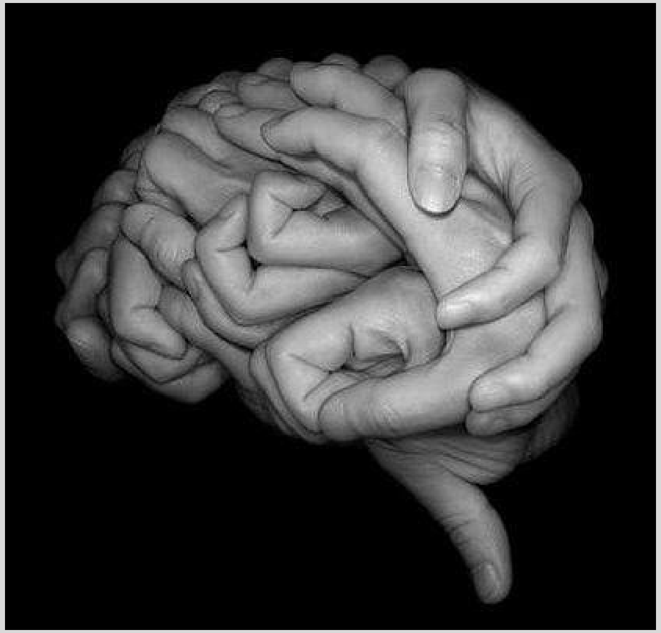
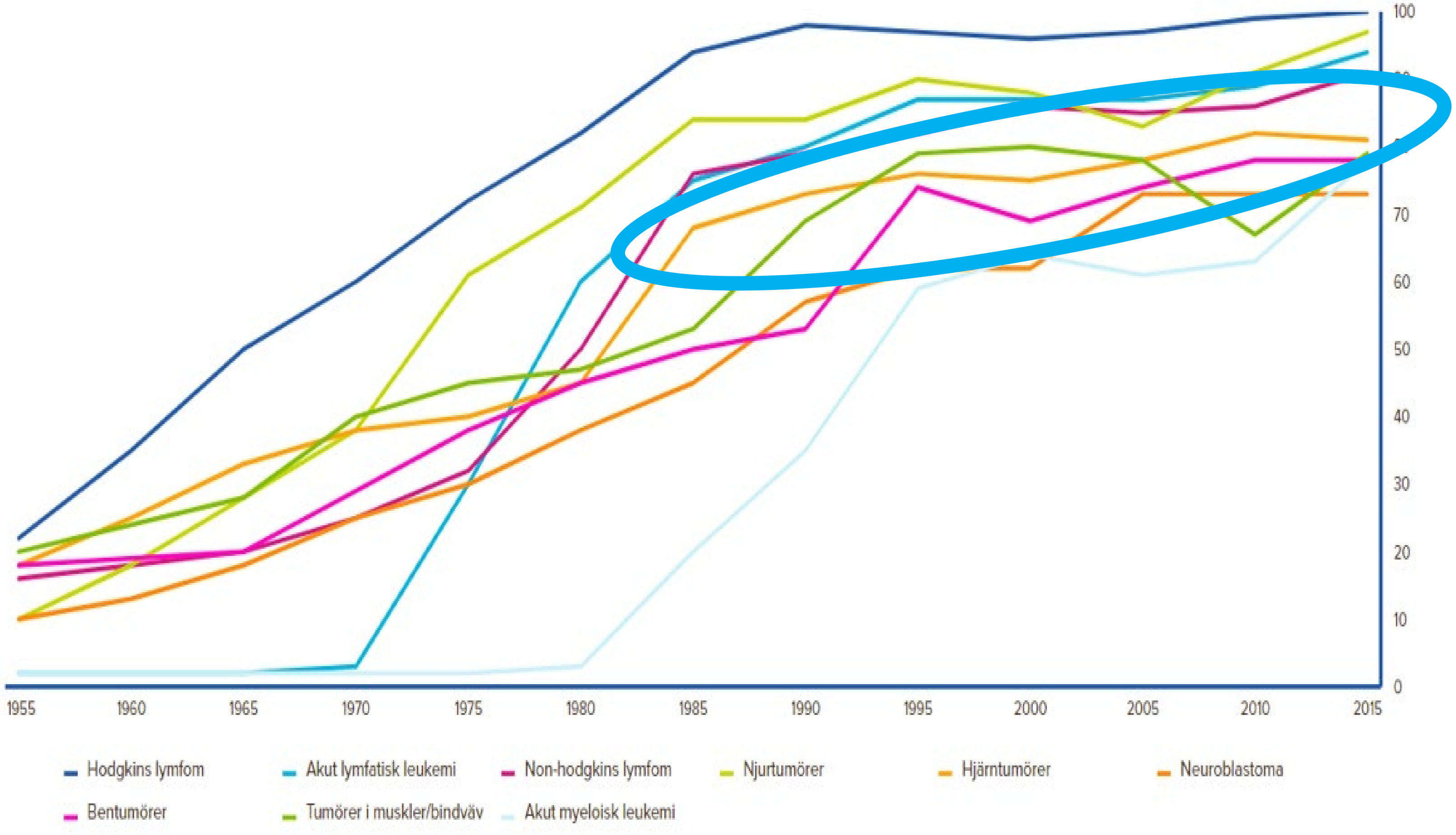
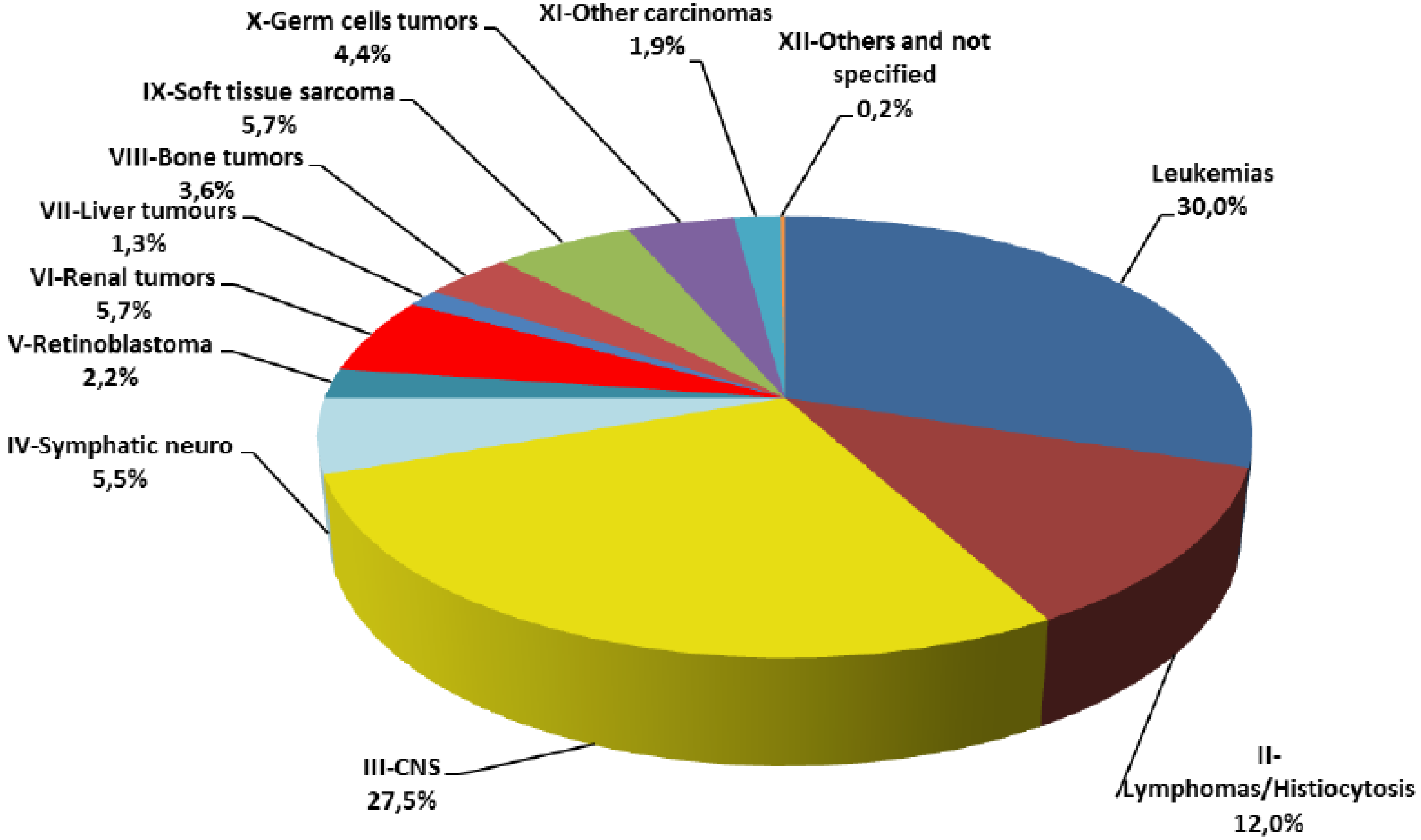


Fysisk aktivitet och hjärnan

Överlevnad (%)

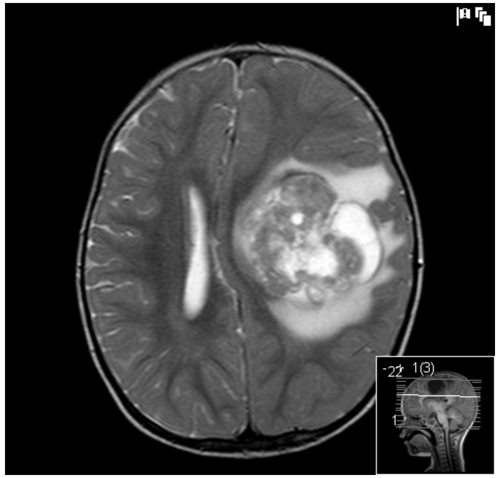

100
70
60
50
40
30
20
10
0
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Hodgkins lymfom
Akut lymfatisk leukemi
Non-hodgkins lymfom
Njurtumörer
Hjärntumörer
Neuroblastoma
Bentumörer
Tumörer i muskler/bindväv
Akut myeloisk leukemi


X-Germ cells tumors
4,4%
XI-Other carcinomas
1,9%
XII-Others and not specified
0,2%
IX-Soft tissue sarcoma
5,7%
VIII-Bone tumors
3,6%
VII-Liver tumours
1,3%
VI-Renal tumors
5,7%
V-Retinoblastoma
2,2%
Leukemias
30,0%
IV-Symphatic neuro
5,5%
III-CNS
27,5%
II-Lymphomas/Histiocytosis
12,0%

- > 80 % långtidsöverlevare
- 1 av 600 unga vuxna är överlevare efter barncancer
- Kognitiva svårigheter

”VI RÄDDAR LIVET PÅ BARNEN MEN ÄR DÅLIGA PÅ ATT HJÄLPA DEM EFTERÅT.”

Ingrid Emanuelson



Hjärntumör – förvärvad hjärnskada

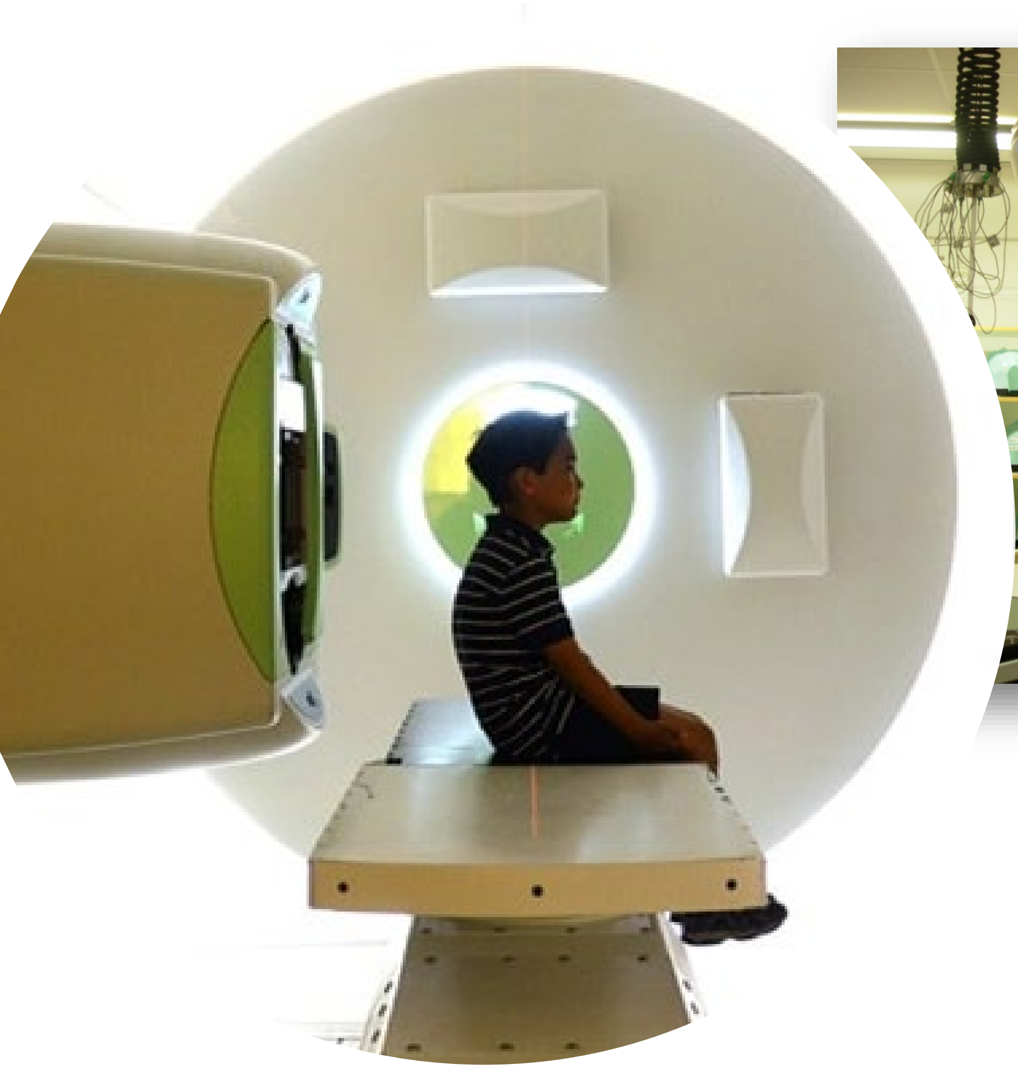
Johan 11 år

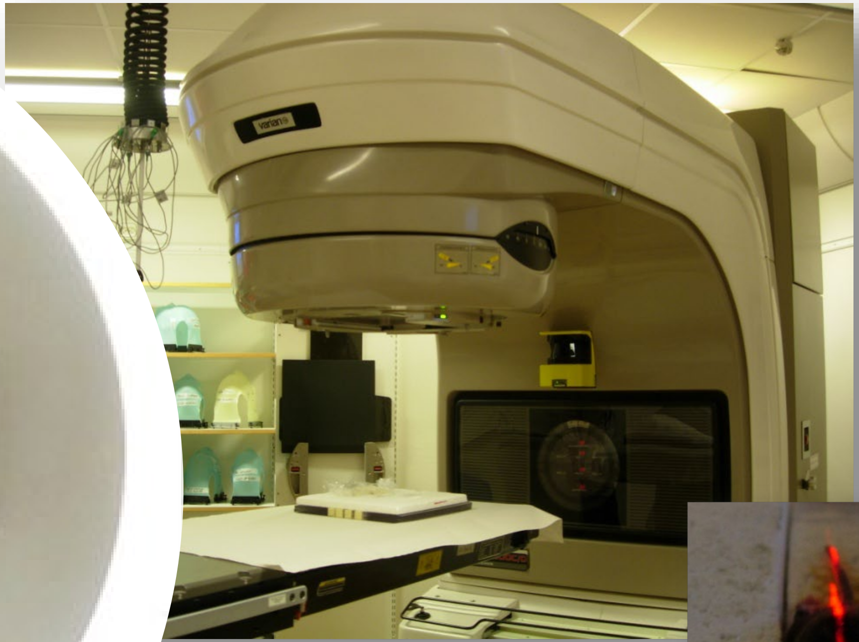
- Medulloblastom
- Kirurgi, strålning och cytostatika
- Färdigbehandlad vid 12 års ålder
- Avstannad tillväxt, GH 13-16 års ålder (7,5 cm kortare än beräknat)
- Hypothyreoidism 14 år
- Thyreoidea-cancer 24 år
- Assistent i skolan, klarade gymnasiet med medel/låga betyg trots mycket pluggande
- Klarade inte högskolestudier, trots assistent

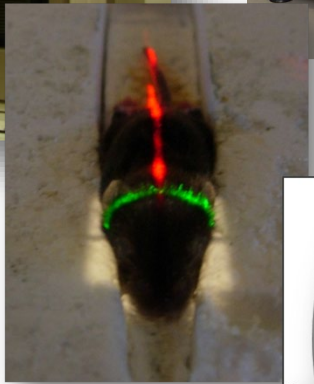
Johan 11 år

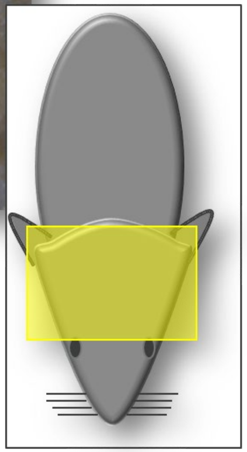
- Gick kvällskurser i programmering, men fick sluta efter en termin
- Problem med minne, processhastighet och förmågan att hantera komplex information
- Bor hos sina föräldrar (27 år)
- Anställd på ett varuhuslager
- Klarade att ta körkort, men har varit med om två mindre olyckor. Långsam reaktionstid. Har slutat köra.
- Han är alltmer olik sina jämnåriga
- Mild depression, vill inte ha behandling

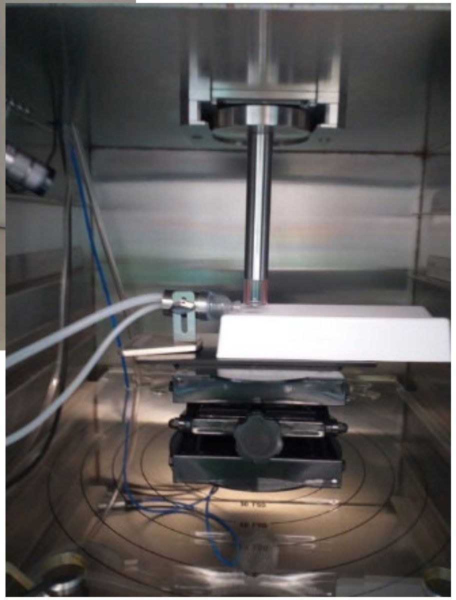
Strålbehandling – vad händer i hjärnan?



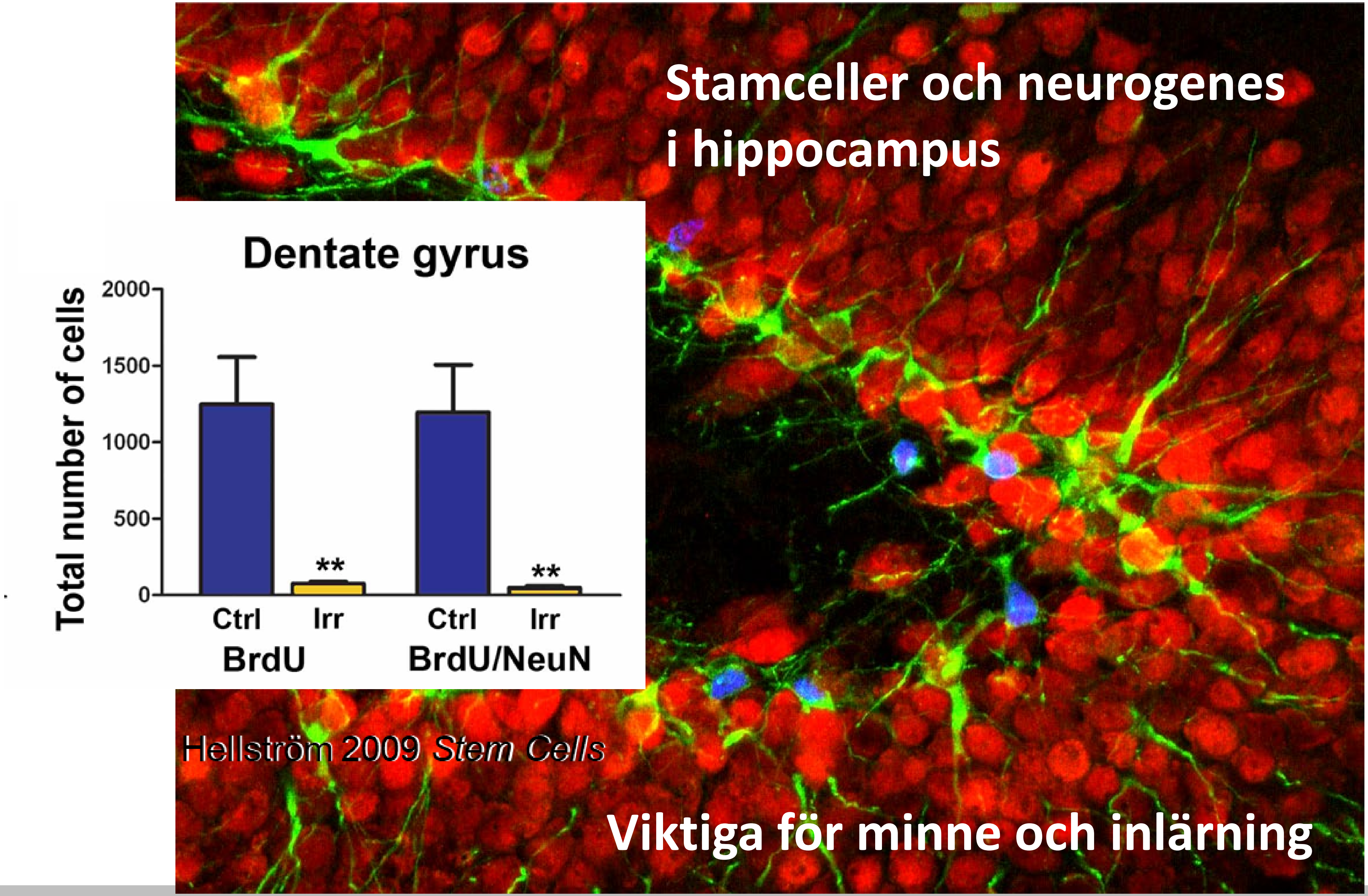








Stamceller och neurogenes i hippocampus



Viktiga för minne och inlärning

Hos människor också… ?

Impaired Human Hippocampal Neurogenesis after Treatment for Central Nervous System Malignancies

Michelle L. Monje, MD, PhD,[1,2] Hannes Vogel, MD,[3] Marilyn Masek, B.A.,[3] Keith L. Ligon, MD, PhD,[4,5] Paul G. Fisher, MD,[6] and Theo D. Palmer, PhD[7]

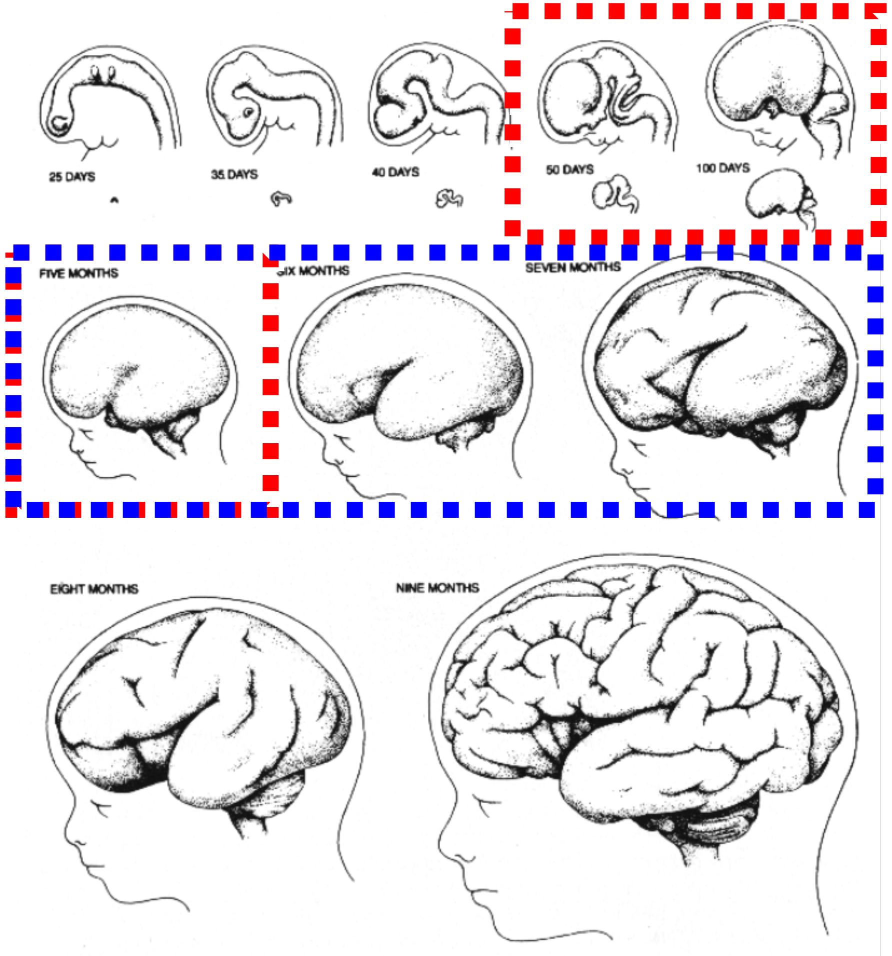
Ann Neurol 2007;62:515–520

Översikt

- Hjärnans utveckling
- Plasticitet och stamceller
- Fysisk aktivitet
- Annan stimulans

- **10^{11} (100 000 000 000) nervceller**
- **10 000 synapses per** nervcell
- **10^{15} (1 000 000 000 000 000) synapser i hjärnan**

The young brain – work in progress

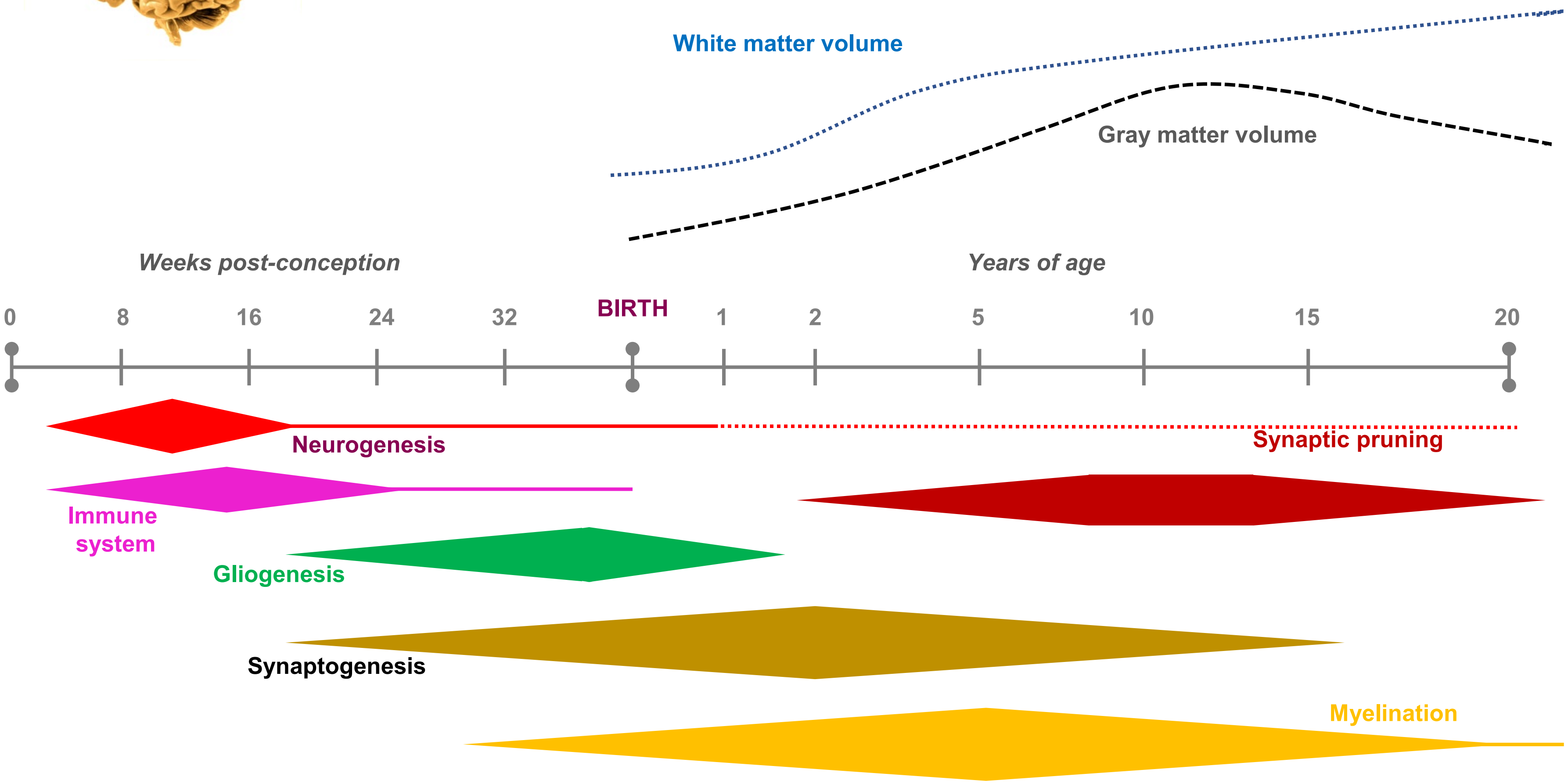


From: **Cowan, W. M.**, The development of the brain, *Sci. Am.* (1979) 241:113.

- **Nerve cells are formed:**
  Week 8-20 of gestation (100 000-250 000 nerve cells per minute!)
- **Glial cells (astrocytes) are formed** :
  Week 20-30
- **Formation of axons and dendrites:**
  Week 25 - 2 years of age
- **Formation of white matter (myelin):**
  Week 25 - 20 years of age

Location and timing are both crucial to the outcome of a specific injury

The young brain – work in progress



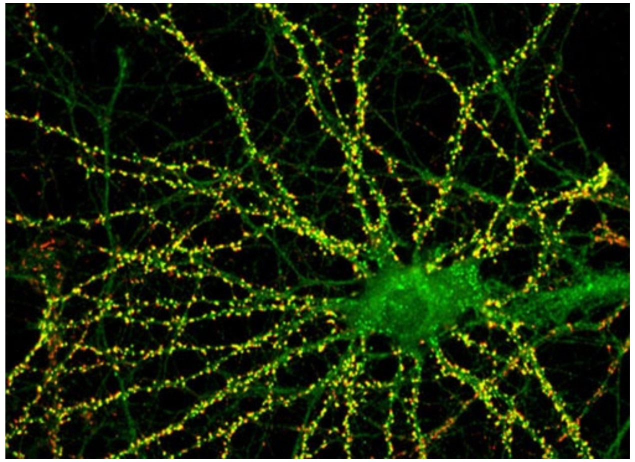
Semple et al., 2013, Progr. Neurobiol.

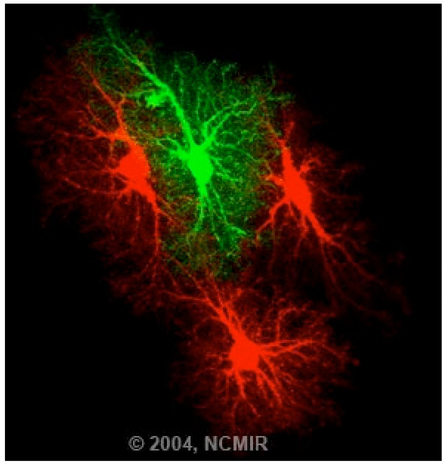
Översikt

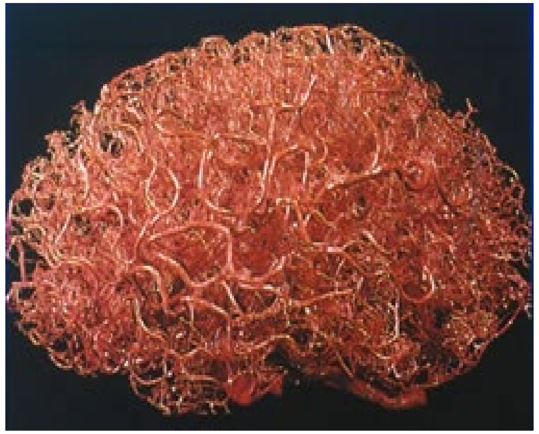
- Hjärnans utveckling
- Plasticitet och stamceller
- Fysisk aktivitet
- Annan stimulans

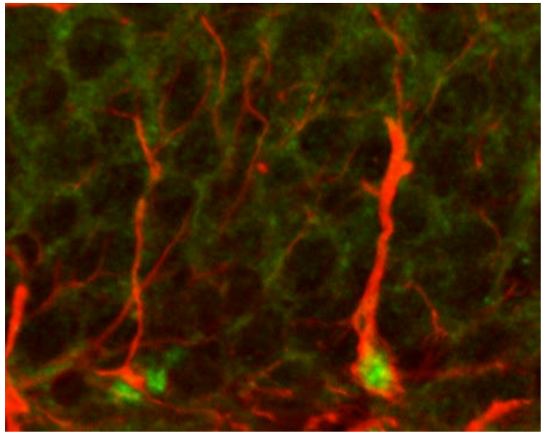
Plasticitet

- Nervceller
  - Synapser
  - Dendriter
- Gliaceller
- Blodkärl
- Stamceller





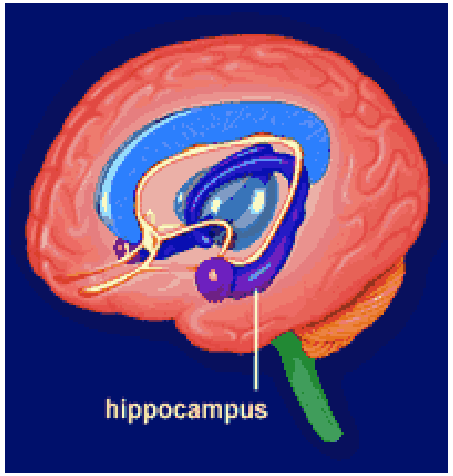




Neurogenesis in the adult human hippocampus

Peter S. Eriksson[1,4], Ekaterina Perfilieva[1], Thomas Björk-Eriksson[2], Ann-Marie Alborn[1], Claes Nordborg[3], Daniel A. Peterson[4] & Fred H. Gage[4]

Nature Medicine, 1998, 4:1313-17



Viktigt för minnesförmågan!

Dynamics of Hippocampal Neurogenesis in Adult Humans

Kirsty L. Spalding,[1,8] Olaf Bergmann,[1,8] Kanar Alkass,[1,2] Samuel Bernard,[3] Mehran Salehpour,[4] Hagen B. Huttner,[1,5] Emil Boström,[1] Isabelle Westerlund,[1] Céline Vial,[3] Bruce A. Buchholz,[6] Göran Possnert,[4] Deborah C. Mash,[7] Henrik Druid,[2] and Jonas Frisén[1,*]

Cell, 2013, 153:1219-27, June 6

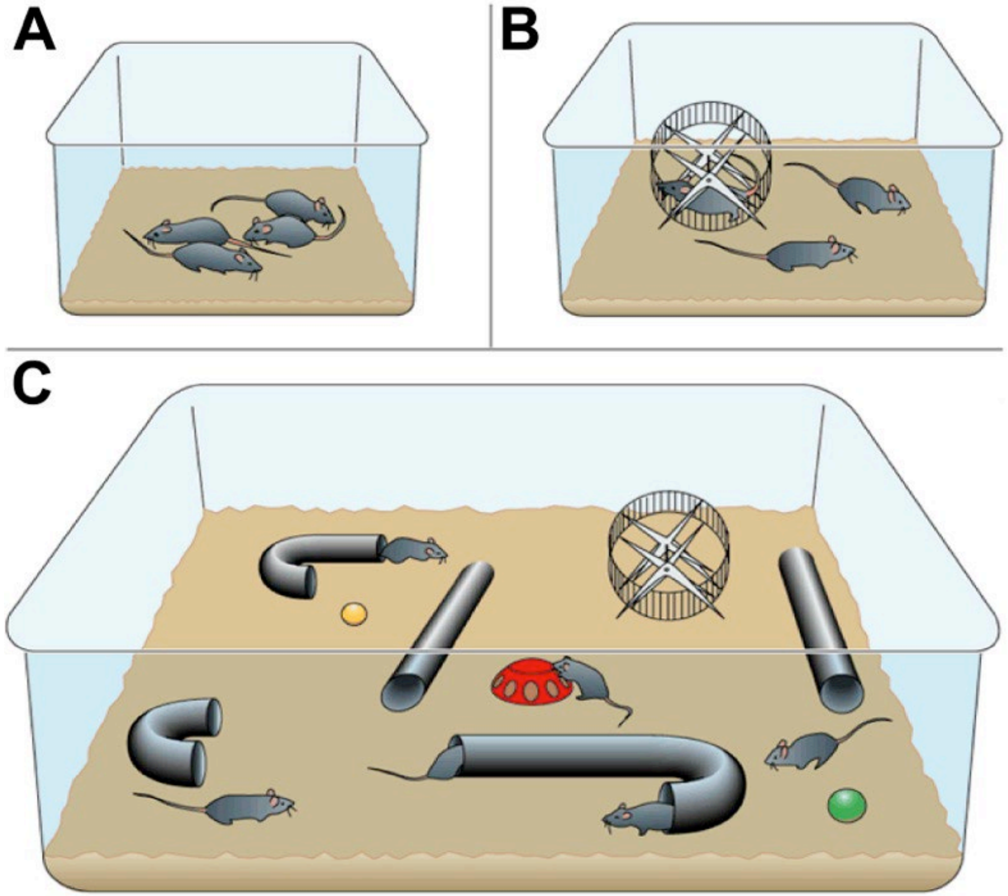
1 400 nervceller bildas i hippocampus varje dag

Hela livet

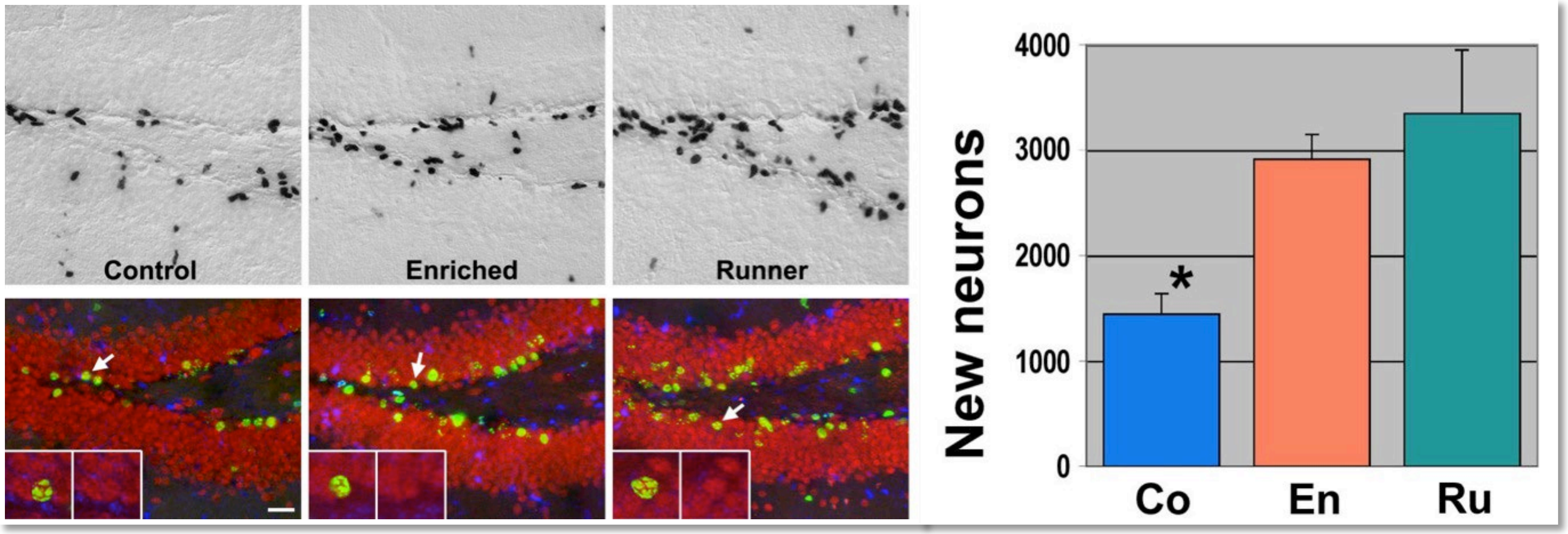
Översikt

- Hjärnans utveckling
- Plasticitet och stamceller
- Fysisk aktivitet
- Annan stimulans

Fysisk aktivitet + berikad miljö



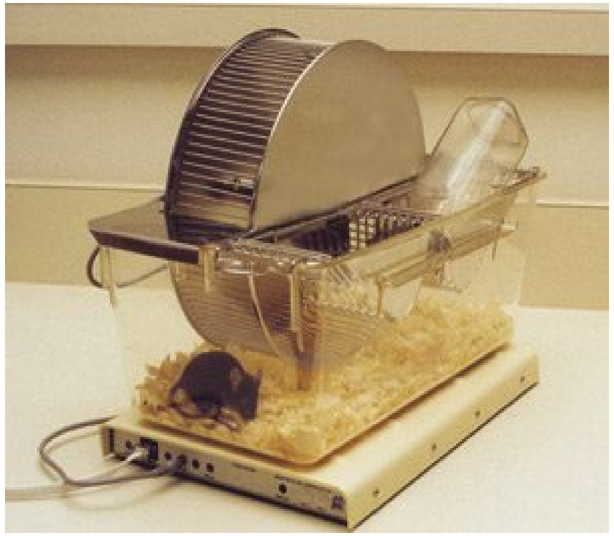
Fysisk aktivitet + berikad miljö

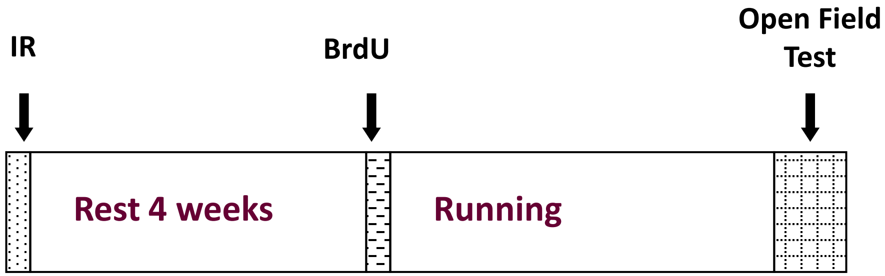


Kempermann, 1996, Nature; Kempermann, 1997, J Neurosci

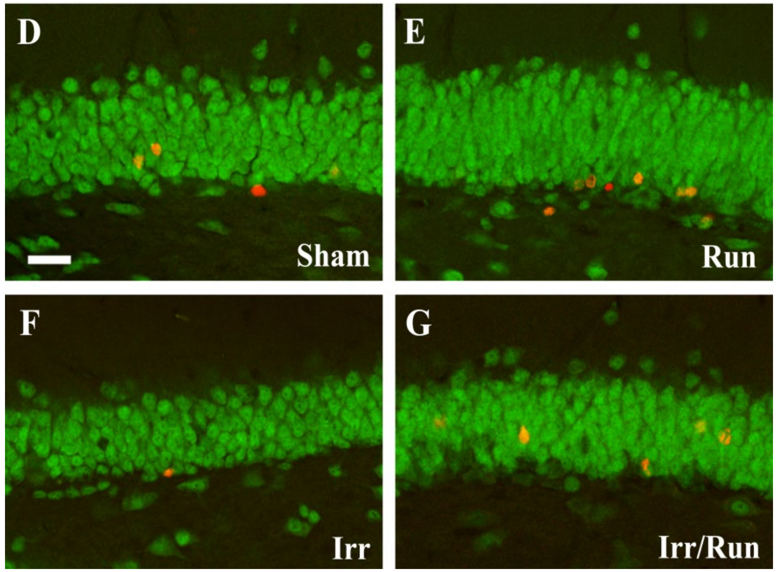
Fysisk aktivitet

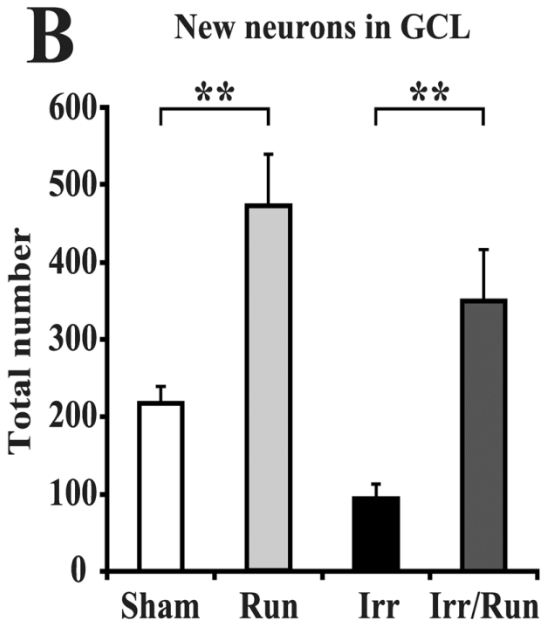
Frivillig fysisk aktivitet efter strålning





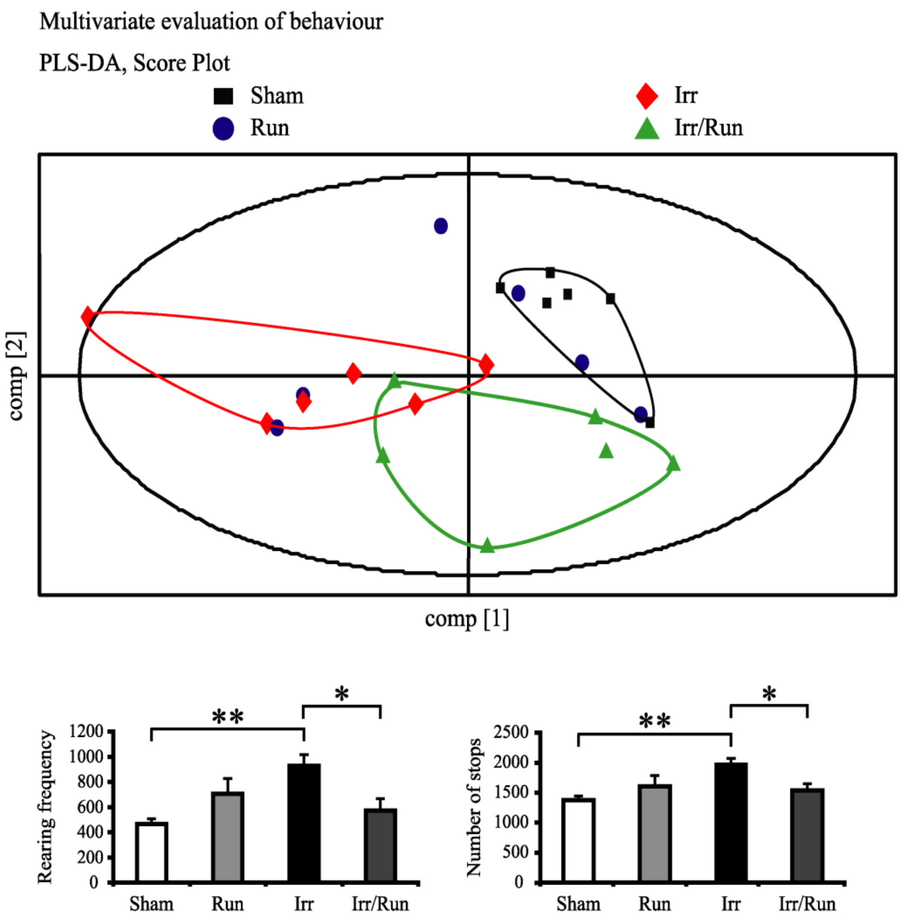
Fysisk aktivitet





Naylor 2008 *PNAS*

Fysisk aktivitet



Naylor 2008 *PNAS*

Fysisk aktivitet

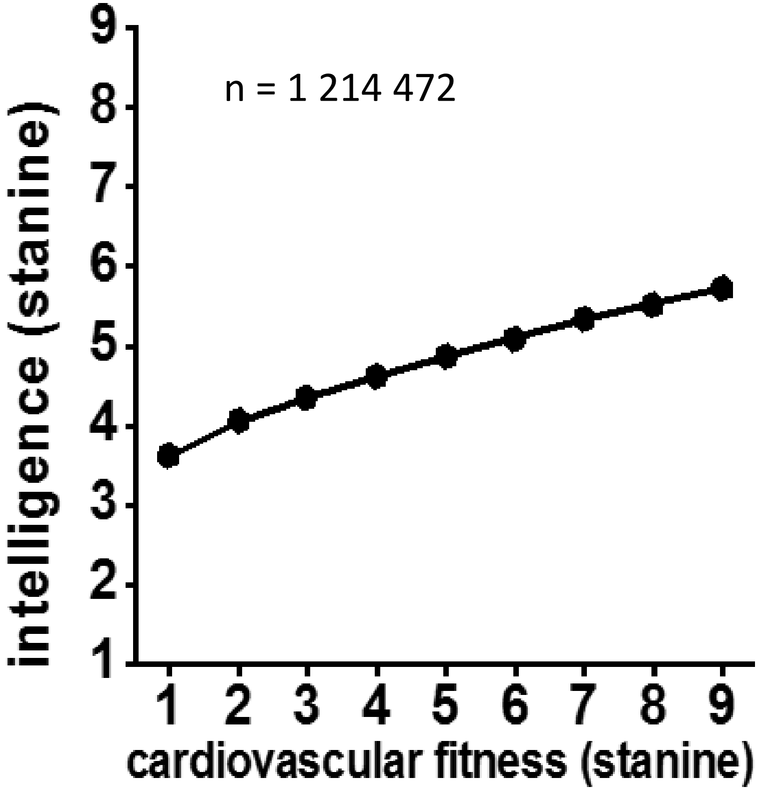
Radiat Res. 2017 Oct;188(4):443-454. doi: 10.1667/RR14737.1. Epub 2017 Aug 4.

Exercise in Adulthood after Irradiation of the Juvenile Brain Ameliorates Long-Term Depletion of Oligodendroglial Cells

Cecilia Bull [1], Christiana Cooper [2], Veronica Lindahl [2], Sylvia Fitting [3], Anders I Persson [4], Rita Grandér [1], Ann-Marie Alborn [2], Thomas Björk-Eriksson [1], H Georg Kuhn [2], Klas Blomgren [5] [6]

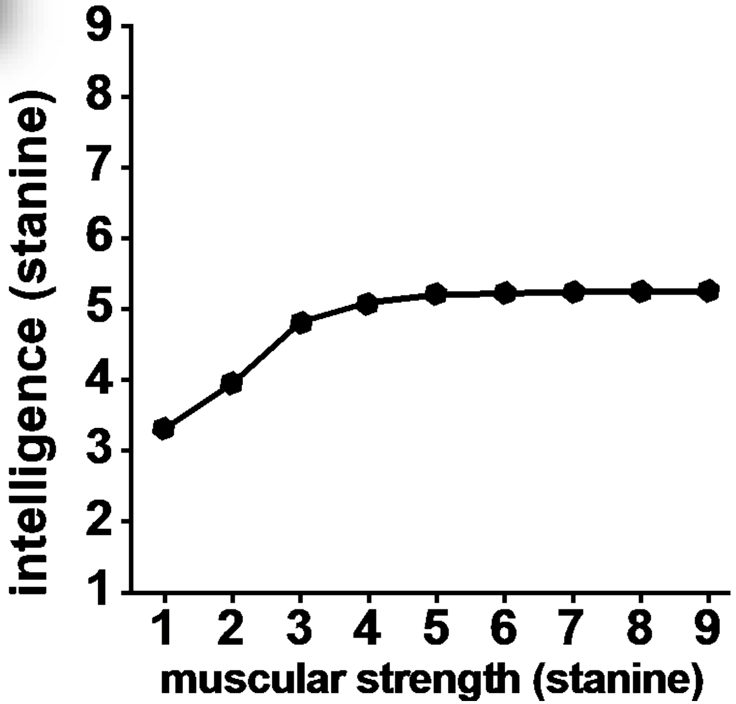
Minskar påverkan på vit substans

Kondition



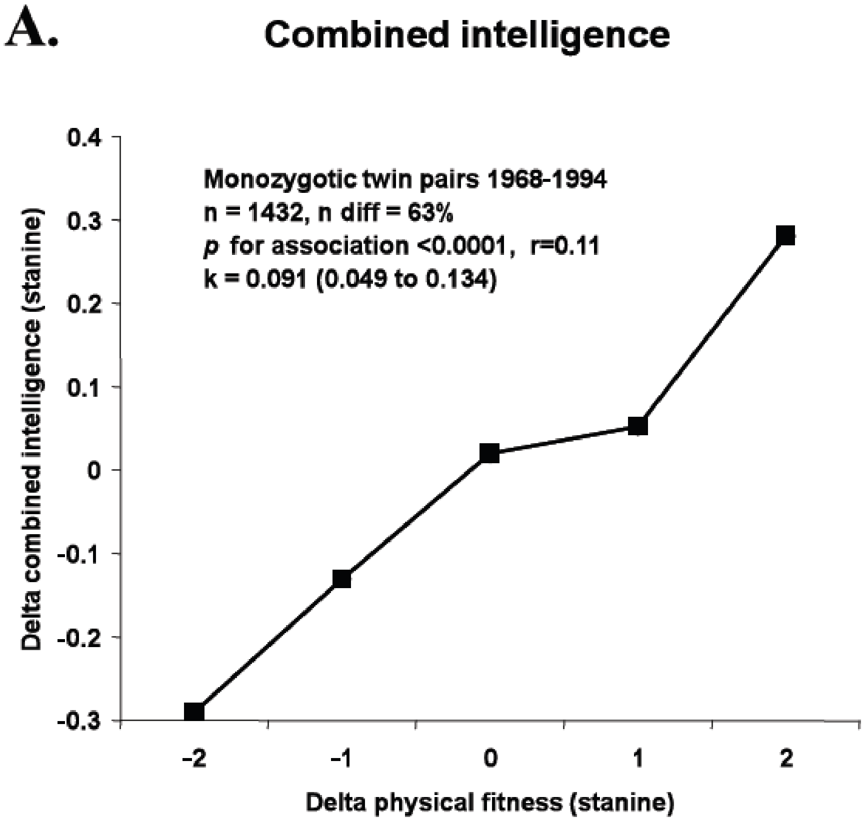
Åberg 2009 PNAS

Muskelstyrka



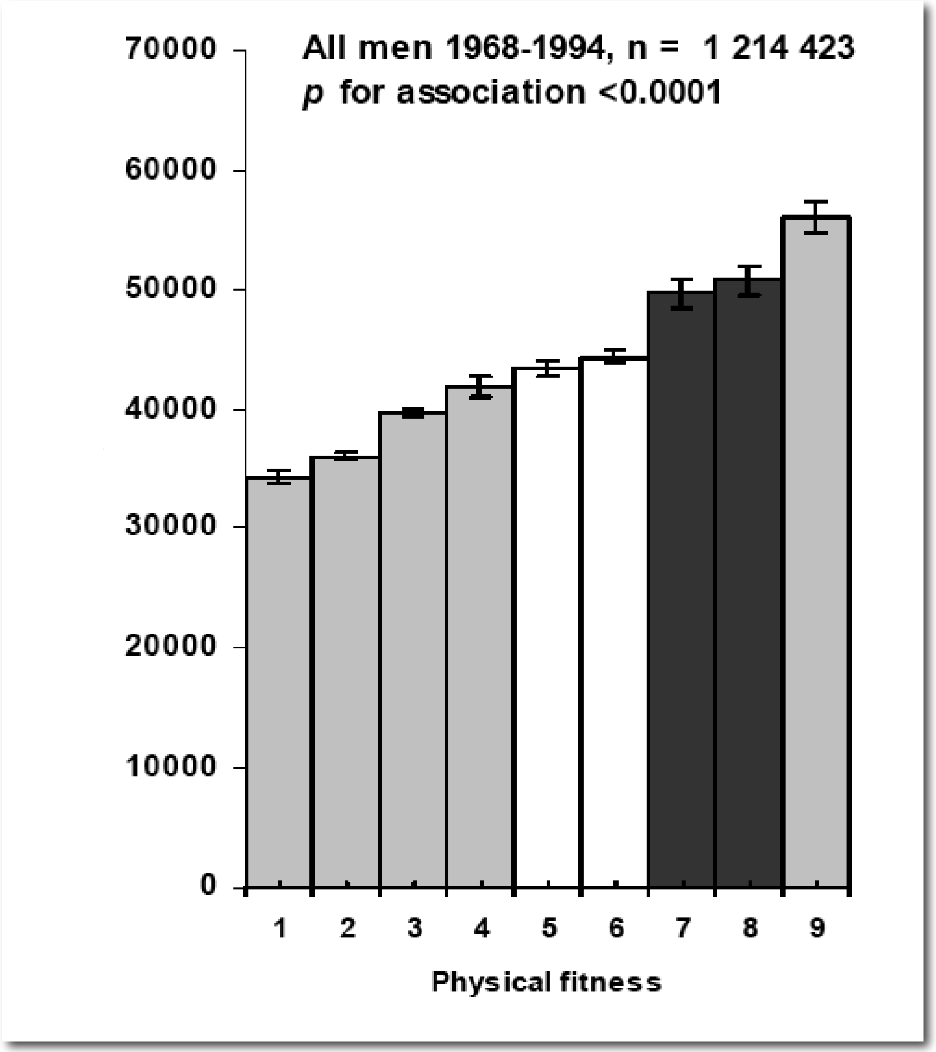
Åberg 2009 PNAS

Tvillingar



Åberg 2009 PNAS

Kondition och framtida inkomst



Åberg et al.
Opublicerade data

Bunkefloprojektet

Idrott 2 eller 5 dagar per vecka - <u>i 9 år</u>

Motoriska avvikelser: 47% jämfört med 7%

Elever med god motorik hade bättre betyg

Antagna till gymnasiet: 81% jämfört med 97%

Fysisk träning efter strålbehandling mot hjärnan

- Nintendo Wii
- Randomiserad
- Testade före och efter 10 veckors spelande

DISABILITY AND REHABILITATION, 2015
http://dx.doi.org/10.3109/09638288.2015.1116619

Taylor & Francis
Taylor & Francis Group

RESEARCH PAPER

Active video gaming improves body coordination in survivors of childhood brain tumours

Magnus Sabel[a,b], Anette Sjölund[b], Jürgen Broeren[c], Daniel Arvidsson[d,e], Jean-Michel Saury[b], Klas Blomgren[a,b,c,f], Birgitta Lannering[a,b] and Ingrid Emanuelson[a]

Effects of physically active video gaming on cognition and activities of daily living in childhood brain tumor survivors: A randomized pilot study

Magnus Sabel, Anette Sjölund, Jürgen Broeren, Daniel Arvidsson, Jean-Michel Saury, Jonas Gillenstrand, Ingrid Emanuelson, Klas Blomgren*, Birgitta Lannering*

- Förbättrad ADL (AMPS)
- En trend mot bättre uppmärksmhet

Neuro Oncology Practice, 2016

Neuro-Oncology Advance Access published August 23, 2016

Neuro-Oncology

Neuro-Oncology xx(xx), 1–10, 2016
doi:10.1093/neuonc/now177

Exercise training for neural recovery in a restricted sample of pediatric brain tumor survivors: a controlled clinical trial with crossover of training versus no training

Lily Riggs, Janine Piscione, Suzanne Laughlin, Todd Cunningham, Brian W. Timmons, Kerry S. Courneya, Ute Bartels, Jovanka Skocic, Cynthia de Medeiros, Fang Liu, Nicholas Persadie, Katrin Scheinemann, Nadia Scantlebury, Kamila U. Szulc, Eric Bouffet, and Donald J. Mabbott

12 veckors träning (3 x 90 min/vecka)

- Ökad vitsubstans
- Ökad hippocampusvolym
- Minskad reaktionstid

FORTE europe

Get strong to fight childhood cancer – An exercise intervention for children and adolescents undergoing anti-cancer treatment

Contemporary Clinical Trials 133 (2023) 107339

Contents lists available at ScienceDirect

Contemporary Clinical Trials

journal homepage: www.elsevier.com/locate/conclintrial

Design and methods of a randomized telehealth-based intervention to improve fitness in survivors of childhood cancer with exercise intolerance

Arun Maharaj [a], John L. Jefferies [b], Daniel A. Mulrooney [c], Gregory T. Armstrong [a], Tara M. Brinkman [d], Sean T. O'Neil [a], Sarah Terrell [a], Robyn E. Partin [a], Deo Kumar Srivastava [e], Melissa M. Hudson [f], Zhaoming Wang [g], Kirsten K. Ness [a,*]

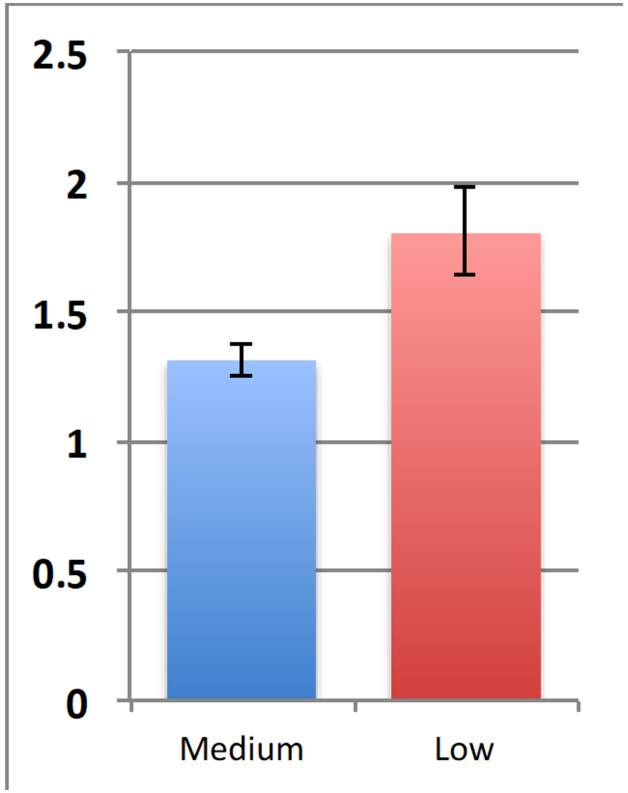
- St Jude, Memphis, TN, USA
- >5 år efter behandlingsavslut
- 160 patienter
- 20 veckors intervention (eller inte)

Fysisk prestationsförmåga vid 18 år -
- Hjärnrelaterade sjd senare i livet?

- Mönstringsregistret
- Multigenerationsregistret (identifiering av bröder)
- LISA-registret (föräldrarnas utbildningsnivå)

- Diagnosregistret (sjukhus)
- Antal vårdtillfällen hos neurolog och/eller psykiater

Depression



Åberg 2012 Br J Psychiat

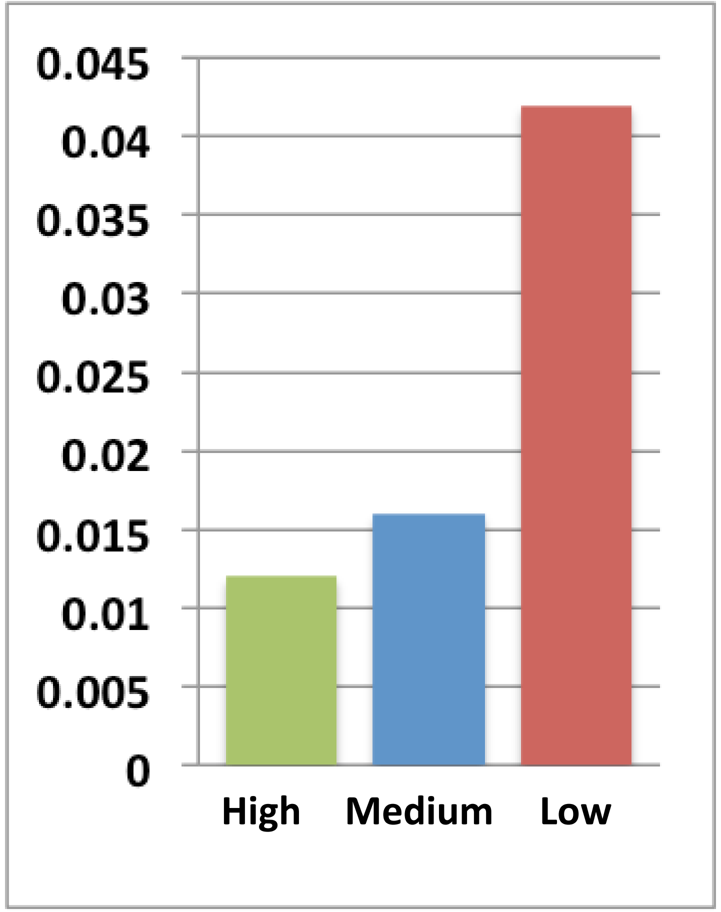
Depression

Low fitness – 79 % increased risk of suicide

Low fitness + low cognitive performance – 550 % increased risk of suicide

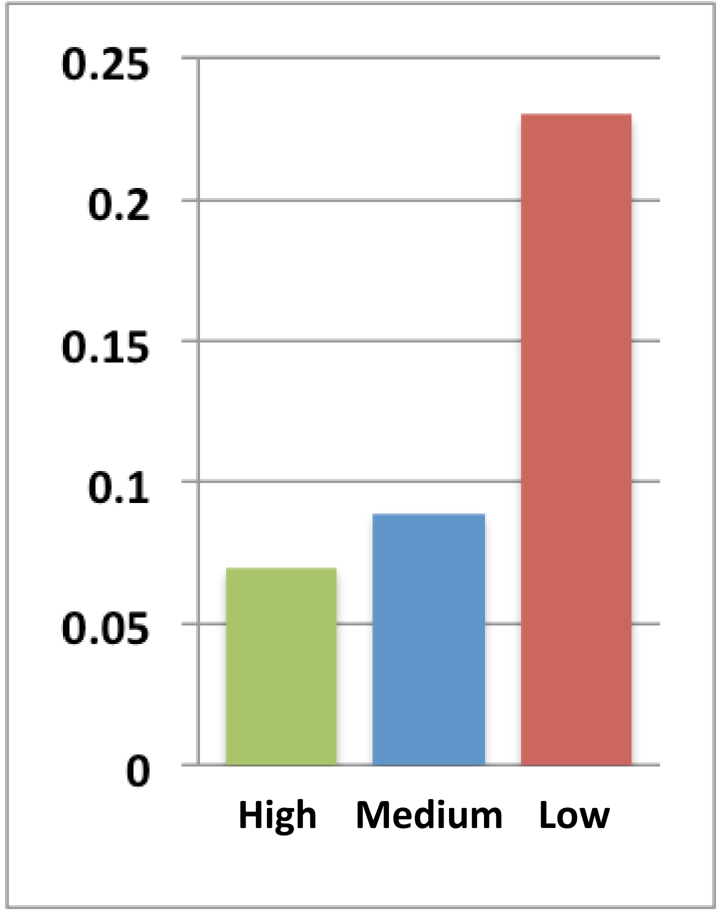
Åberg 2013 Psychol Med

Mild demens



Nyberg et al., 2014, Brain

Alla former av demens



Nyberg et al., 2014, Brain

Kondition och demens

		Hazard ratio (95% CI)		
		Age adjusted	Adjusted[a]	Adjusted[b]
All dementias, *n* = 657				
Low fitness	Low IQ	7.67 (5.41–10.88)	7.74 (5.42–11.06)	7.34 (5.08–10.58)
	Medium IQ	3.42 (2.39–4.91)	3.42 (2.37–4.95)	3.31 (2.28–4.80)
	High IQ	2.06 (1.55–2.73)	2.00 (1.49–2.68)	1.92 (1.43–2.58)
Medium fitness	Low IQ	4.74 (3.59–6.27)	5.07 (3.82–6.73)	4.90 (3.65–6.57)
	Medium IQ	2.12 (1.60–2.81)	2.25 (1.69–3.00)	2.21 (1.65–2.95)
	High IQ	1.27 (1.08–1.51)	1.31 (1.10–1.56)	1.28 (1.08–1.52)
High fitness	Low IQ	3.73 (2.92–4.75)	3.88 (3.03–4.96)	3.82 (2.96–4.93)
	Medium IQ	1.66 (1.31–2.11)	1.72 (1.35–2.18)	1.73 (1.35–2.20)
	High IQ	Reference category	Reference category	Reference category
MCI, *n* = 213				
Low fitness	Low IQ	8.75 (4.91–15.61)	8.83 (4.93–15.79)	8.44 (4.64–15.37)
	Medium IQ	4.18 (2.31–7.58)	4.31 (2.37–7.86)	4.18 (2.28–7.69)
	High IQ	2.92 (1.83–4.66)	3.05 (1.89–4.91)	2.96 (1.83–4.78)
Medium fitness	Low IQ	4.52 (2.80–7.33)	4.46 (2.75–7.25)	4.32 (2.62–7.15)
	Medium IQ	2.16 (1.33–3.51)	2.18 (1.34–3.55)	2.14 (1.30–3.52)
	High IQ	1.51 (1.11–2.05)	1.54 (1.13–2.11)	1.51 (1.11–2.07)
High fitness	Low IQ	3.00 (1.99–4.52)	2.90 (1.91–4.39)	2.85 (1.86–4.38)
	Medium IQ	1.43 (0.96–2.12)	1.42 (0.95–2.10)	1.41 (0.95–2.11)
	High IQ	Reference category	Reference category	Reference category

[a]Adjusted for calendar year, BMI, region, conscription test centre.
[b]Adjusted for calendar year, BMI, region, conscription test centre, parental education.

Nyberg et al., 2014, Brain

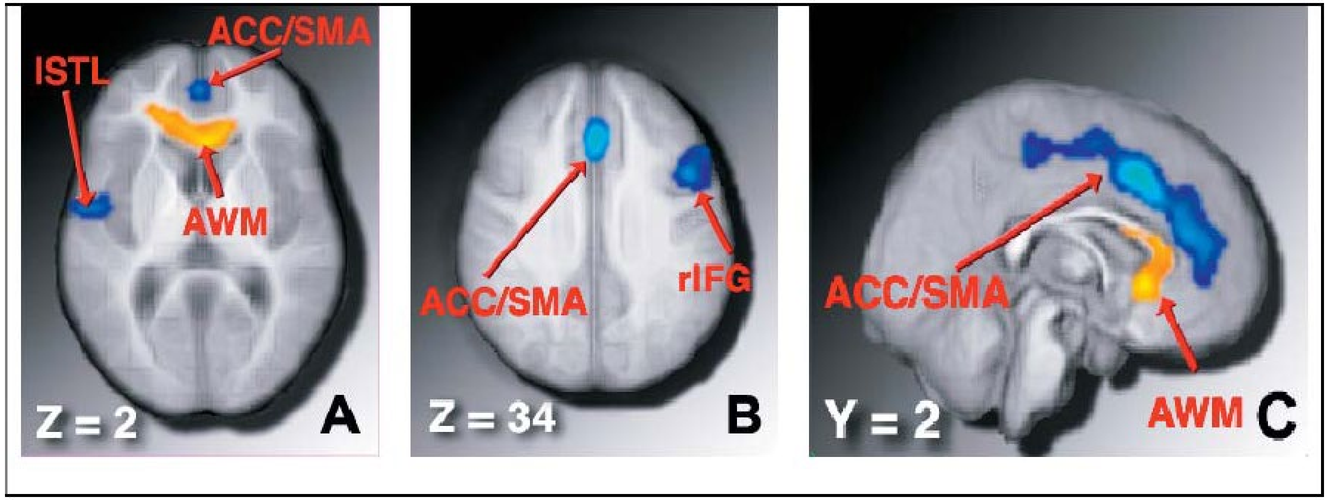
Exercise: An Active Route to Healthy Aging

Aerobic Exercise Training Increases Brain Volume in Aging Humans

Stanley J. Colcombe,[1] Kirk I. Erickson,[1] Paige E. Scalf,[1] Jenny S. Kim,[1] Ruchika Prakash,[1] Edward McAuley,[2] Steriani Elavsky,[2] David X. Marquez,[2] Liang Hu,[2] and Arthur F. Kramer[1]

[1]Beckman Institute & Department of Psychology and [2]Department of Kinesiology, University of Illinois, Urbana.

J Gerontol, 2006, 11:1166-70



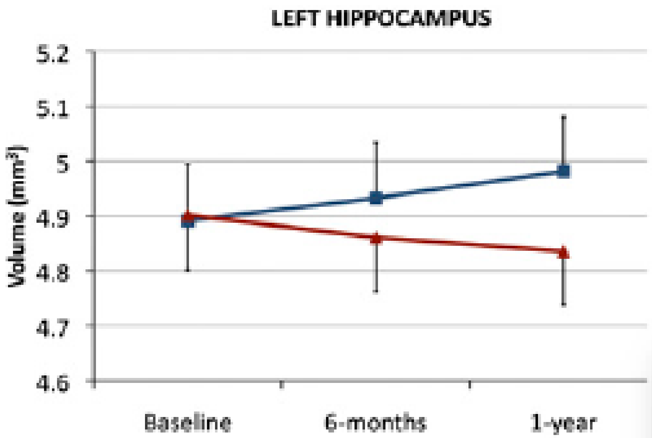
Exercise training increases size of hippocampus and improves memory

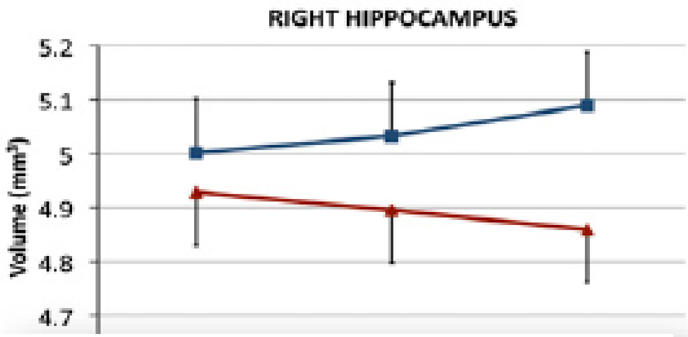
Kirk I. Erickson[a], Michelle W. Voss[b,c], Ruchika Shaurya Prakash[d], Chandramallika Basak[e], Amanda Szabo[f], Laura Chaddock[b,c], Jennifer S. Kim[b], Susie Heo[b,c], Heloisa Alves[b,c], Siobhan M. White[f], Thomas R. Wojcicki[f], Emily Mailey[f], Victoria J. Vieira[f], Stephen A. Martin[f], Brandt D. Pence[f], Jeffrey A. Woods[f], Edward McAuley[b,f], and Arthur F. Kramer[b,c,1]

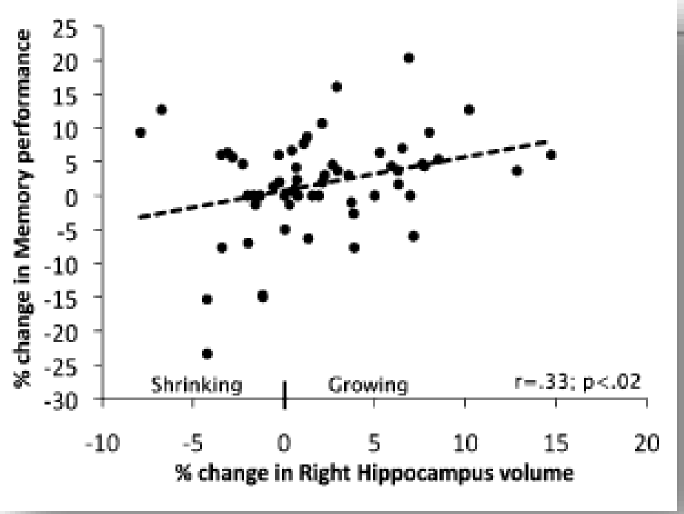
[a]Department of Psychology, University of Pittsburgh, Pittsburgh, PA 15260; [b]Beckman Institute for Advanced Science and Technology, and [f]Department of Kinesiology and Community Health, University of Illinois, Champaign-Urbana, IL 61801; [c]Department of Psychology, University of Illinois, Champaign-Urbana, IL 61820; [d]Department of Psychology, Ohio State University, Columbus, OH 43210; and [e]Department of Psychology, Rice University, Houston, TX 77251

Erickson, 2011, PNAS, 108:3017-22

Hippocampus







Översikt

- Hjärnans utveckling
- Plasticitet och stamceller
- Fysisk aktivitet
- Annan stimulans

frontiers in
AGING NEUROSCIENCE

ORIGINAL RESEARCH ARTICLE
published: 21 July 2010
doi: 10.3389/fnagi.2010.00031

Superior sensory, motor, and cognitive performance in elderly individuals with multi-year dancing activities

*Jan-Christoph Kattenstroth[1], Izabella Kolankowska[1], Tobias Kalisch[2] and Hubert R. Dinse[1]**

Kattenstroth, 2010, Front Aging Neurosci

Comparative Effectiveness Research

Influencing Self-rated Health Among Adolescent Girls With Dance Intervention

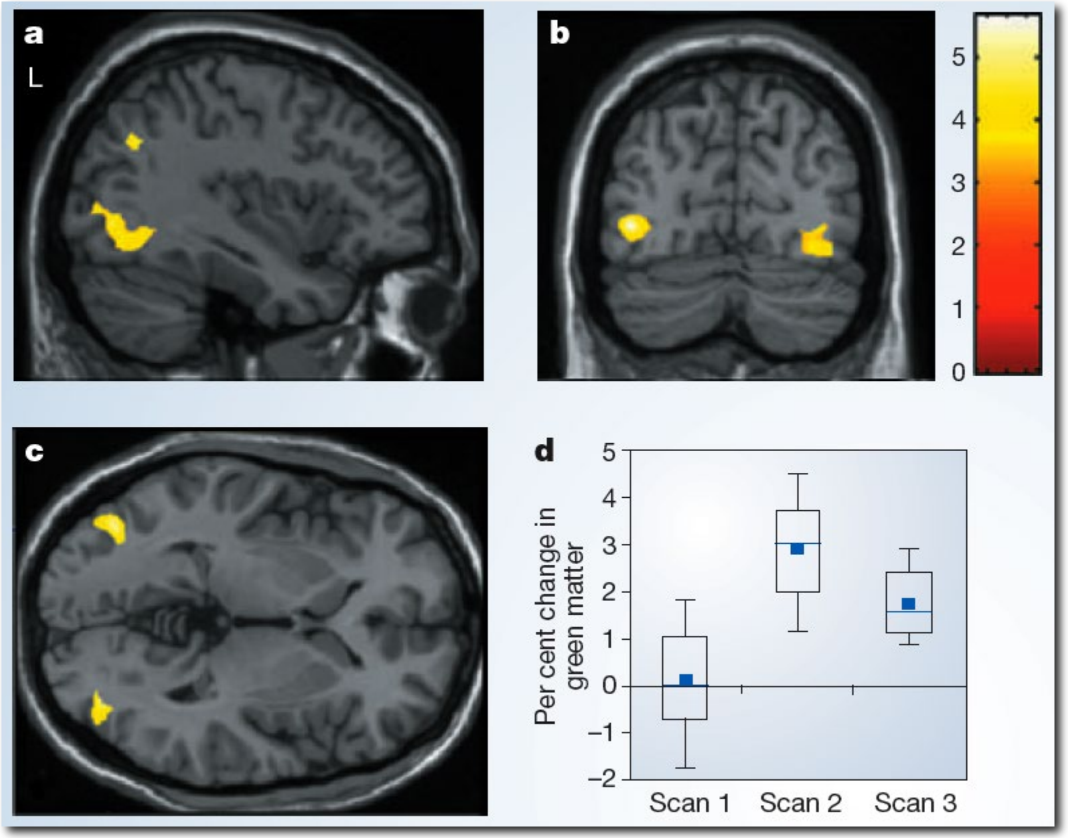
A Randomized Controlled Trial

Anna Duberg, RPT; Lars Hagberg, PhD; Helena Sunvisson, PhD; Margareta Möller, PhD

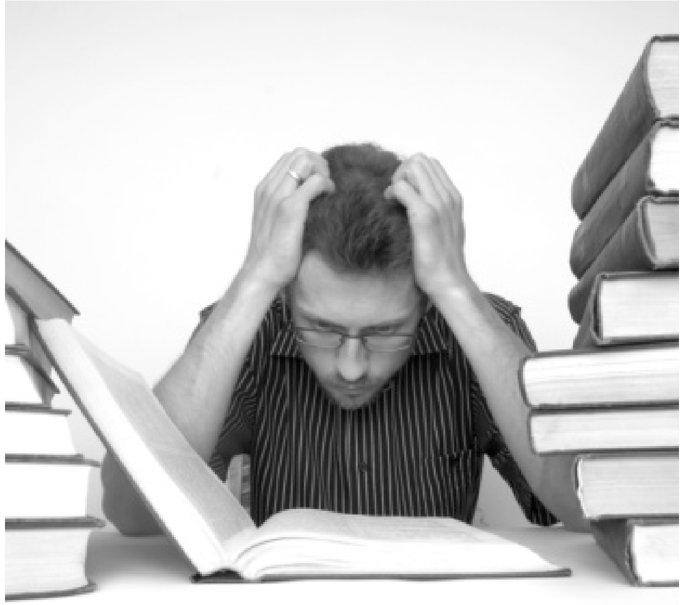
Duberg, 2013, JAMA Pediatr, 167:27-31

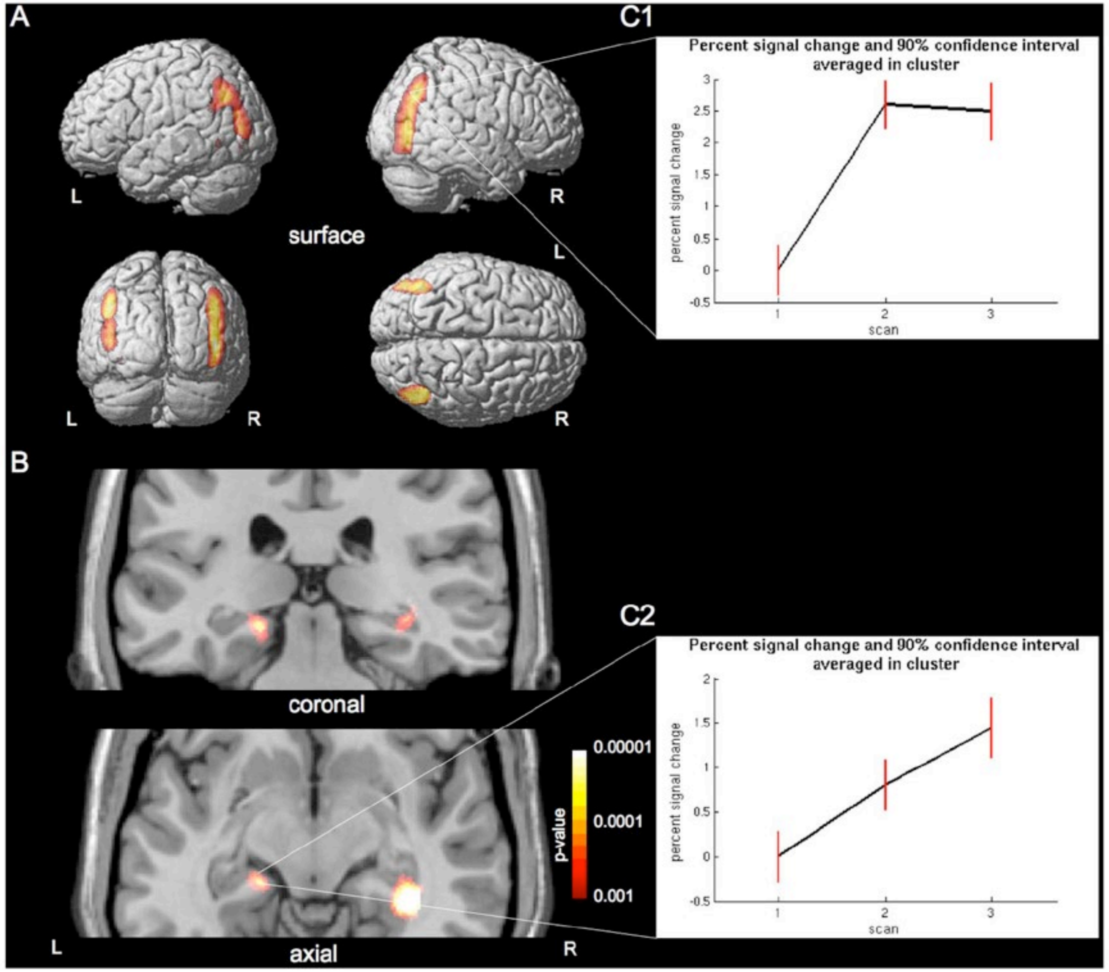
"8 månaders dansprogram ökade självkänslan hos de unga kvinnorna."

»Vår hjärna är skapad för att tillhöra en kropp som rör på sig.«



Draganski et al., 2004, Nature



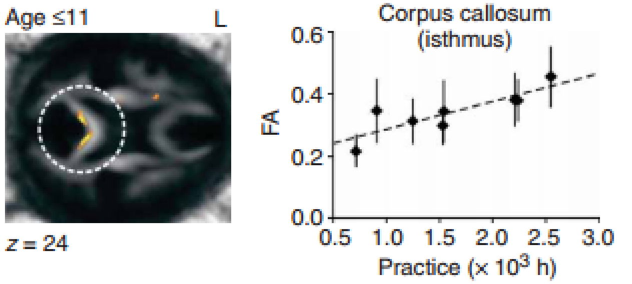


Draganski et al., 2006, J Neurosci

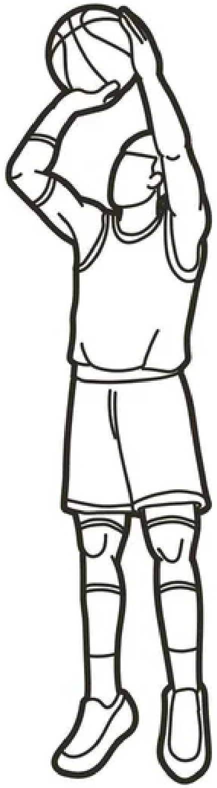
Extensive piano practicing has regionally specific effects on white matter development

Sara L Bengtsson[1], Zoltán Nagy[1,2], Stefan Skare[2], Lea Forsman[1], Hans Forssberg[1] & Fredrik Ullén[1]

Nature Neuroscience, 2005, 8:1148-9



Lars-Eric Uneståhl



Tre grupper

- Ingen träning
- Straffträning
- ”Tänka på straffträning”

Samma resultat!

Sammanfattning

Plasticitet, däribland stamceller och neurogenes, är viktiga för läkning i hjärnan

Fysisk aktivitet

Berikad miljö

Tack!