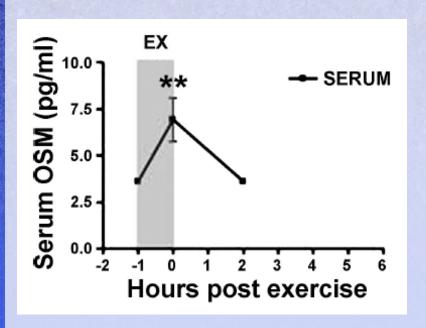






Oncostatin M – An anti-cancer myokine





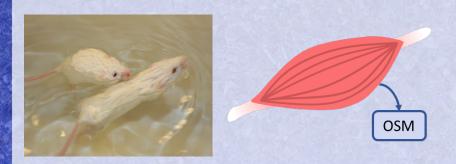
Hojman et al. 2011, Am J Physiol Endocrinol Metab

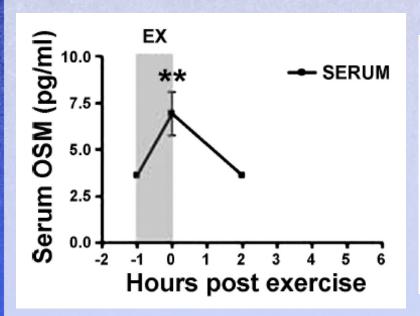


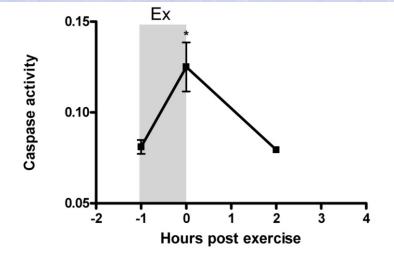


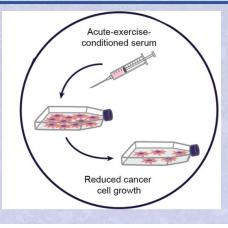


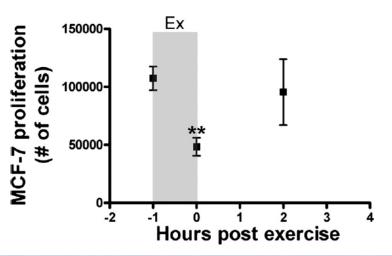
Oncostatin M – An anti-cancer myokine











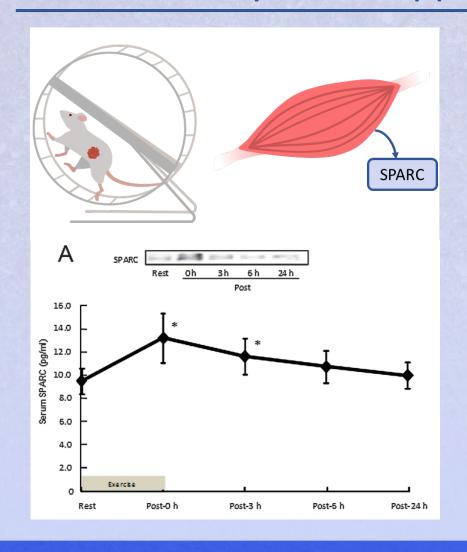
Hojman et al. 2011, Am J Physiol Endocrinol Metab

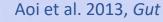






SPARC – A myokine suppressing onset of colon cancer?



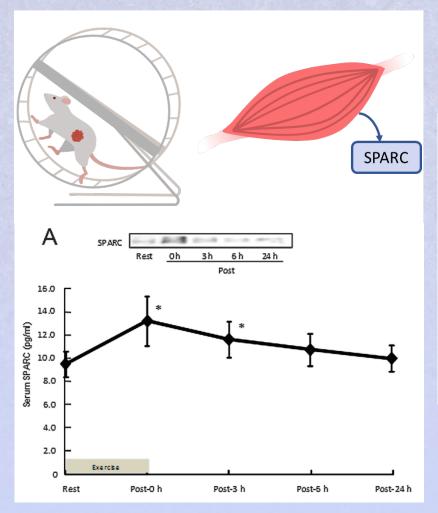


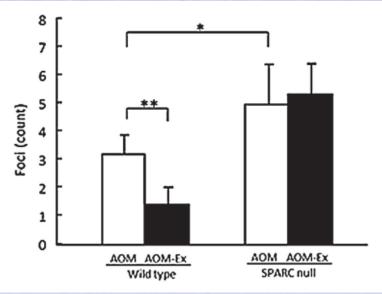


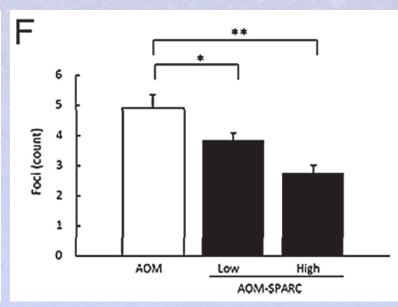




SPARC – A myokine suppressing onset of colon cancer?







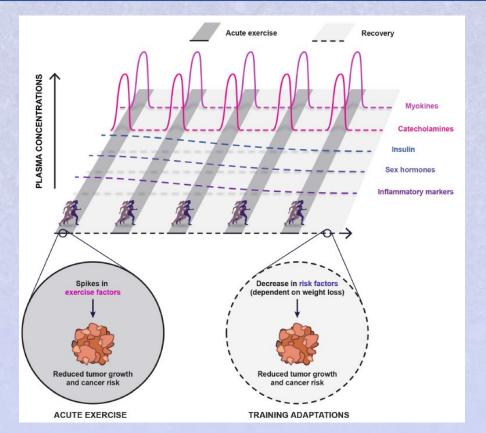
Aoi et al. 2013, Gut

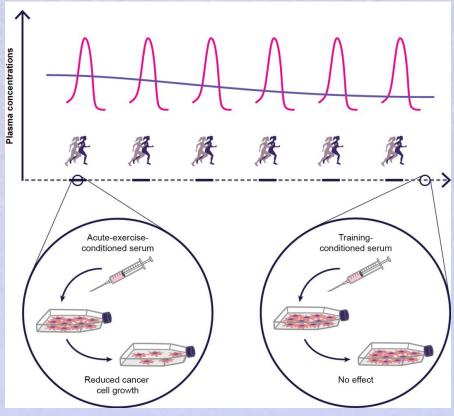






Every exercise bout matters





With every exercise bout, we create an "anti-cancer environment"

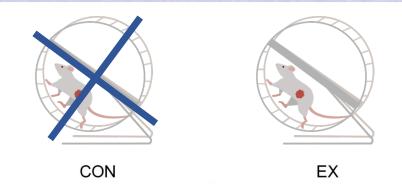
Dethlefsen et al. 2017, Breast Cancer Res Treat

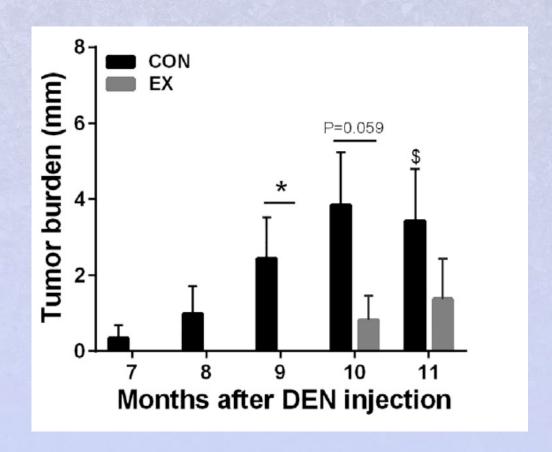






The effect of voluntary wheel running tumor incidence and burden











The effect of voluntary wheel running on tumor growth



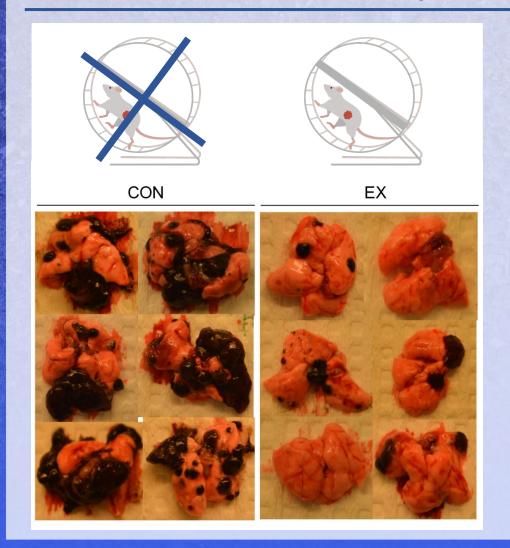








The effect of voluntary wheel running on tumor growth

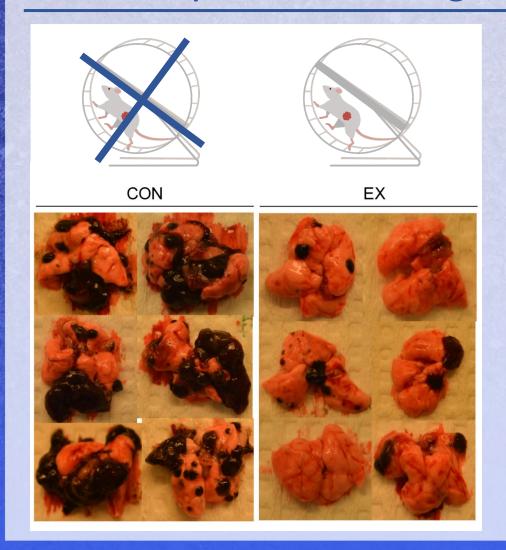


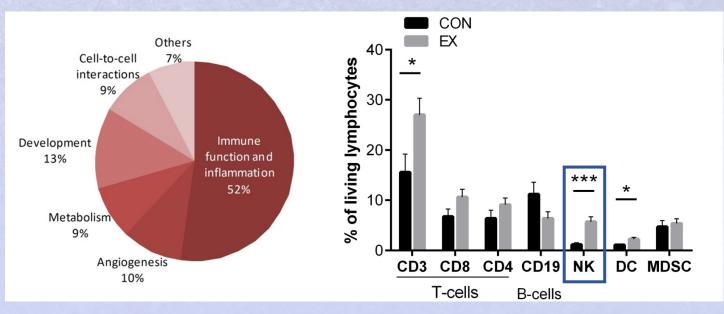






Voluntary wheel running increases tumor NK cell infiltration



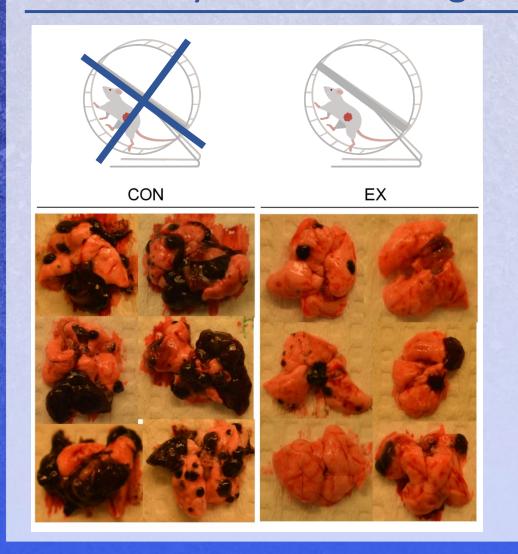


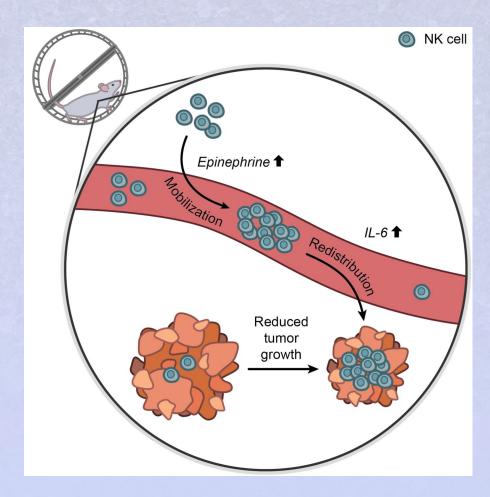






Voluntary wheel running increases tumor NK cell infiltration



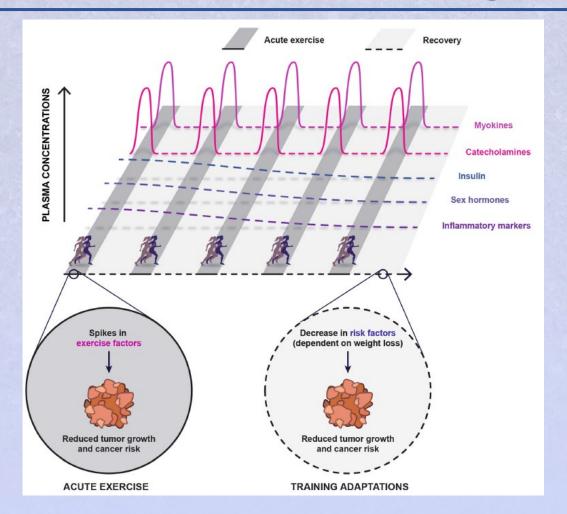


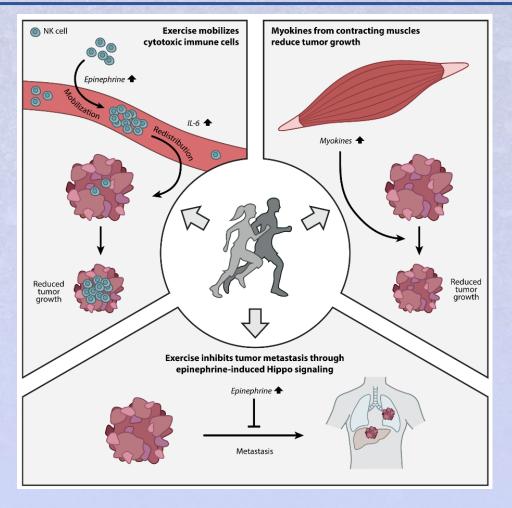






Molecular mechanisms linking exercise to cancer prevention





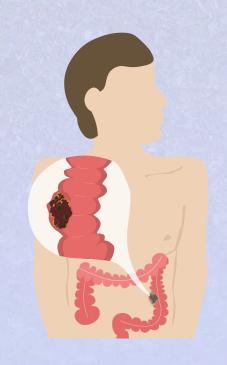
Christensen, Simonsen, and Hojman 2019, Compr Phys; Hojman et al. 2018, Cell Metab







Primary prevention: Physical activity as a protective factor for cancer onset



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