Gesundheitsförderung und Prävention durch Bewegung

Andreas M. Nieß[1, 2]

[1] *Innere Medizin V, Abteilung Sportmedizin, Universitätsklinikum Tübingen*

[2] *Interfakultäres Forschungsinstitut für Sport und körperliche Aktivität, Universität Tübingen*

04.05.20

Universitätsklinikum Tübingen

Agenda

Epidemiologische Studien

Mechanismen körperlicher Aktivität

Individuelle Dosis-Wirkungsbeziehung

Körperliche Aktivität und Krankheitsrisiko – Die historische Entwicklung

Inzidenz der KHK

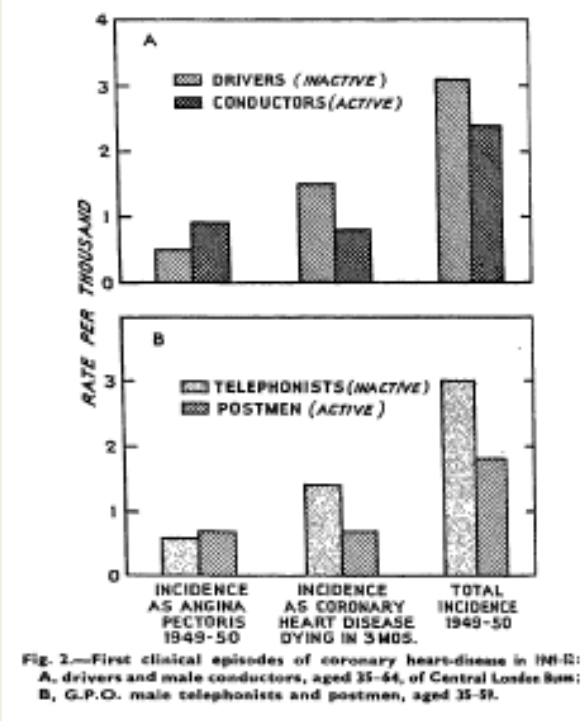
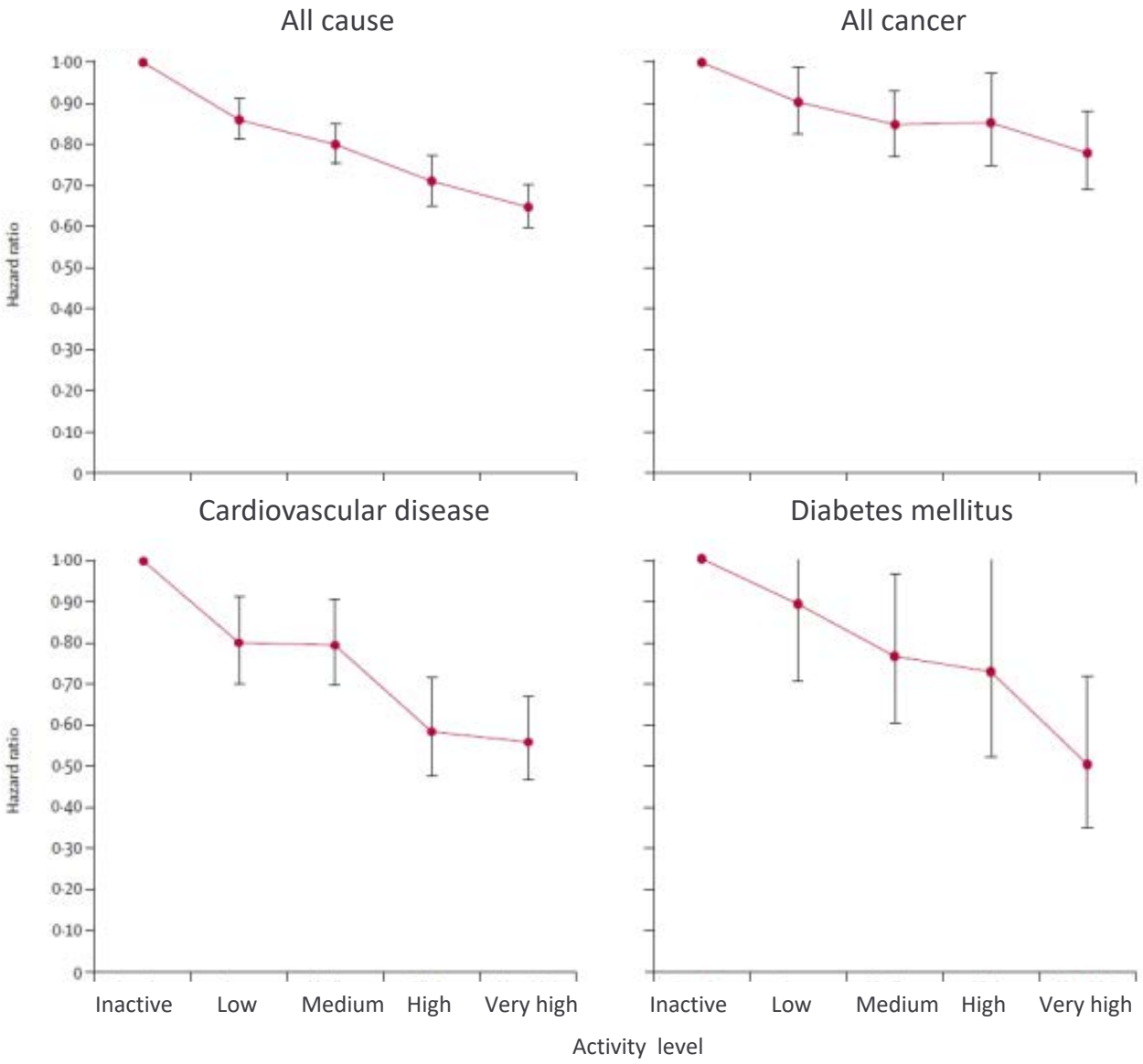


Fig. 2.—First clinical episodes of coronary heart-disease in 1949-50: A, drivers and male conductors, aged 35-64, of Central London Bus; B, G.P.O. male telephonists and postmen, aged 35-64.

Morris et al. (1953) *Lancet* 265: 1111-20

Wen et al. *Lancet (2011)* 378: 1244-1253

Epidemiologische Evidenz



Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study

Chi Pang Wen, Jackson Pui Man Wai*, Min Kuang Tsai, Yi Chen Yang, Ting Yuan David Cheng, Meng-Chih Lee, Hui Ting Chan, Chwen Keng Tsao, Shan Pou Tsai, Xifeng Wu*

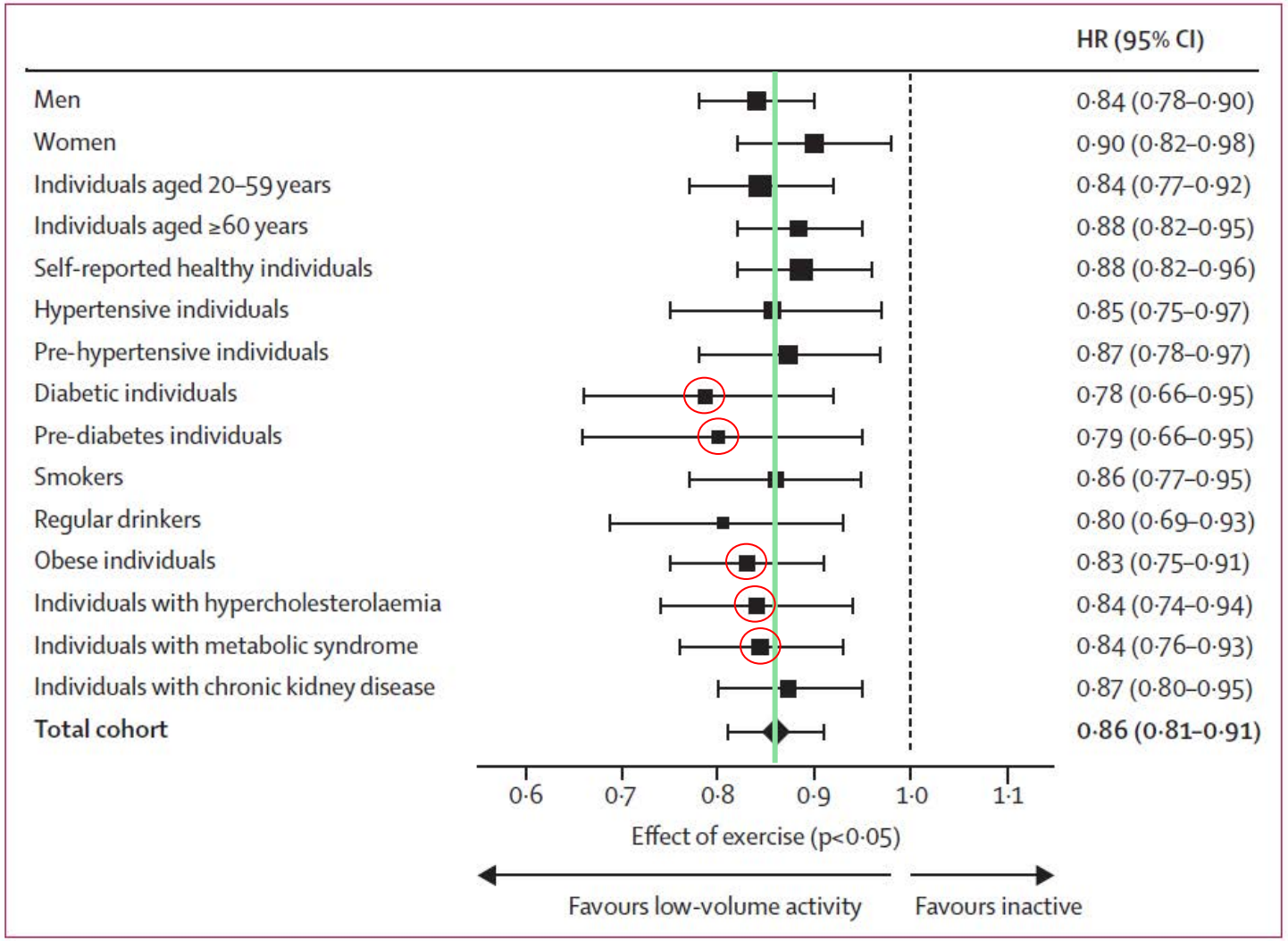
Lancet (2011) 378: 1244-1253

N = 416.175 Personen
199.265 Männer, 216.910 Frauen

Gruppen körperlicher Aktvität (MET-Std. / Woche):

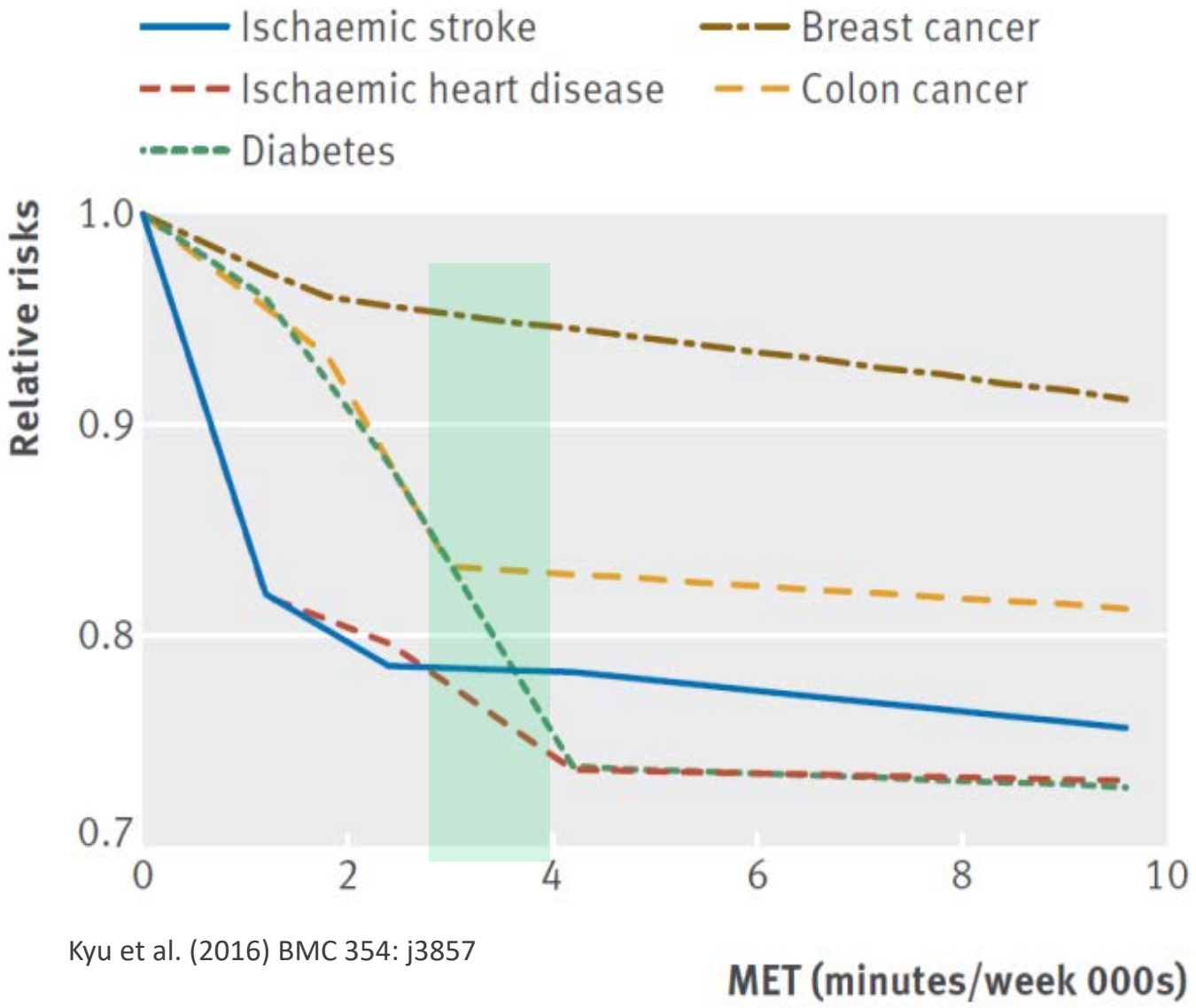
inaktiv:	< 3.75
gering:	3.75 – 7.49
mittlere:	7.49 – 16.49 (z.b. 2.5 Std. Walking)
hohe:	16.49-25.49
Sehr hohe:	> 25.49 (e.g. >3.5 hrs. Jogging)

Epidemiologische Evidenz - Subgruppenanalyse



Wen et al. (2011) *Lancet* 378: 1244-1253

Epidemiologische Evidenz - Gesamtaktivität



Kyu et al. (2016) BMC 354: j3857

Transport

-Täglich 30 min (3 MET)

= 630 MET-min pro Woche

http://igel-in-bayern.br.de/wp-content

Körperliche Aktivität / Training

- 300 min „moderat“ z.b. Walking (4 MET)

oder

- 120 min „intensiver“ z.b. Joggen (10 MET)

= 1.200 MET-min pro Woche

http://www.healthindex.de

Arbeitsplatz / Schreibtisch

inklusive Sitzunterbrechung (Gehen, inkl. Treppen mit 45 min pro Arbeitstag mit 3 MET)

= 675 MET-min pro Woche

http://www.gesund-durch.de

~ 3600 MET-min

Leichte Haus-/Gartenarbeit

- *Täglich 30 min (3 MET)*

= 630 MET-min pro Woche

http://www.evidero.de/gartenarbeit-verbraucht-kalorien

Sonstiges

An-/Auskleiden, Waschen, etc.

= 500 MET-min pro Woche

Epidemiologische Evidenz
- Koronare Herzerkrankung -

Dose Response Between Physical Activity and Risk of Coronary Heart Disease
A Meta-Analysis

Jacob Sattelmair, MSc, ScD; Jeremy Pertman, MS; Eric L. Ding, ScD; Harold W. Kohl III, PhD; William Haskell, PhD; I-Min Lee, MBBS, ScD

Circulation (2011) 124: 789-795

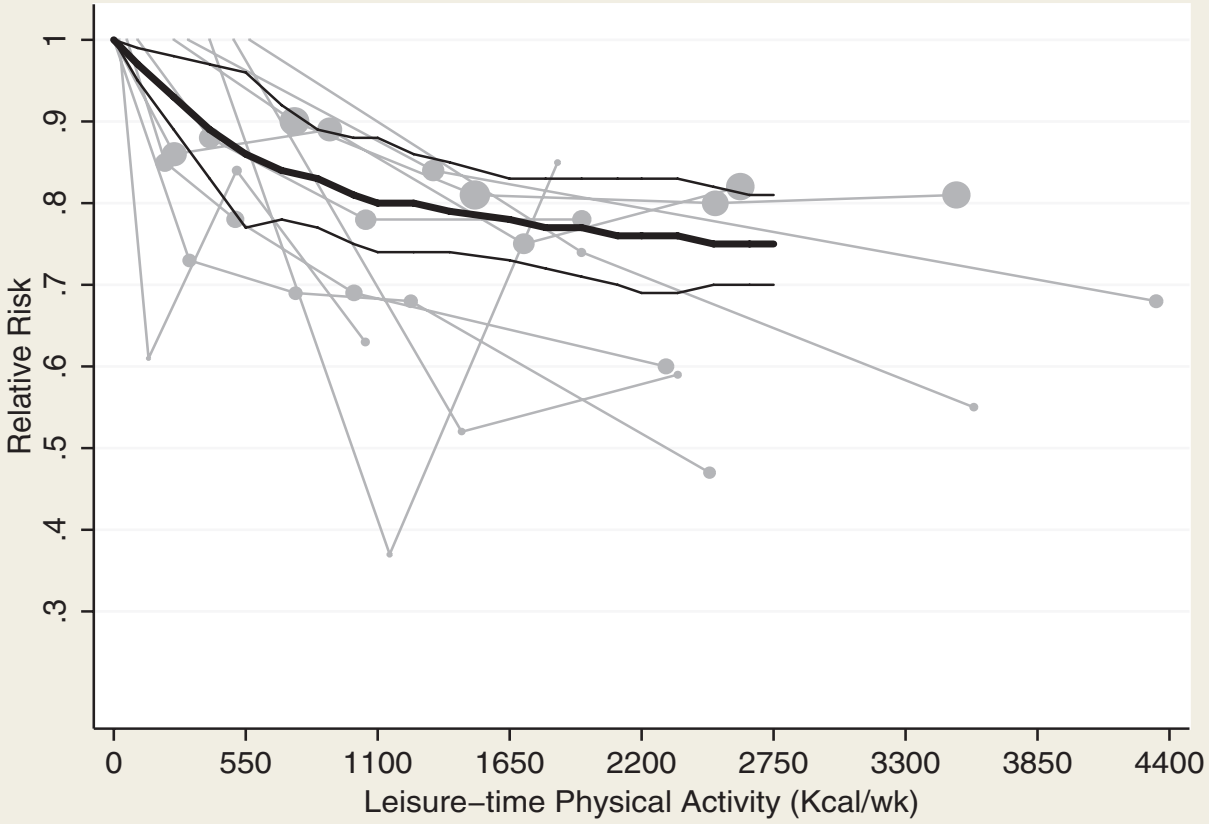


Table. Pooled Relative Risks of Coronary Heart Disease Comparing Highest and Lowest Physical Activity Categories

Type of Activity	Sex	Studies	Relative Risk (95% CI)	I^2, %	Studies, n*
LTPA	Combined	All studies	0.74 (0.69–0.78)	28.3	26
		Quant	0.71 (0.63–0.80)	39.8	9
	Men	All studies	0.78 (0.73–0.82)	0	15
		Quant	0.79 (0.72–0.86)	0	5
	Women	All studies	0.67 (0.61–0.74)	12.5	11
		Quant	0.64 (0.52–0.79)	40.6	5
Total PA	Combined	All studies	0.74 (0.62–0.90)	0	3
	Men	All studies	0.79 (0.59–1.07)	18.9	2
	Women	All studies	0.66 (0.44–0.99)	0	2

Epidemiologische Evidenz

- Typ 2 – Diabetes -

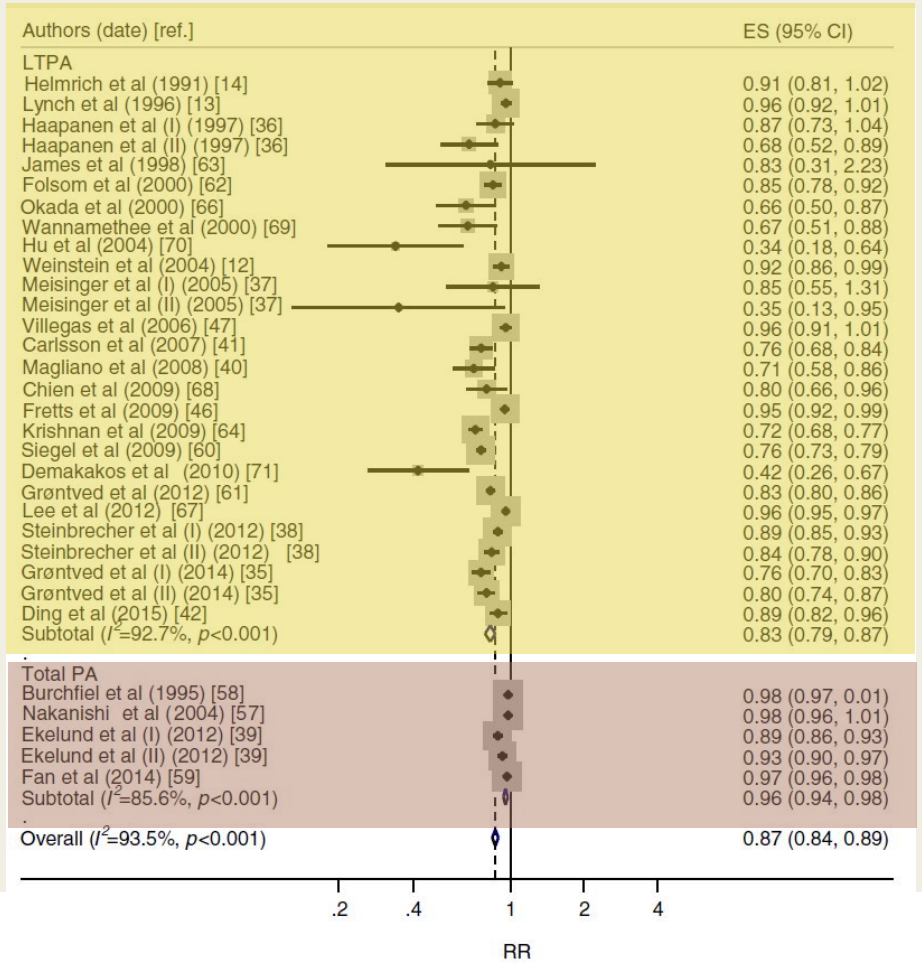
META-ANALYSIS

Physical activity and incident type 2 diabetes mellitus: a systematic review and dose–response meta-analysis of prospective cohort studies

Andrea D. Smith[1,2] · Alessio Crippa[3] · James Woodcock[4] · Søren Brage[5]

Diabetologia (2016) 59: 2527-2545

Risikoreduktion pro 10 MET-Stunden pro Woche



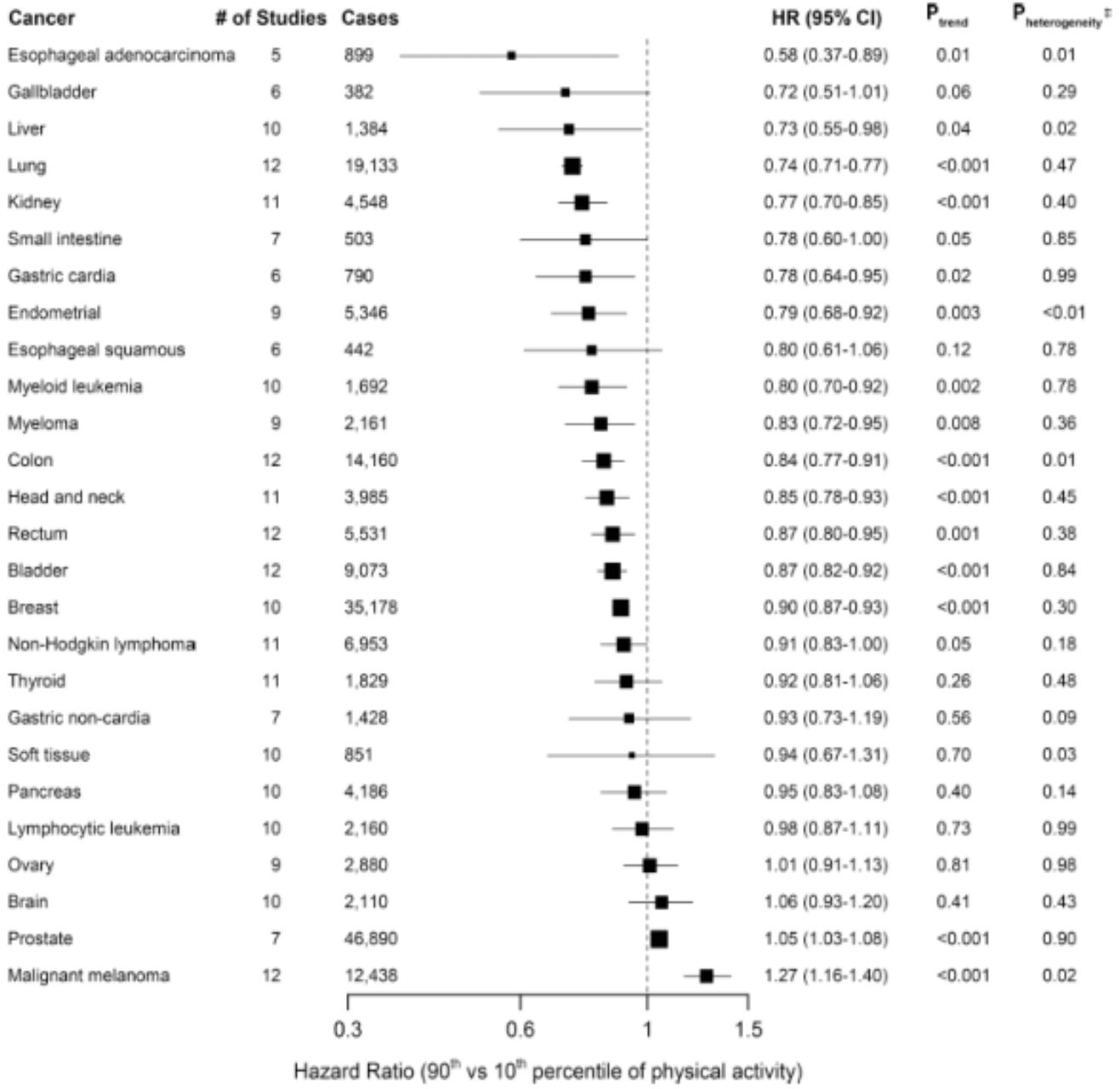
Dosis an körperlicher Aktivität	**Risikoreduktion**
Pro 10 MET-Stunden/Woche	13% (95% CI 11 – 16%)
150 min moderat 11.25 MET-Stunden/Woche	26% (95% CI 20 – 31%)
300 min moderat	36% (95% CI 27 – 46%)
60 MET-Stunden/Woche	53%

Epidemiologische Evidenz
- Neoplastische Erkrankungen -

n = 1.44 Mio. Teilnehmer

In 13 von 26 Tumorentitäten geringeres Risiko unter körperlicher Aktivität

Bei 7 Tumorentitäten Risikoreduktion > 20%



Moore et al. (2016) JAMA Intern Med 176: 816–825

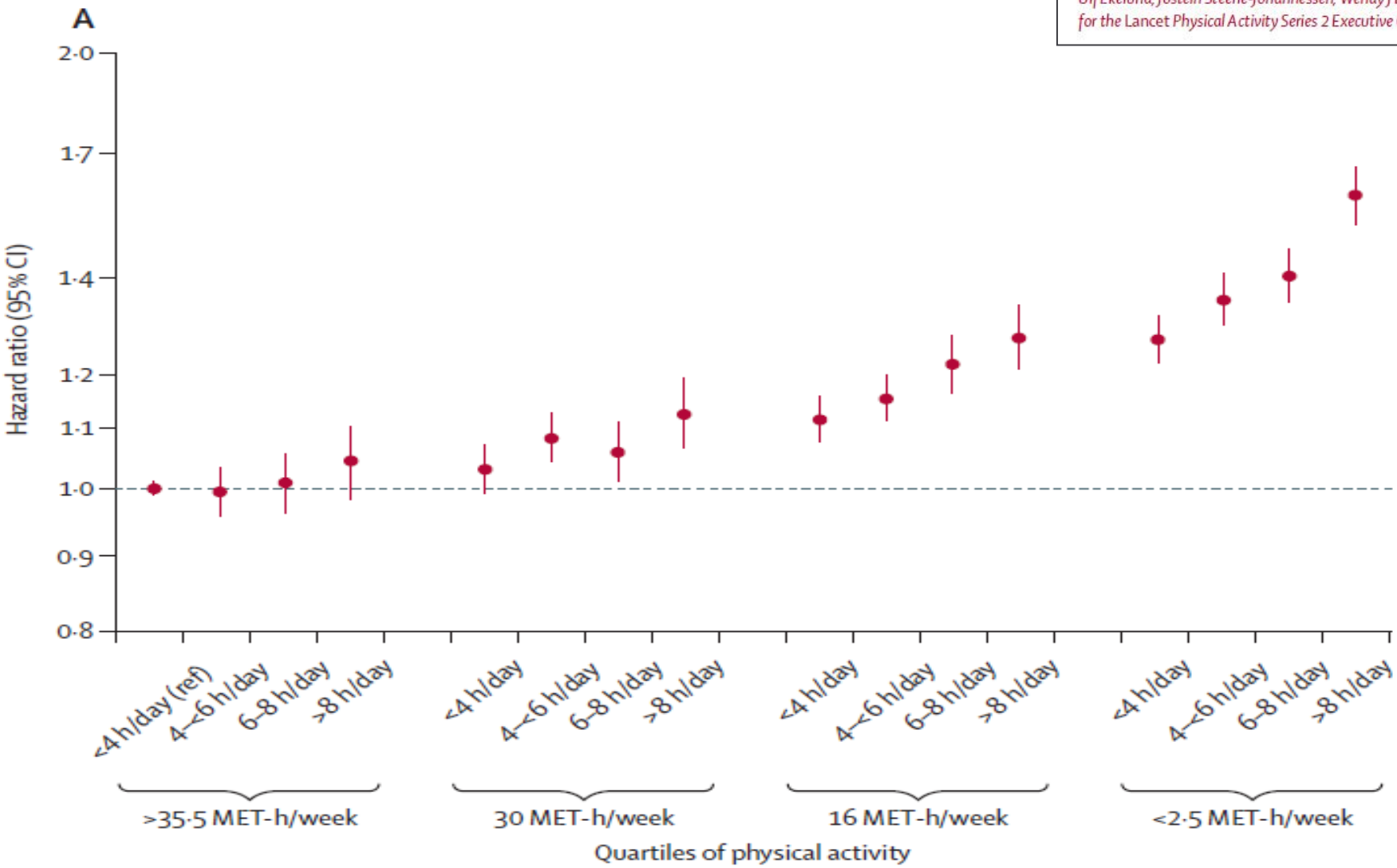
Epidemiologische Evidenz

- Sitzen und Sterblichkeitsrisiko -

Does physical activity attenuate, or even eliminate, the detrimental association of sitting time with mortality? A harmonised meta-analysis of data from more than 1 million men and women

Ulf Ekelund, Jostein Steene-Johannessen, Wendy J Brown, Morten Wang Fagerland, Neville Owen, Kenneth E Powell, Adrian Bauman, I-Min Lee, for the Lancet Physical Activity Series 2 Executive Committe and the Lancet Sedentary Behaviour Working Group**

Lancet (2016) 388: 1302-1310



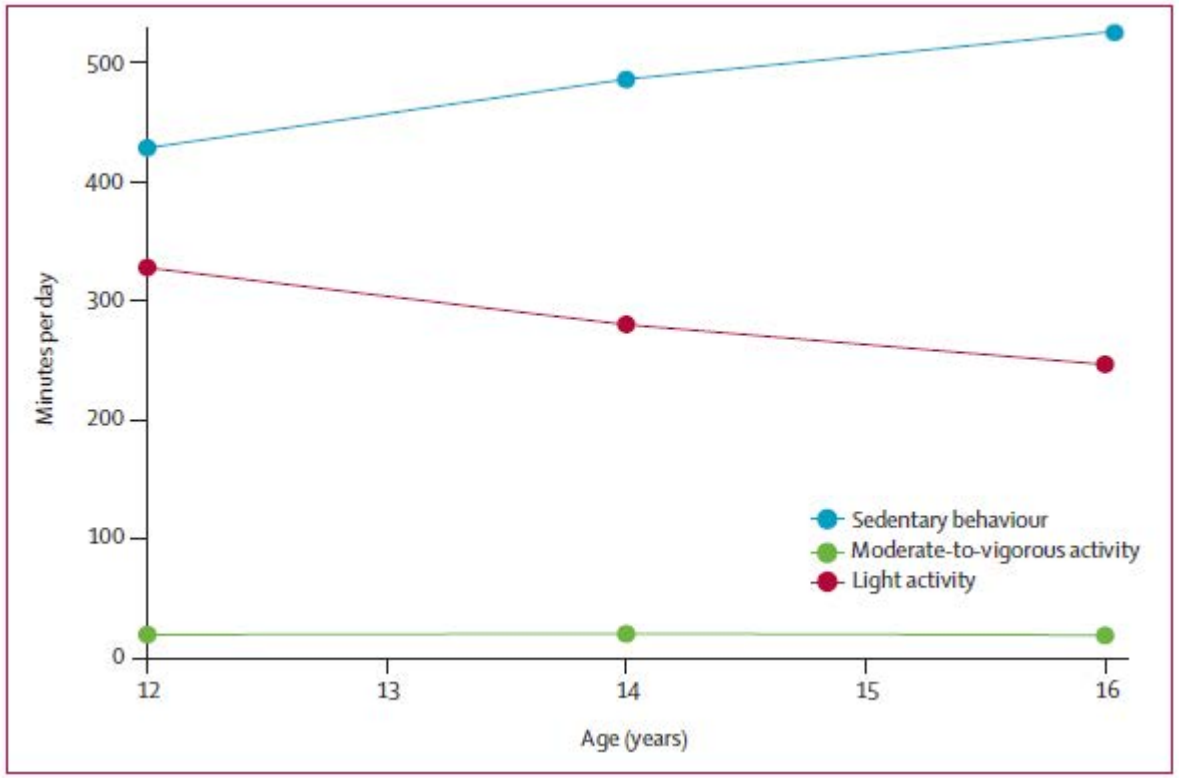
STERN Nr. 16 20-04-2015

Epidemiologische Evidenz
- Inaktivität und Seelische Gesundheit

Depressive symptoms and objectively measured physical activity and sedentary behaviour throughout adolescence: a prospective cohort study

Aaron Kandola, Gemma Lewis, David P J Osborn, Brendon Stubbs, Joseph F Hayes

Lancet Psychiatry (2020) 7: 262-271



	Unadjusted model		Fully adjusted model*	
	IRR (95% CI)	p value	IRR (95% CI)	p value
Exposure at 12 years (n=2486)				
Count per minute (per 100)	0·910 (0·882–0·939)	<0·0001	0·941 (0·910–0·972)	<0·0001
Sedentary behaviour (per 60 min)	1·108 (1·054–1·165)	<0·0001	1·111 (1·051–1·176)	<0·0001
Light activity (per 60 min)	0·883 (0·834–0·933)	<0·0001	0·904 (0·850–0·961)	0·0012
Moderate-to-vigorous activity (per 15 mins)	0·848 (0·863–0·965)	<0·0001	0·910 (0·857–0·966)	0·0018
Exposure at 14 years (n=1938)				
Count per minute (per 100)	0·933 (0·902–0·965)	<0·0001	0·965 (0·932–0·999)	0·0443
Sedentary behaviour (per 60 min)	1·114 (1·057–1·175)	<0·0001	1·080 (1·012–1·152)	0·0200
Light activity (per 60 min)	0·908 (0·851–0·970)	0·0044	0·922 (0·857–0·992)	0·0299
Moderate-to-vigorous activity (per 15 mins)	0·913 (0·863–0·965)	0·0409	0·960 (0·905–1·018)	0·1691
Exposure at 16 years (n=1220)				
Count per minute (per 100)	0·939 (0·896–0·983)	0·0072	0·984 (0·937–1·033)	0·5092
Sedentary behaviour (per 60 min)	1·101 (1·026–1·180)	0·0068	1·107 (1·015–1·208)	0·0210
Light activity (per 60 min)	0·882 (0·810–0·961)	0·0040	0·889 (0·809–0·974)	0·0133
Moderate-to-vigorous activity (per 15 mins)	0·938 (0·883–0·997)	0·0413	1·001 (0·936–1·071)	0·9662

Depression at 18 years of age was assessed with the Clinical Interview Schedule-Revised. IRR=incidence rate ratio.
*Adjusted for sex, maternal social class, parental psychiatric history, parental education, ethnicity, baseline depression, and total accelerometer wear time at each timepoint.

Table 3: **Longitudinal associations between depression scores at 18 years and different levels of physical activity and sedentary behaviour at 12 years, 14 years, and 16 years of age**

„Polypill“ Körperliche Aktivität

http://www.healthexpress.eu/de

Wirkmechanismen körperlicher Aktivität

- Insulinresistenz -

Glucose Transporter Number, Function, and Subcellular Distribution in Rat Skeletal Muscle After Exercise Training

LAURIE J. GOODYEAR, MICHAEL F. HIRSHMAN, PATRICIA M. VALYOU, AND EDWARD S. HORTON

Diabetes (1992) 41: 1091-1099

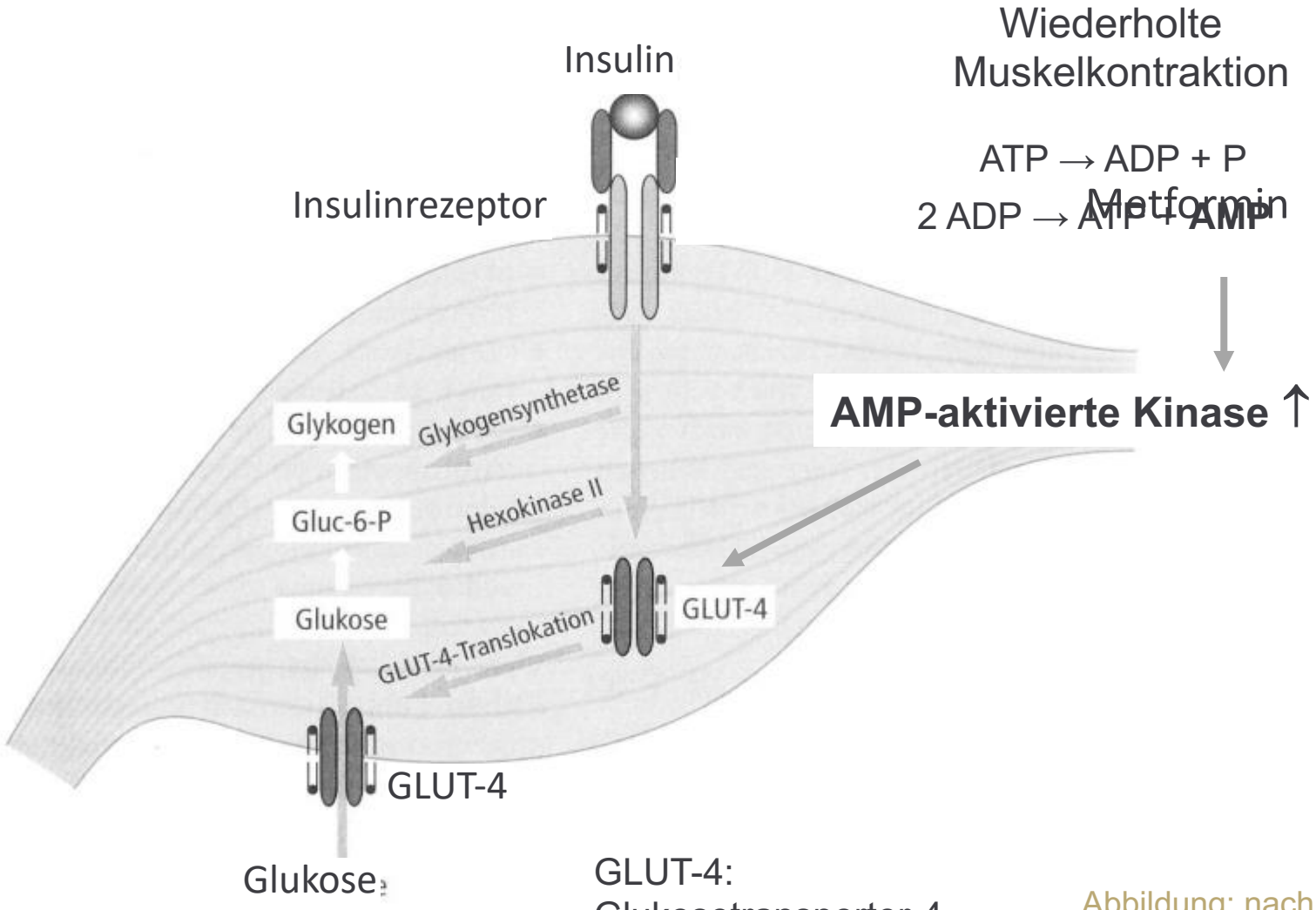
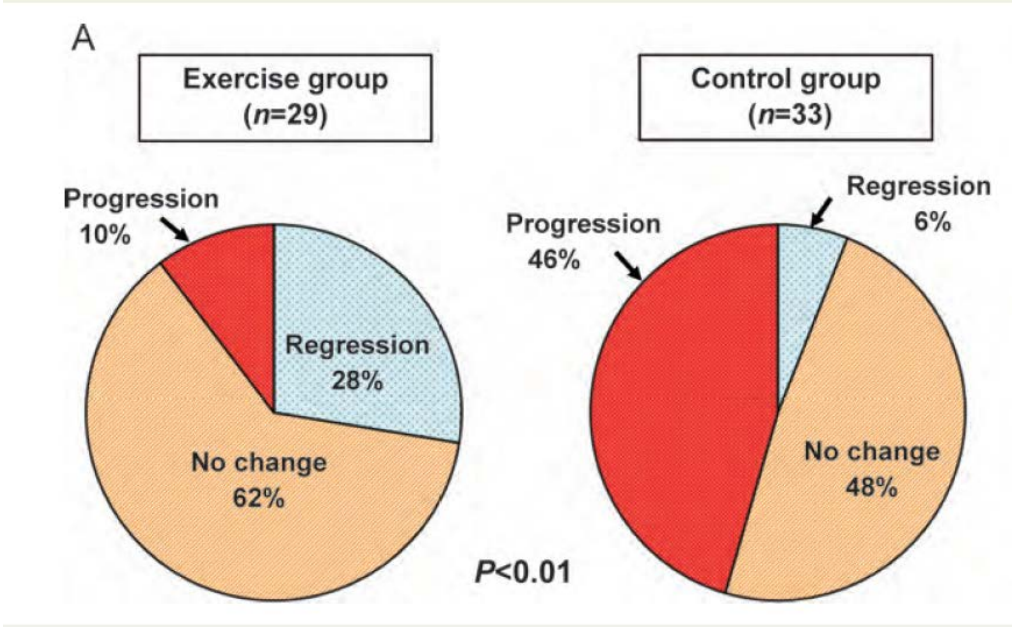
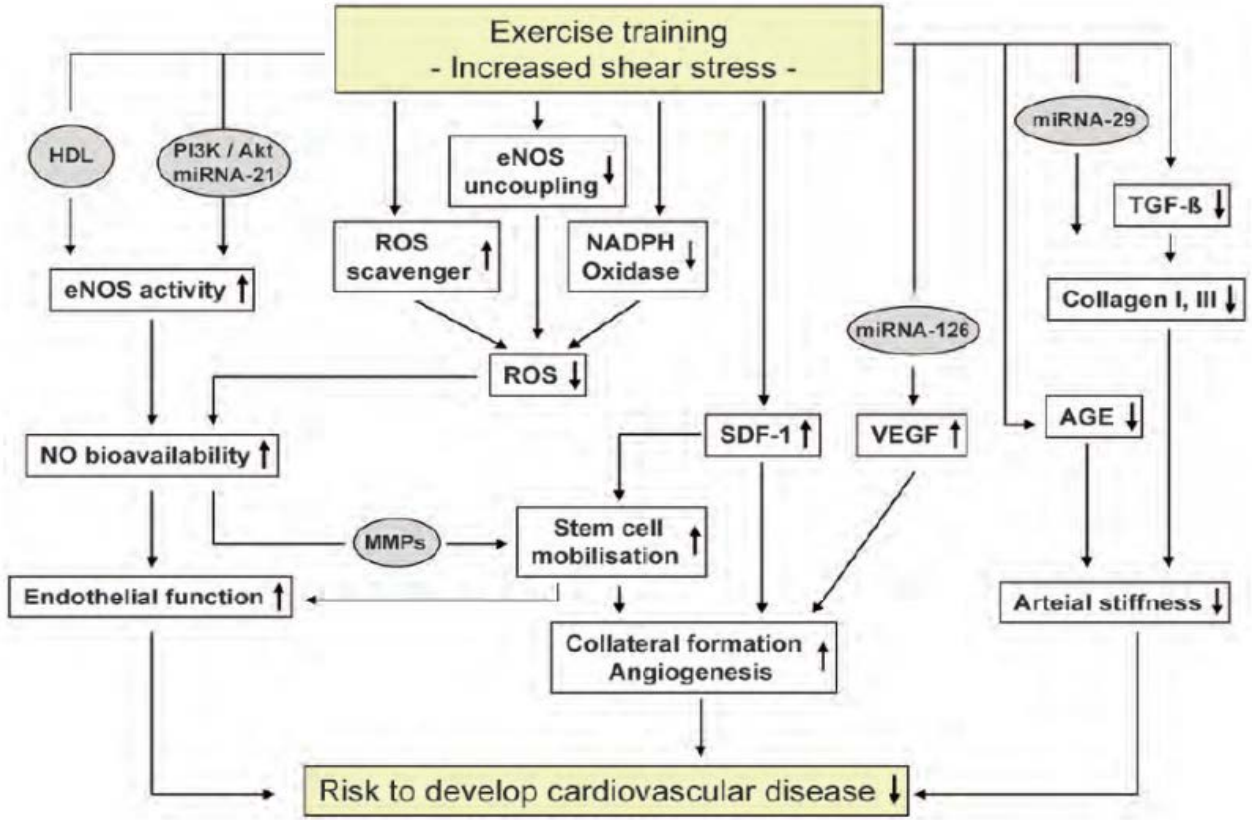


Abbildung: nach König et al. *Dtsch Z Sportmed* (2006) 57: 242 – 247

Wirkmechanismen körperlicher Aktivität
- Kardiovaskuläre Erkrankungen –

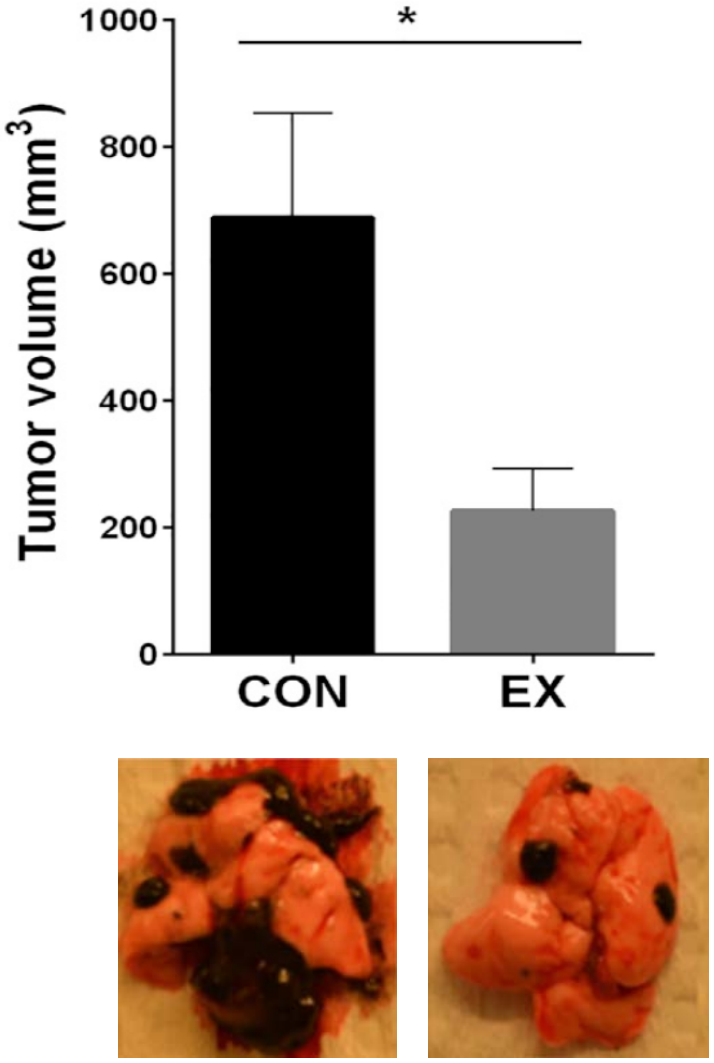
Koronare Arteriosklerose im 12-monatigen Follow-up





Schuler et al. (2018) Eur Heart J 34: 1790–1799

Wirkmechanismen körperlicher Aktivität - Krebserkrankungen -

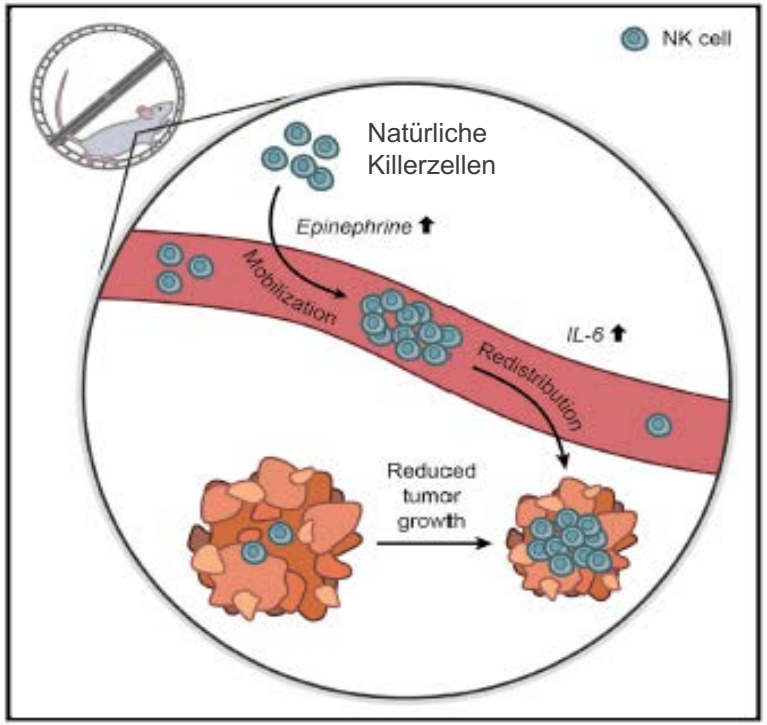


(2016) 23, 554–562

Cell Metabolism

Voluntary Running Suppresses Tumor Growth through Epinephrine- and IL-6-Dependent NK Cell Mobilization and Redistribution

Graphical Abstract



Authors

Line Pedersen, Manja Idorn, Gitte H. Olofsson, ..., Bente K. Pedersen, Per thor Straten, Pernille Hojman

Correspondence

phojman@inflammation-metabolism.dk

In Brief

The beneficial effects of exercise are countless. Pedersen et al. now link exercise, cancer, and immunity and reveal that exercise decreases tumor incidence and growth by over 60% across several mouse tumor models through a direct regulation of NK cell mobilization and trafficking in an epinephrine- and IL-6-dependent manner.

Wirksamkeit körperlicher Aktivität - Qualitative Aspekte

Kraft vs. Ausdauertraining

Variable	Aerobes Ausdauertraining	Kraft-training
Maximale Sauerstoffaufnahme	↑ ↑	↔/↑
Leistung an der individuellen anaeroben (Laktat-)Schwelle	↑ ↑ ↑	↔/↑
Körperfettanteil (%)	↓ ↓	↓
Fettfreie Körpermasse	↔/↑	↑ ↑
Muskelkraft	↔/↑	↑ ↑ ↑
Ektope Fettspeicher (Leber, viszeral)	↓ ↓ ↓	↔/↓
Insulinsensitivität	↑ ↑	↑ ↑
HDL-Cholesterin	↑	↔/↑
LDL-Cholesterin	↔/↓	↔/↓
Ruheumsatz	↑	↑
Herz-Kreislauf-System:		
▪ Ruheherzfrequenz	↓ ↓	↔/↓
▪ Schlagvolumen	↑ ↑	↔
▪ Ruheblutdruck (systolisch)	↓	↓
▪ Ruheblutdruck (diastolisch)	↓	↓

Nieß & Thiel (2017) *Diabetologie* 12: 112-126

Adapted from Pollok et al., 2001; Mandic et al., 2012
Fagard et al. 2006

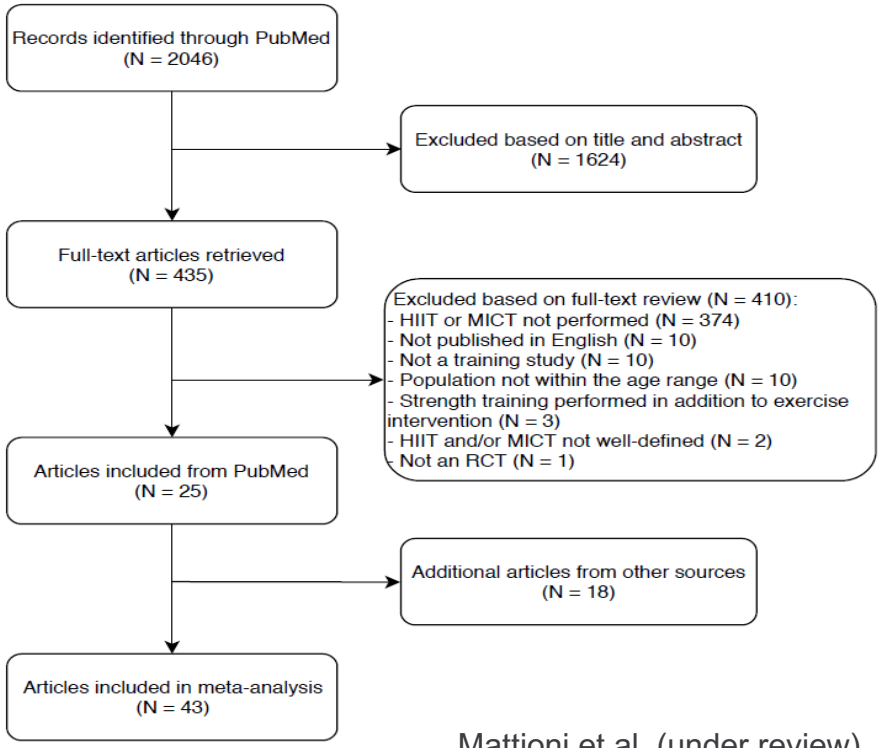
Wirksamkeit körperlicher Aktivität - Qualitative Aspekte

Metabolic Adaptations to Short-term High-Intensity Interval Training: A Little Pain for a Lot of Gain?

Martin J. Gibala,[1] and Sean L. McGee[2]

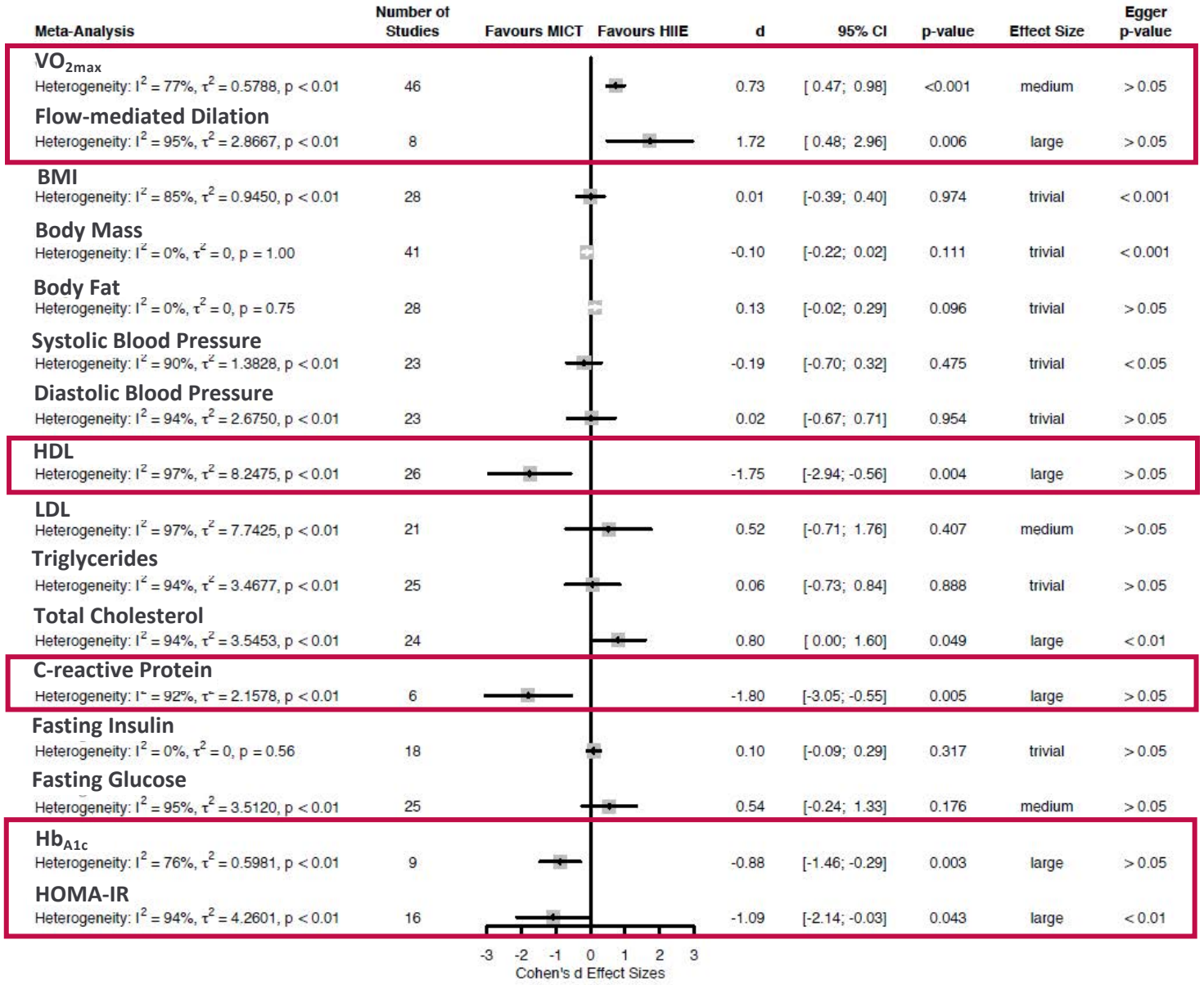
[1]Exercise Metabolism Research Group, Department of Kinesiology, McMaster University, Hamilton, Ontario, Canada; and [2]Department of Physiology, University of Melbourne, Melbourne, Victoria, Australia

Exerc Sport Sci Rev (2008) 36: 58-63



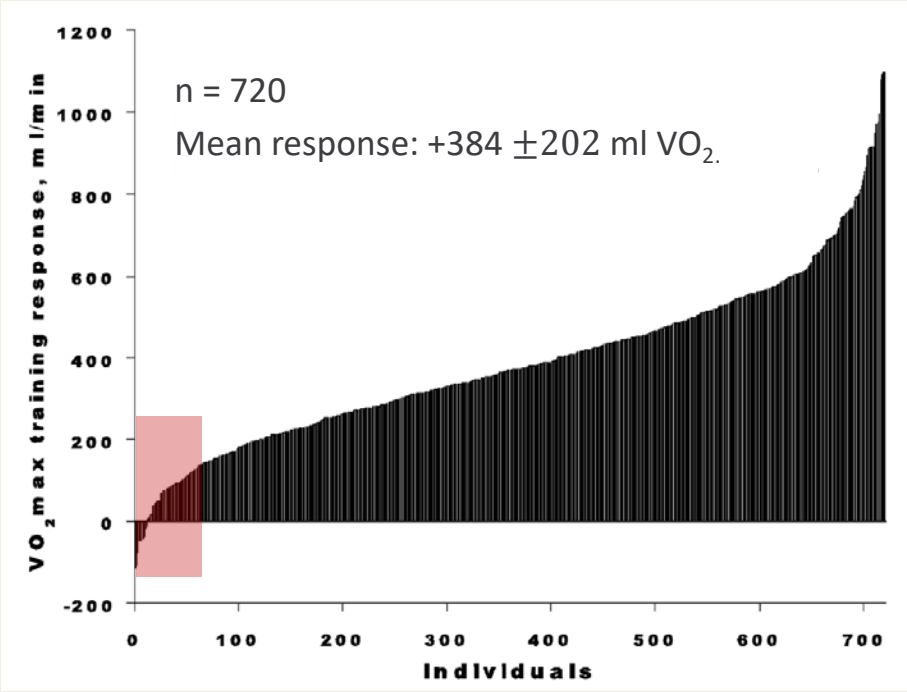
Mattioni et al. (under review)

Cardio-metabolic risk factors adaptations in HIIE and MICT: A meta-analysis



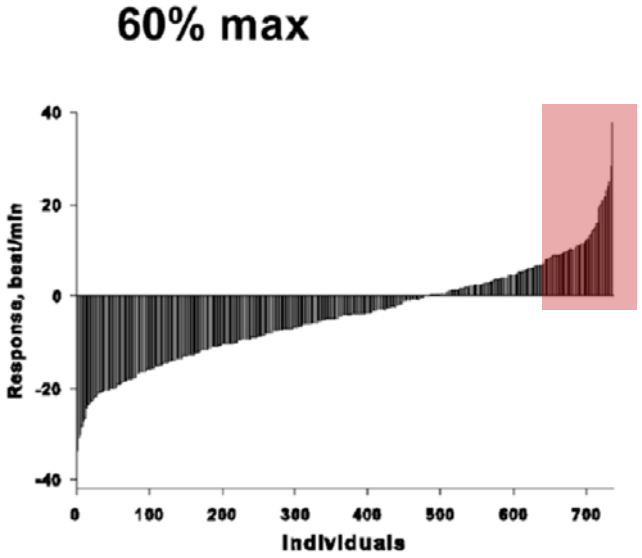
Individuelle Trainierbarkeit

Maximale Sauerstoffaufnahme

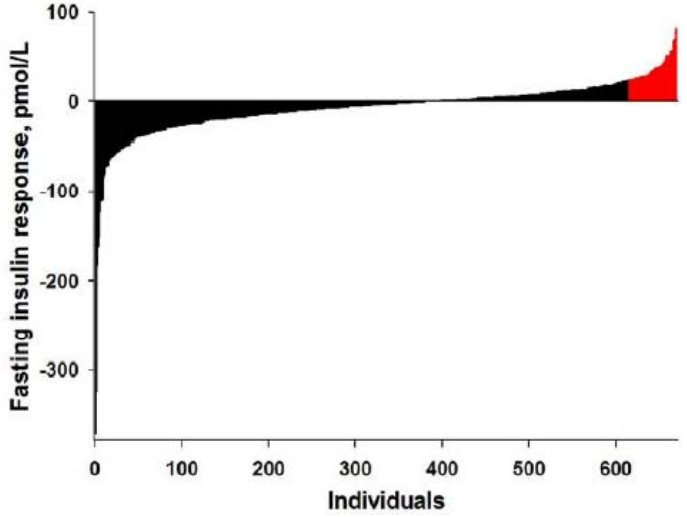


Bouchard & Rankinen (2001) *Med Sci Sports Exerc* 33: S446

Belastungs-Herzfrequenz



Nüchtern-Insulin



Bouchard et al. (2012) PLoS ONE 7: e37887

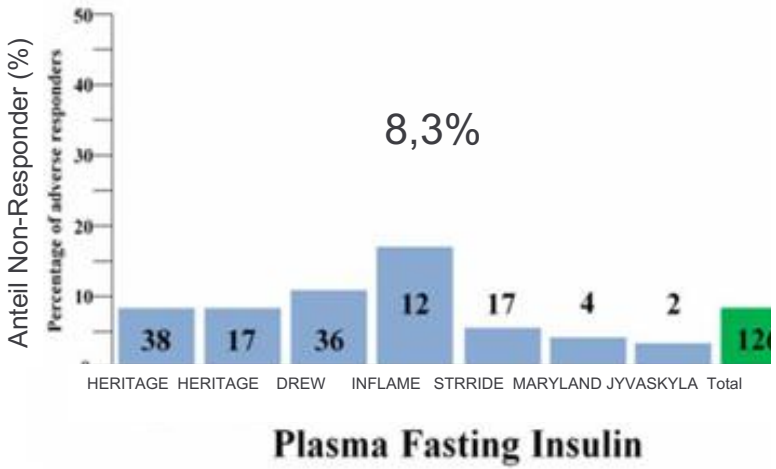
Individuelle Trainierbarkeit

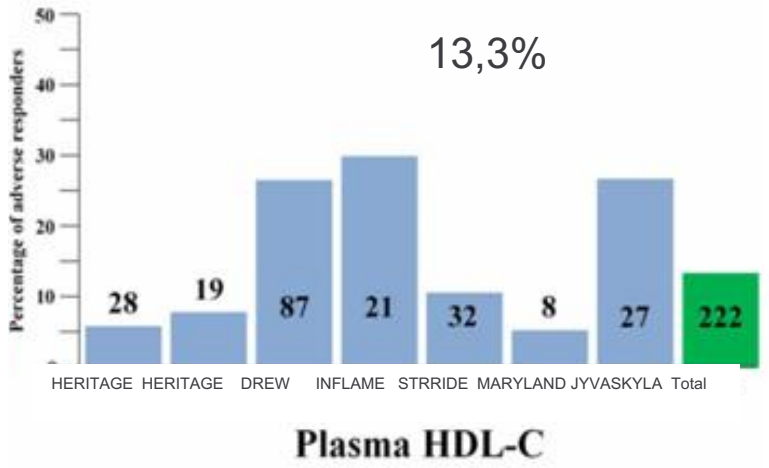
OPEN ACCESS Freely available online PLoS one

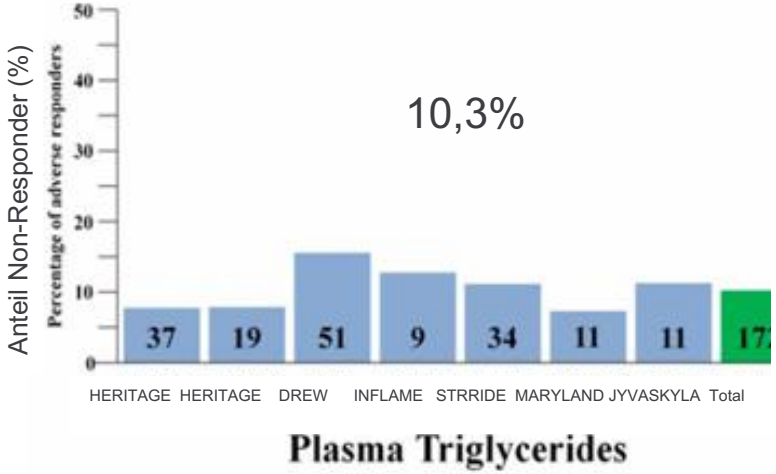
Adverse Metabolic Response to Regular Exercise: Is It a Rare or Common Occurrence?

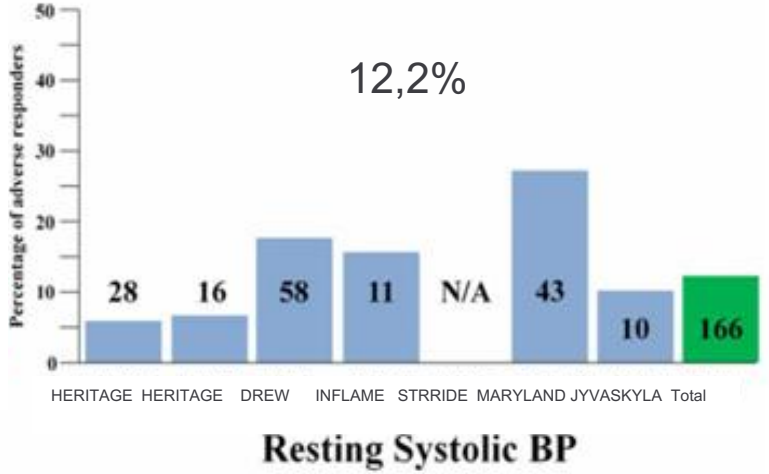
Claude Bouchard[1*], Steven N. Blair[2], Timothy S. Church[3], Conrad P. Earnest[3], James M. Hagberg[4], Keijo Häkkinen[5], Nathan T. Jenkins[4¤], Laura Karavirta[5], William E. Kraus[6], Arthur S. Leon[7], D. C. Rao[8], Mark A. Sarzynski[1], James S. Skinner[9], Cris A. Slentz[6], Tuomo Rankinen[1]

PLoS ONE (2012) 7: e37887









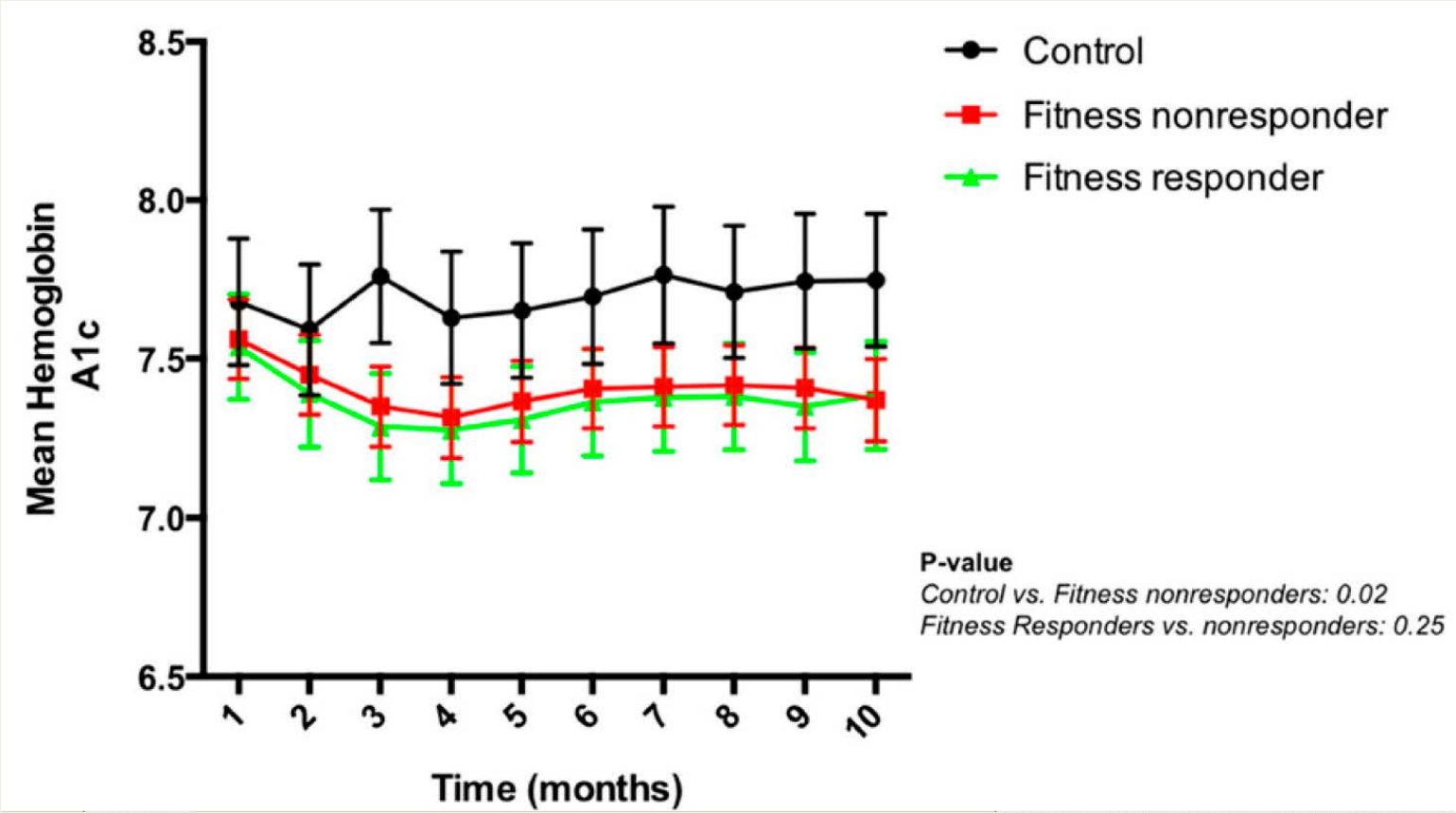
Anteil Non – Responder für
1 RF: 31%
2 RF: 6%
3-4 RF: 0,8%

Individuelle Trainierbarkeit

Metabolic Effects of Exercise Training Among Fitness-Nonresponsive Patients With Type 2 Diabetes: The HART-D Study

Ambarish Pandey,[1] Damon L. Swift,[2] Darren K. McGuire,[1,3] Colby R. Ayers,[3] Ian J. Neeland,[1] Steven N. Blair,[4] Neil Johannsen,[5] Conrad P. Earnest,[6] Jarett D. Berry,[1,3] and Timothy S. Church[7]

Diabetes Care 2015;38:1494–1501 | DOI: 10.2337/dc14-2378



n = 202 Personen mit Typ-2-Diabetes

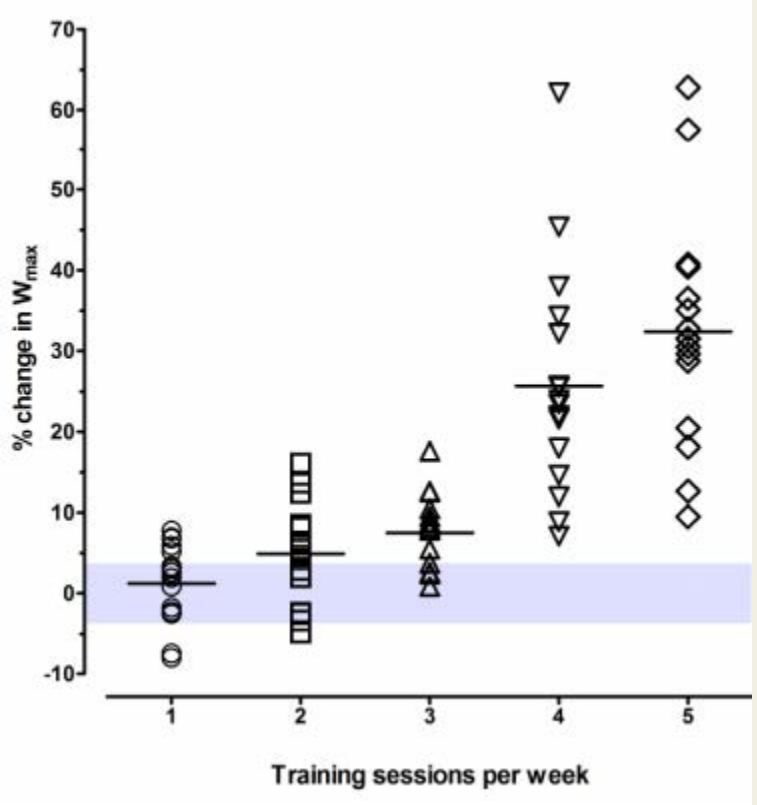
9-monatiges Trainingsintervention
3-5 x Ausdauer-/Kraft-/Kombitraining/Woche
bei 50-80% VO_{2peak}

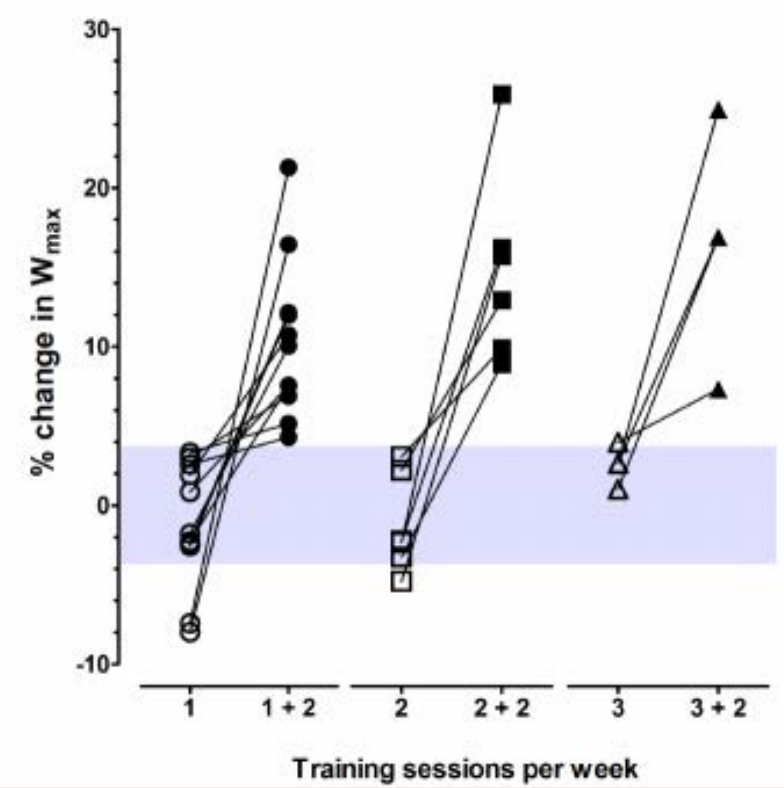
Refuting the myth of non-response to exercise training: 'non-responders' do respond to higher dose of training

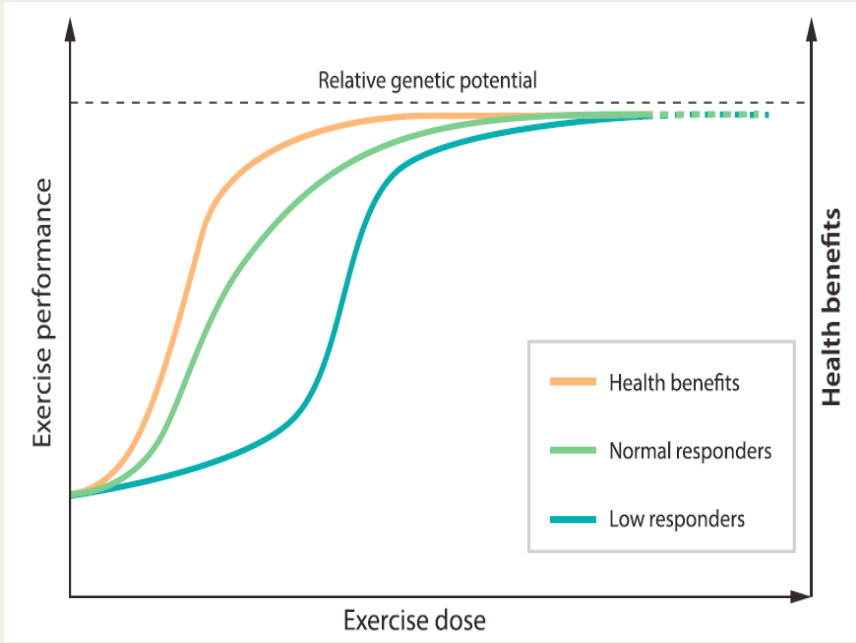
David Montero[1,2] and Carsten Lundby[1]

J Physiol (2017) 595: 3377-3387

Individuelle Trainierbarkeit
Alles nur eine Frage der Dosis ?

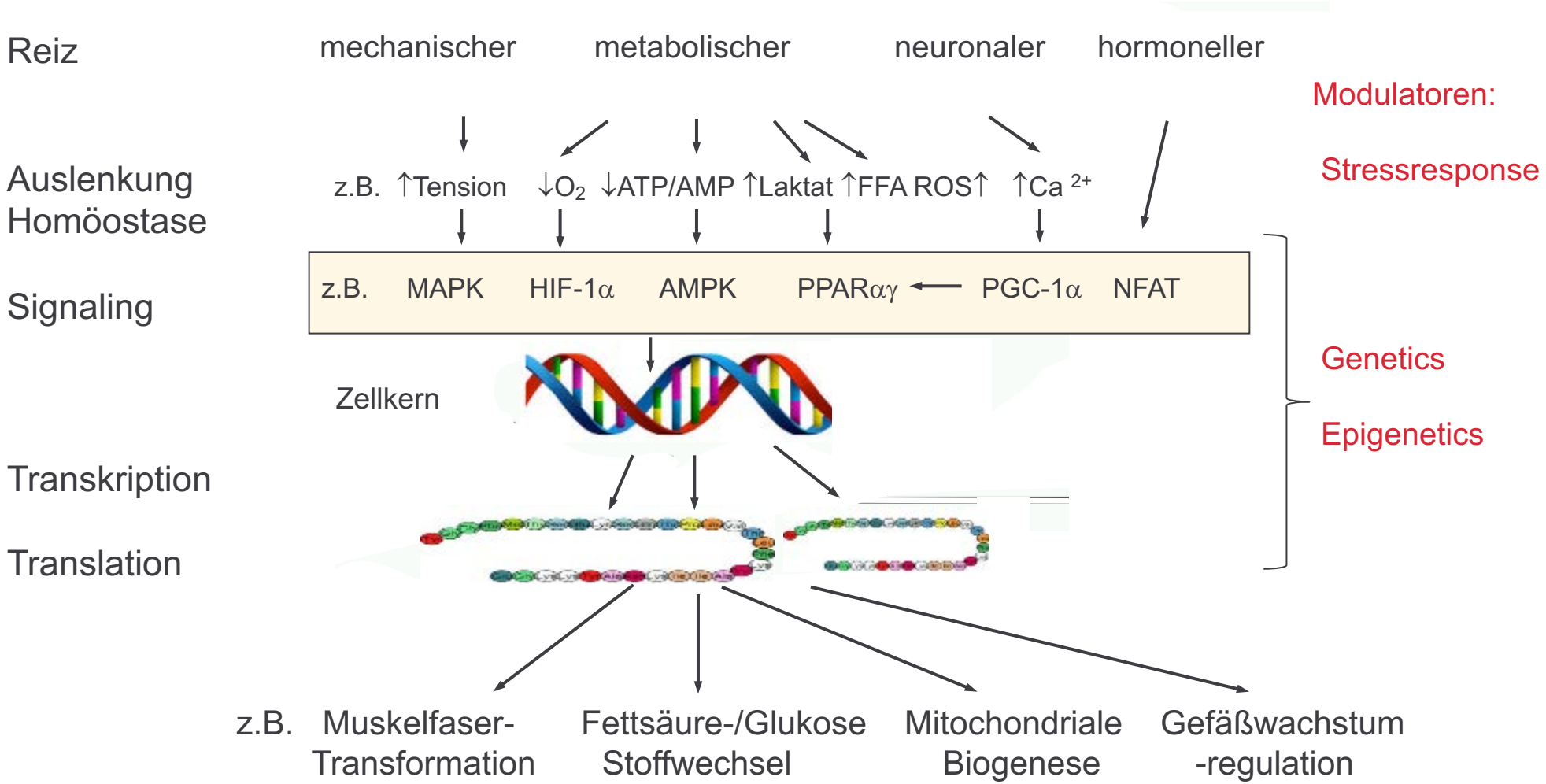






Gabriel & Zierath (2017) Cell Metabol 25: 1000-1011

Vom vom Trainingsreiz zur Trainingsanpassung



modifiziert nach: M. Flück (2006) J Exp Biol 209: 2239 • Hood et al. (2006) J Exp Biol 209: 2265 • Yan et al. (2011) J Appl Physiol 110: 264

Zusammenfassung

Große Evidenz zur Wirksamkeit körperlicher Aktivität aus epidemiologische Studien mit Hinweisen zu Dosis-Wirkungsbeziehung (Gruppeneffekte) als robuste Basis für Empfehlungen zur aktivitätsbasierten Prävention

Wachsende Erkenntnisse zu den zugrundeliegenden Mechanismen körperlicher Aktivität bei der Risikoreduktion mit präzisierenden Hinweisen zur Dosis-Wirkungsbeziehung und Reizqualität sowie unter entitätsspezifischen Gesichtspunkten

Individuelle Dosis-Wirkungsbeziehung körperlicher Aktivität als „offene Flanke“ in der aktivitätsbezogenen Prävention mit der Notwendigkeit des Verfolgens interdisziplinärer Forschungsansätze

Vielen Dank für Ihre Aufmerksamkeit

Universitätsklinikum Tübingen

04.05.20