

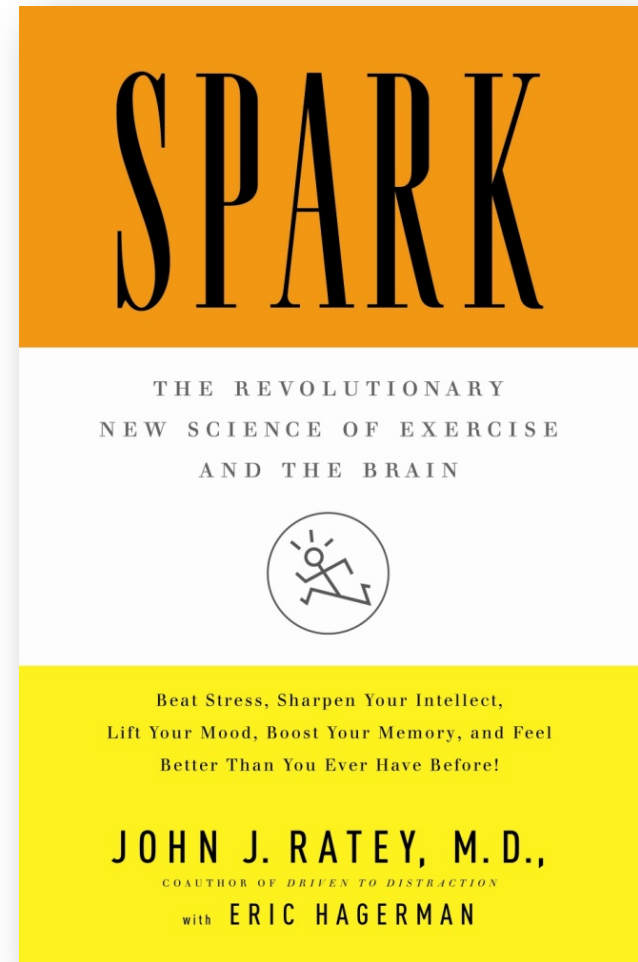
Another example of shameless self-promotion

www.JohnRatey.com



The Ratey Institute

ON FACEBOOK



Partially funded by Reebok



Harvard on the Move, a new initiative sponsored by President Drew Faust (from left), kicked off with a panel discussion at Sanders Theatre on Wednesday. Panelists included Daniel Lieberman, professor of human evolutionary biology and department chair of human evolutionary biology in the Faculty of Arts and Sciences, Christopher McDougall '85, author of "Born to Run: A Hidden Tribe, Superathletes, and the Greatest Race the World Has Never Seen," and John Ratey, an associate clinical professor of psychiatry at Harvard Medical School.

- DIET
- EXERCISE
- SLEEP
- BIOPHILLIA NATURE
- MINDFULNESS
- CONNECTION
- SMALL TRIBES

GO WILD

FREE YOUR BODY AND MIND
FROM THE AFFLICTIONS
OF CIVILIZATION



Eat fat, run free, be social,
and follow evolution's other rules for
total health and well-being

JOHN J. RATEY, MD

Coauthor of the National Bestseller SPARK and

RICHARD MANNING



Every student at Madison Junior High completes a computer-based fitness test



Students spend one day a week in the school's state-of-the-art fitness center.



California Department of Education 2001 Study

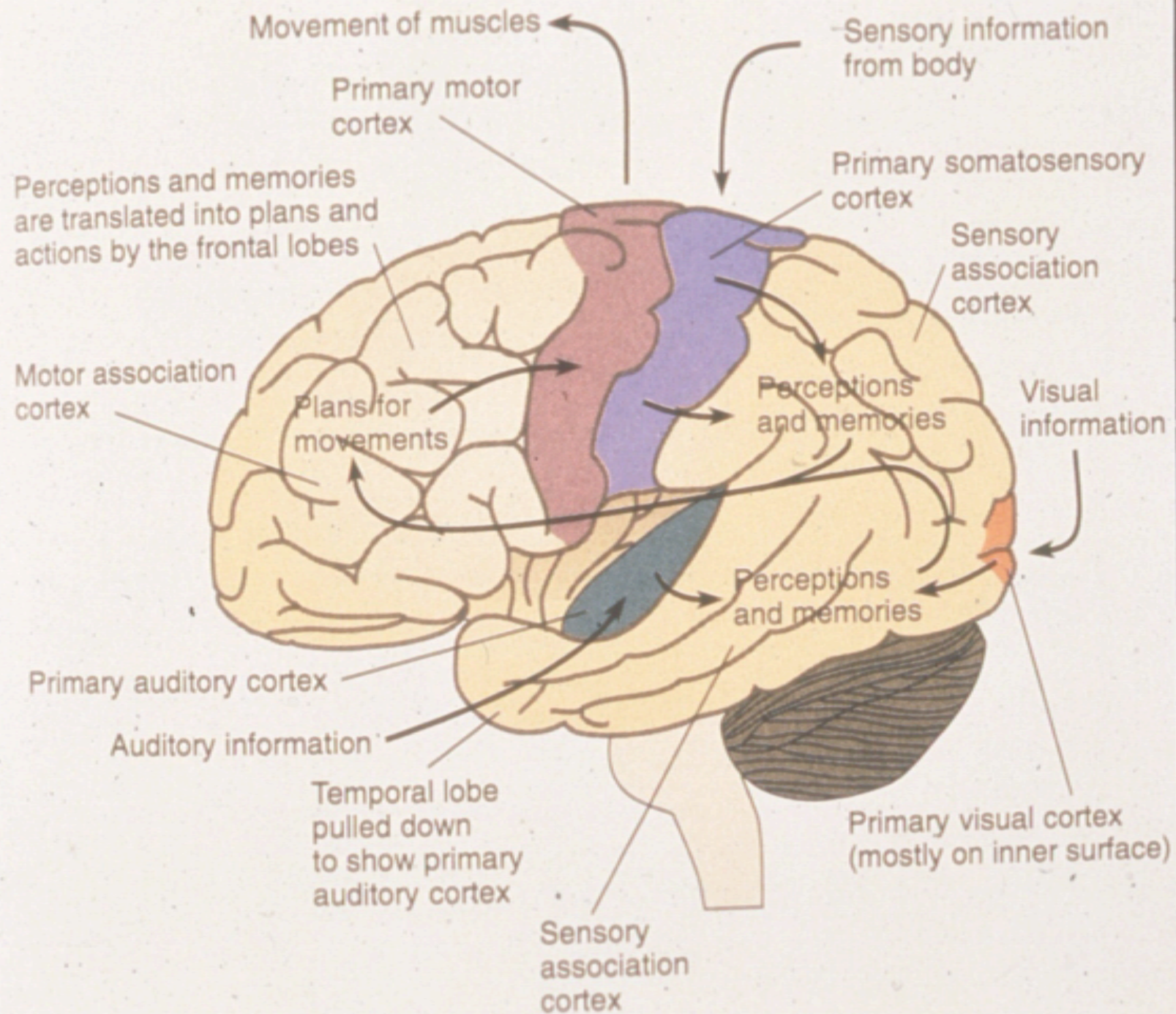
33% of freshmen in California were overweight or obese.

Naperville – District 203 – 2002 Study

3% of freshmen were overweight or obese. 19,000 children in the district.

TIMSS – Trends in International Mathematics / Science.

An international benchmarking test comparing the achievement of eighth-grade students . In 1999, Naperville District 203 scored #1 in science and #6 in math. An amazing 94.1% of Naperville parents were satisfied with the PE curriculum.



EvolutionMovement

Thinking

“That which we call thinking is the evolutionary internalization of movement.”

Lilinas, 2001

EXERCISE AND COGNITION

MAKES THE LEARNER A BETTER LEARNER

KEEPS OUR BRAINS YOUNG AND PERKY

OPTIMIZES BRAIN CELL PLASTICITY AND GROWTH

GROWS HEALTHIER DENDRITES

BEST PROMOTER OF NEUROGENESIS

USE IT OR LOOSE IT- 100 BILLION NERVE CELLS

Mayo Clinic Sept 2011

Dr Ahlskog's Group - looked at >1600 papers on exercise and cognition and countered the NIH consensus panel's conclusion that nothing has been proven to have a preventive effect on dementia or cognitive decline.

The NIH's panel was very restrictive in each review and did not include many articles that did not meet the strictest of guidelines. They took a broader view and looked at both animal and human studies and of course there is a plethora of evidence supporting the preventive effect of exercise on cognitive decline and Alzheimer's disease in the elderly and in middle age.

Acute Exercise Intervention from 1-12 months in sedentary elderly has an improving effect on cognitive tests. The benefits of exercise for atherosclerosis is so solid and this review shows an effect over and above its vascular protective effect.

Fitness or the result of Chronic Exercise- shows an increase in size of hippocampus- essential for memory and memory integration. As well the more fit the person is they have larger cortical volumes and show better Cortical Connections

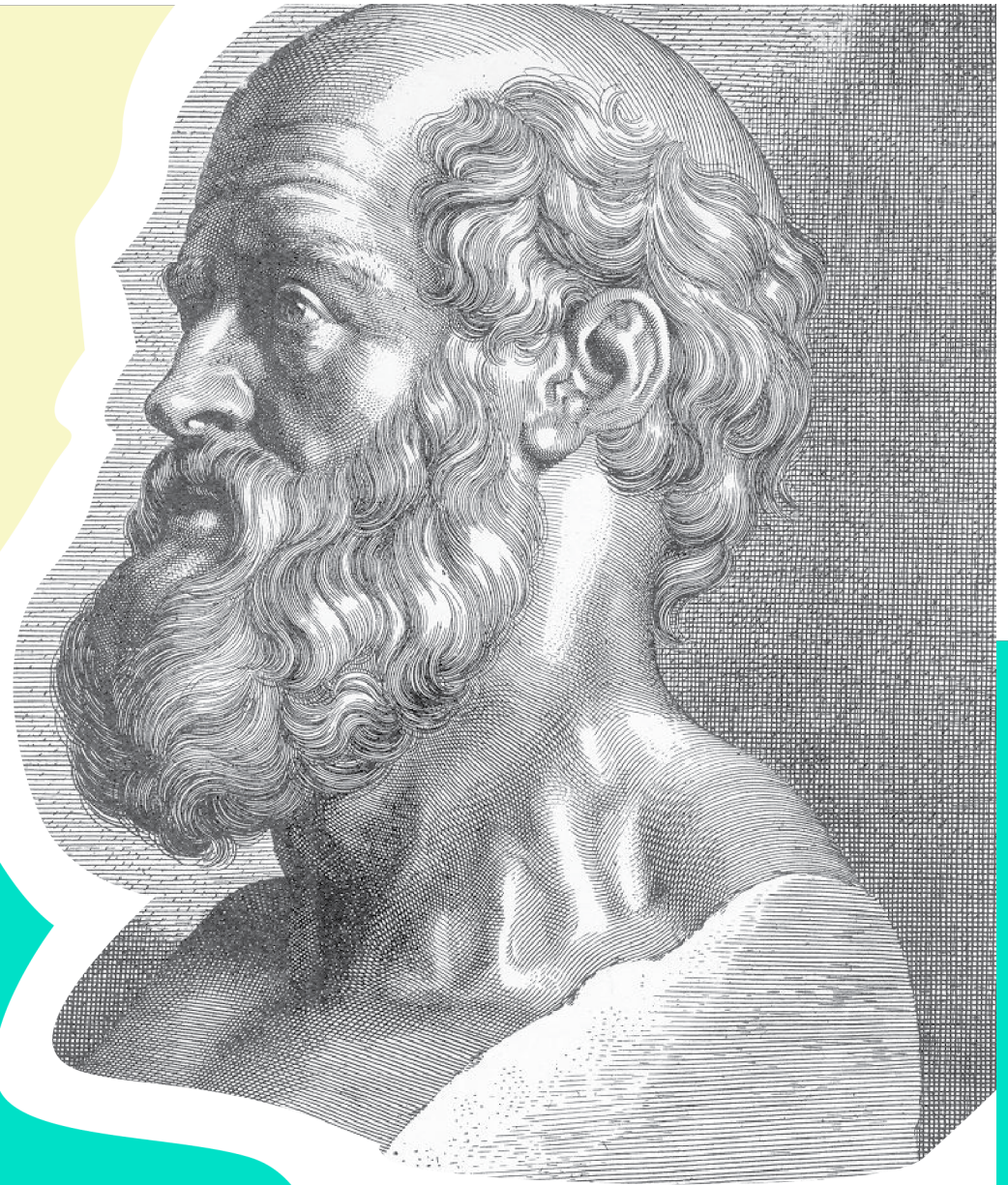
© 2008 Photo by George Legeros





IF YOU'RE IN A
BAD MOOD, GO
FOR A WALK...

IF YOU'RE
STILL IN A
BAD MOOD, GO
FOR ANOTHER WALK.



HIPPOCRATES

ZOLOFT VS EXERCISE at 4 Months

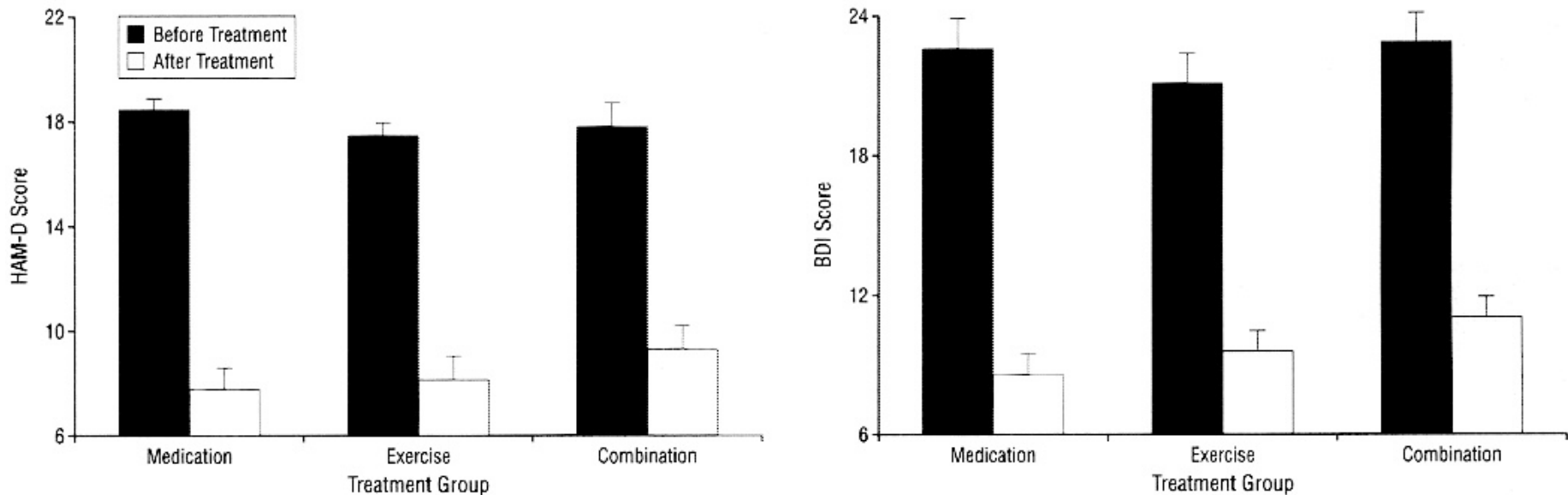


Figure 3. Observed mean depression scores before and after treatment. All changes from pretreatment to posttreatment were statistically significant ($P < .001$ for all). The treatment groups did not differ on baseline or posttreatment levels of depression. Error bars represent SEs. HAM-D indicates Hamilton Rating Scale for Depression; BDI, Beck Depression Inventory.

From: Blumenthal: Arch Intern Med, Volume 159(19).October 25, 1999.2349-2356

Hippocrates -move to beat bad humors – 340 BC

American Psychiatric Association adds exercise as a valid way of battling depression

By Joyce Davis For the Reporter-Herald

Posted: 09/01/2013 01:00:00 AM MDT



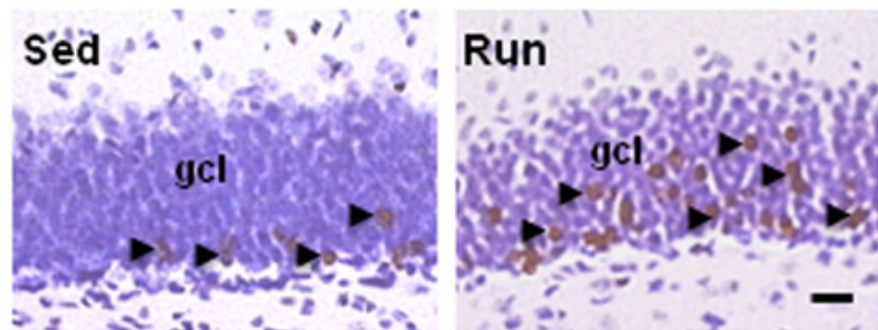
EXERCISING RATS MAKE
MORE GABA CELLS IN
HIPPOCAMPUS-

MORE RESISTANT TO
THREATS – IMMEDIATE
AND LONGER TERM

STRESSORS HAVE TO BE
MORE THREATENING

6 WEEKS OF RUNNING VS
CONTROL

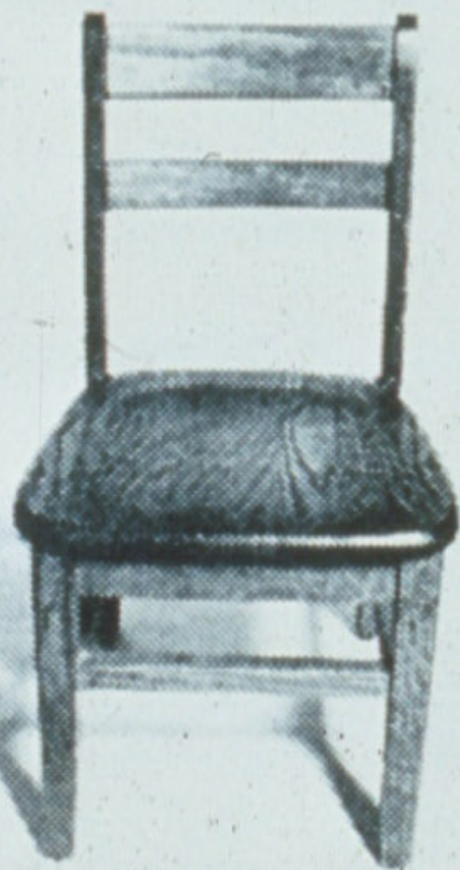
B



[Physical exercise prevents stress-induced activation of granule neurons and enhances local inhibitory mechanisms in the dentate gyrus.](#)

Schoenfeld TJ, Rada P, Pieruzzini PR, Hsueh B, **Gould E.** J Neurosci. 2013 May 1;33(18):7770-7. doi: 10.1523/JNEUROSCI.5352-12.2013.

This is a typical
hyperactive child.



Funny, he was here just a second ago.

MICHAEL PHELPS OFF RITALIN



At age 9, Michael was put on Ritalin, a stimulant used to treat hyperactivity. His mother thinks it helped a little. He seemed to be able to focus longer, he could get through homework without moving around so much. She said he was still a middling student. It might have raised some C's to B's, she said. But if a homework assignment had to be at least four sentences, she said, He'd just do four sentences.

After two years, Michael asked to get off the meds. He had to go to the school nurse's office to take a pill at lunch, she said, and felt stigmatized. Just out of the blue, he said to me: 'I don't want to do this anymore, Mom.'

After consulting with the Dr., Michael stopped medication. In the meantime, Michael the swimmer had appeared. By 10, he was ranked nationally in his age group. Ms. Phelps watched the boy who couldn't sit still at school sit for four hours at a meet waiting to swim his five minutes' worth of races.

At age 12 Michael needed an algebra tutor, and was so antsy in school that his mother suggested the teacher sit him at a table in the back. And yet he willingly got up at 6:30 daily for 90-minute morning practices and swam 2 to 3 hours every afternoon.



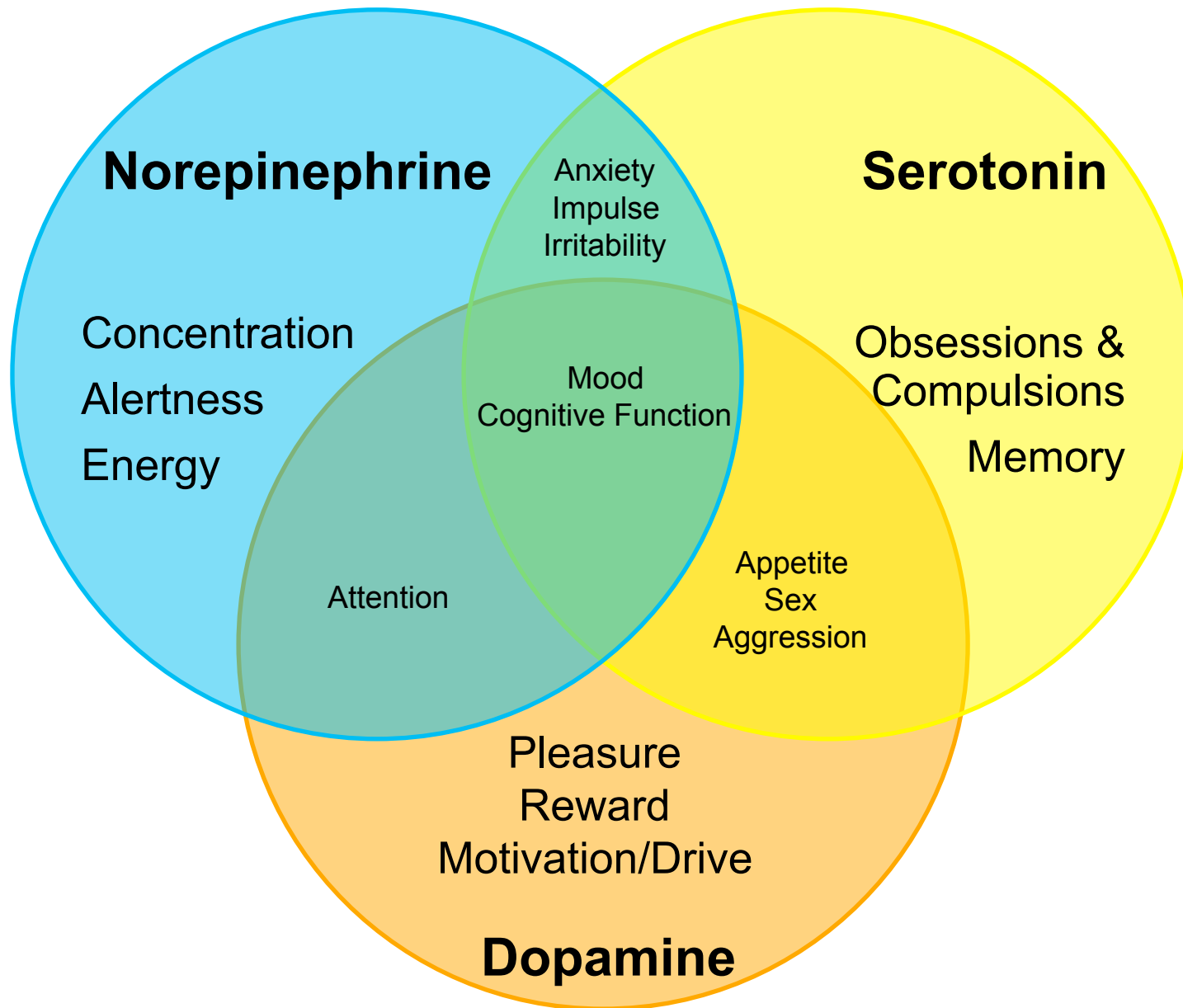
Exercise & Learning – *The JACK Effect*



NO RECESS



Neurochemistry





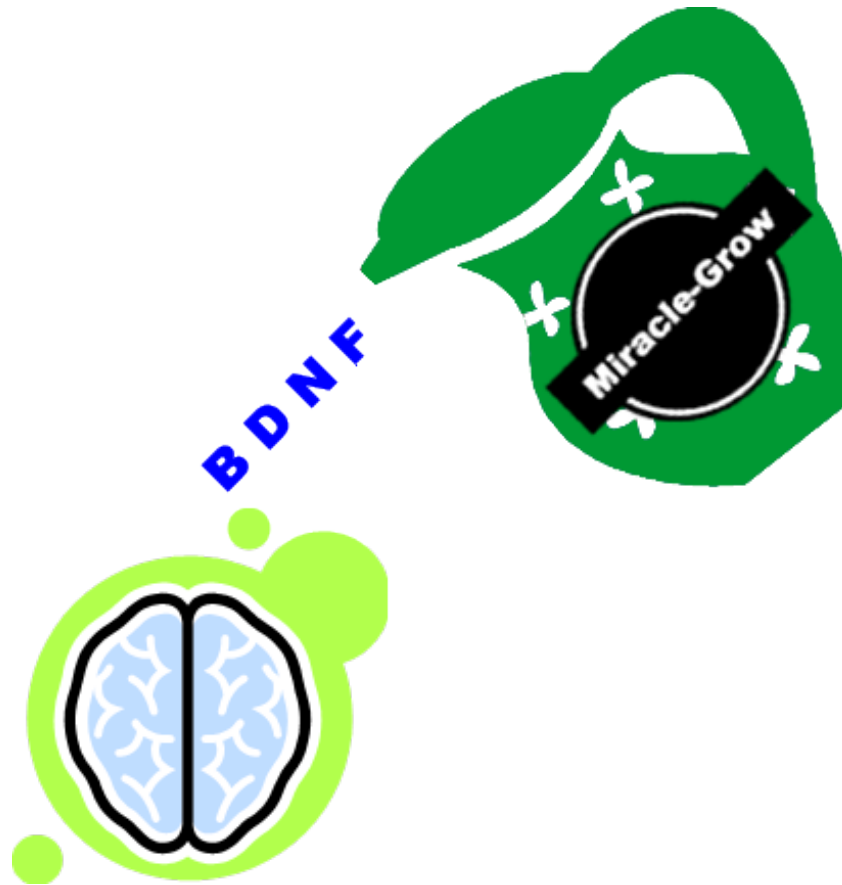
= Endorphins



= Endocannabinoids



BDNF = Miracle-Gro



BDNF DOES

SURVIVAL OF THE NEURON

MIGRATION

DIFFERENTIATION

SYNAPTIC GROWTH

PLASTICITY

REGULATES MOOD AND ANXIETY



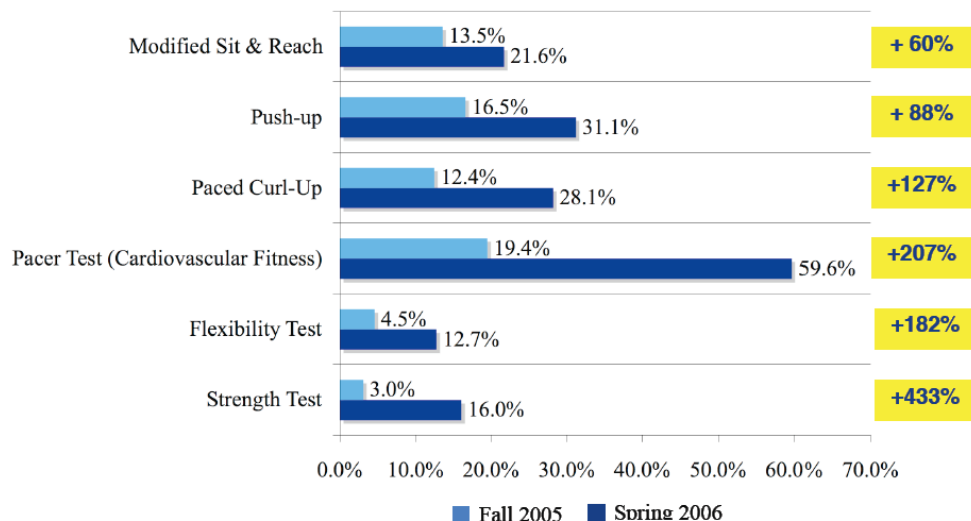
SIPRESS

*"O.K., fellas—calm down. Does it really matter
which is better, yoga or Pilates?"*

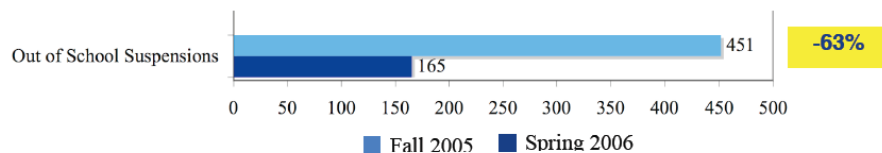
CN
COLLECTION

GROUP REPORT
Grades 4 and 5
Fitness Gram Results: Fall 2005 – Spring 2006

Percent of Students in Healthy Fitness Zone



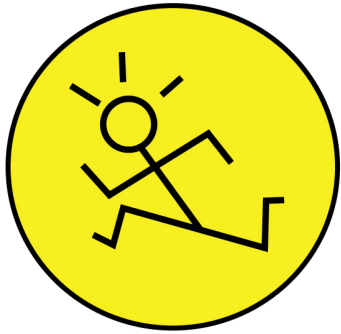
Percent Reduction in Disciplinary Issues



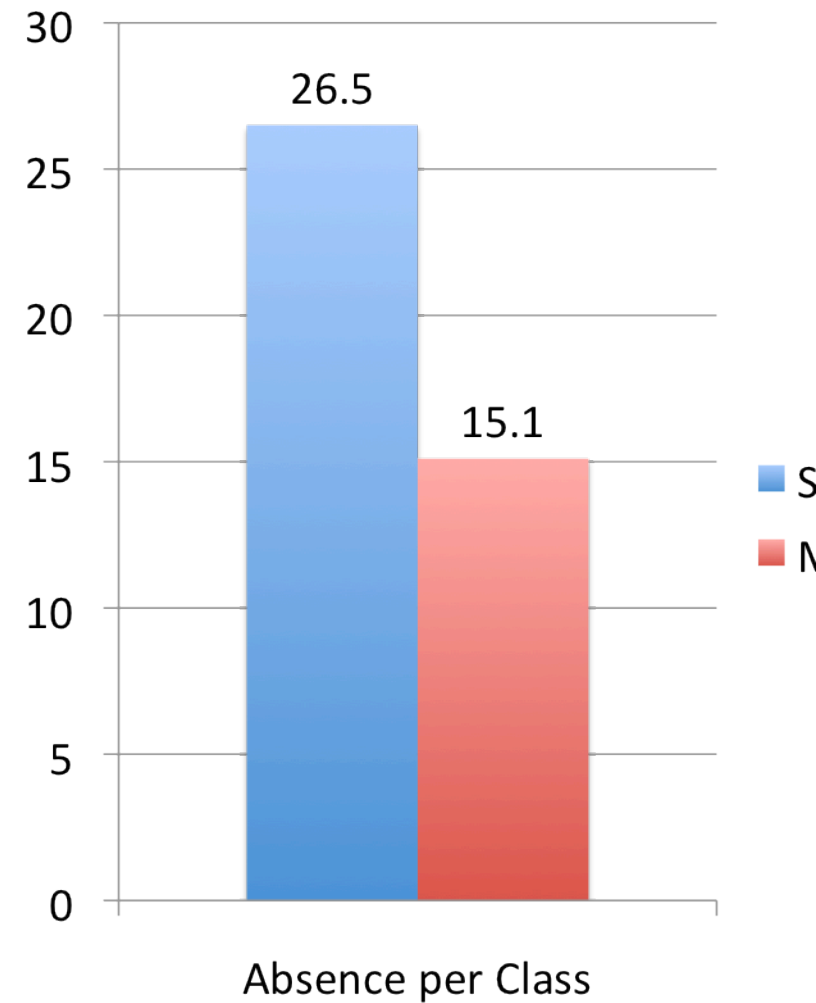
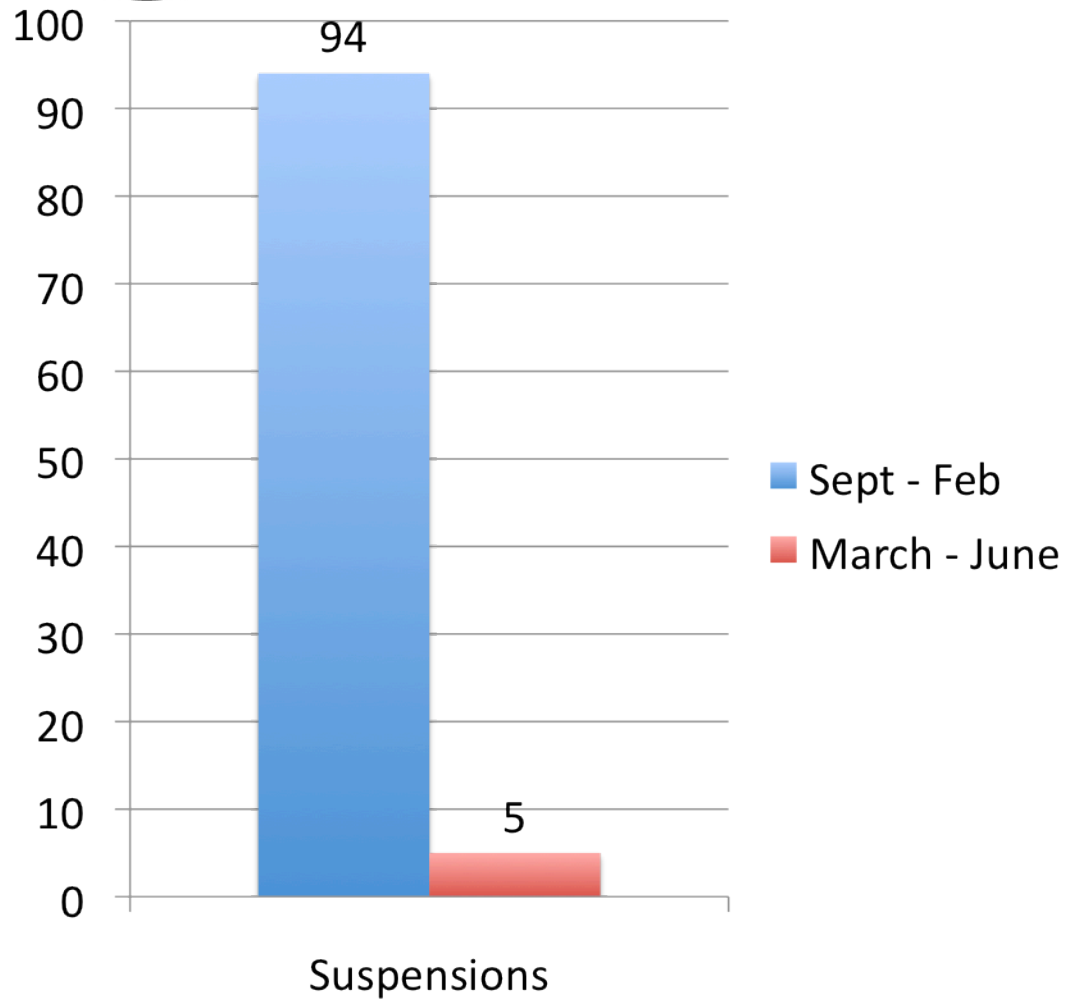
In the fall of 2005, this elementary school had PE one day per week of 50 minutes. This year Jan-June 2006 a PE4life Program was offered five days a week at 45 minutes.

The changes are remarkable. This is an inner city school with 80% of kids on free lunch program, mostly Hispanic and African American heritage.

The PE4LIFE added elements were cardiac monitored watches, Dance Dance Revolution, a few exercise bicycles, and a small number of fitness machines. Mostly what was added was a new attitude.

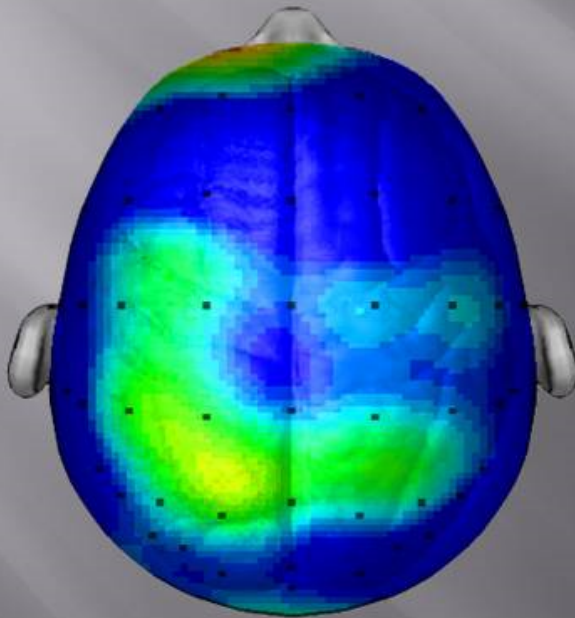


Behavior

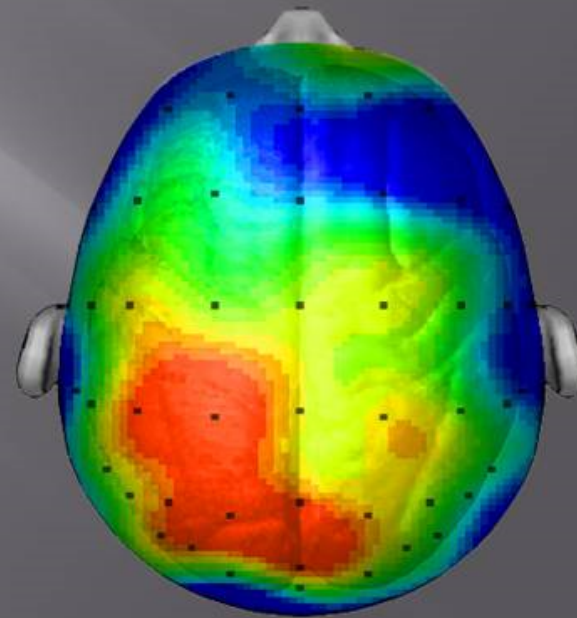


Average composite of 20 students brains taking the same test

BRAIN AFTER SITTING
QUIETLY



BRAIN AFTER 20 MINUTE
WALK



Research/scan compliments of Dr. Chuck Hillman University of Illinois

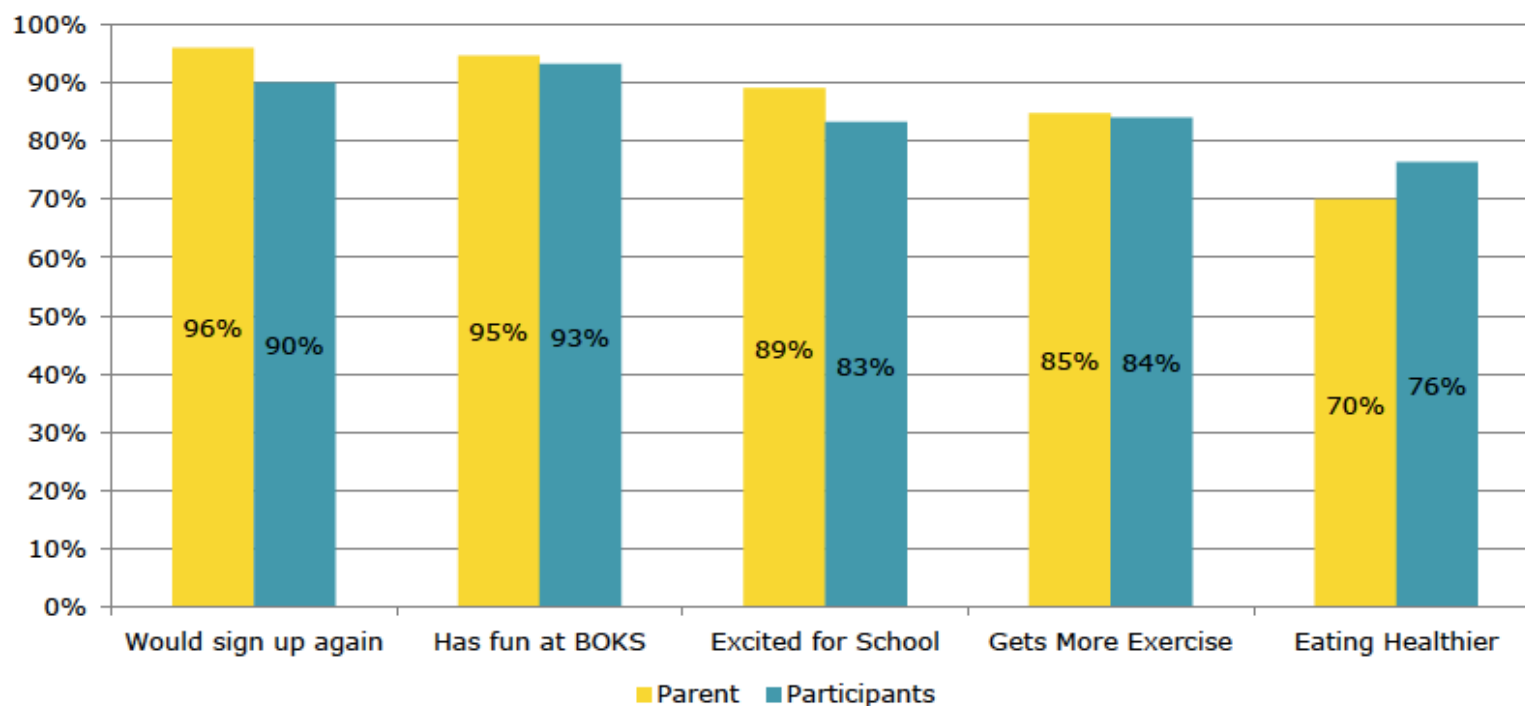
IN THE MOMENT



Spring 2012 Survey Results

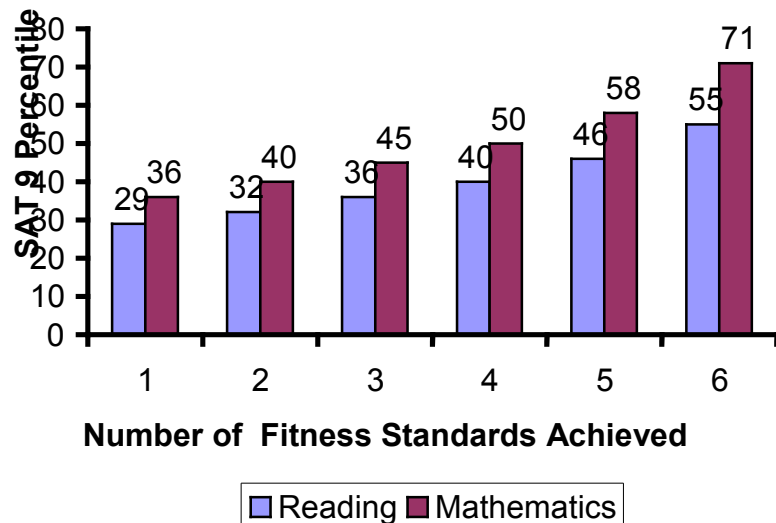
Parents and Participants

Parents and Participants Agree with the Following Statements:



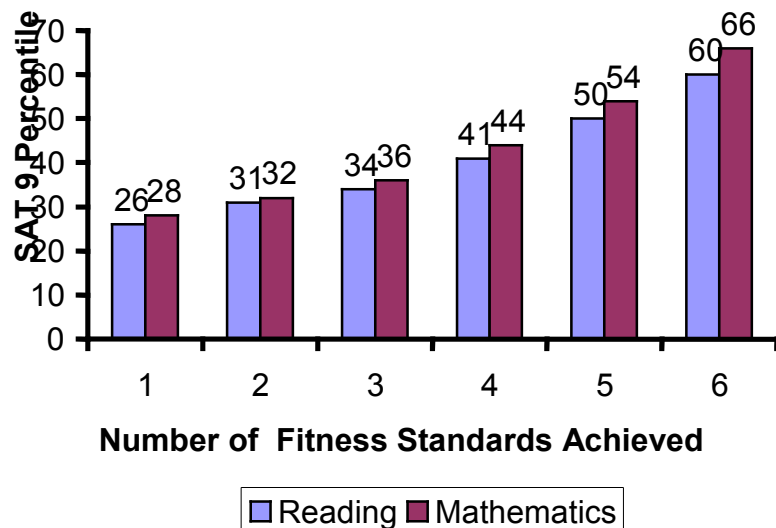
These results based on a sample size of parents n=412 and participants n=1087 from schools in Natick, Boston, D.C. and New York.

2001 Grade 5 SAT 9 and Physical Fitness Scores



<http://pe4life.org/research.php>

2001 Grade 7 SAT 9 and Physical Fitness Scores



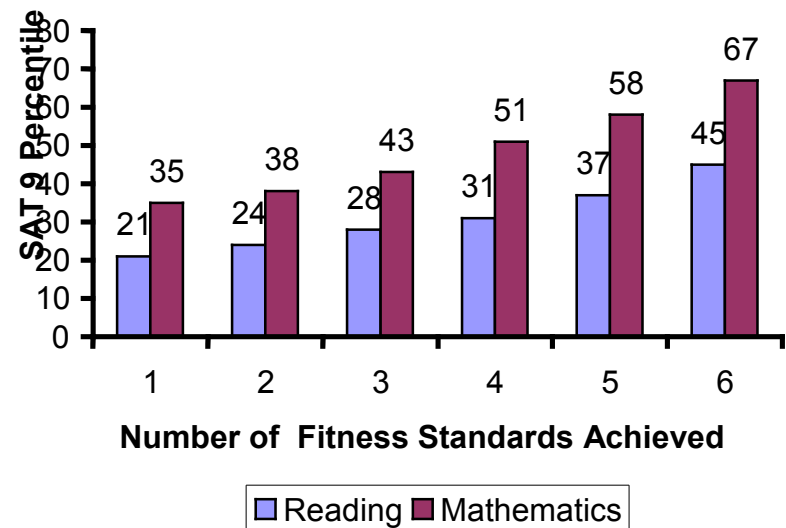
California Department of Education Study December 10, 2002

The height of each bar shows the average (median) SAT-9 national percentile rank of those students with a particular fitness score.

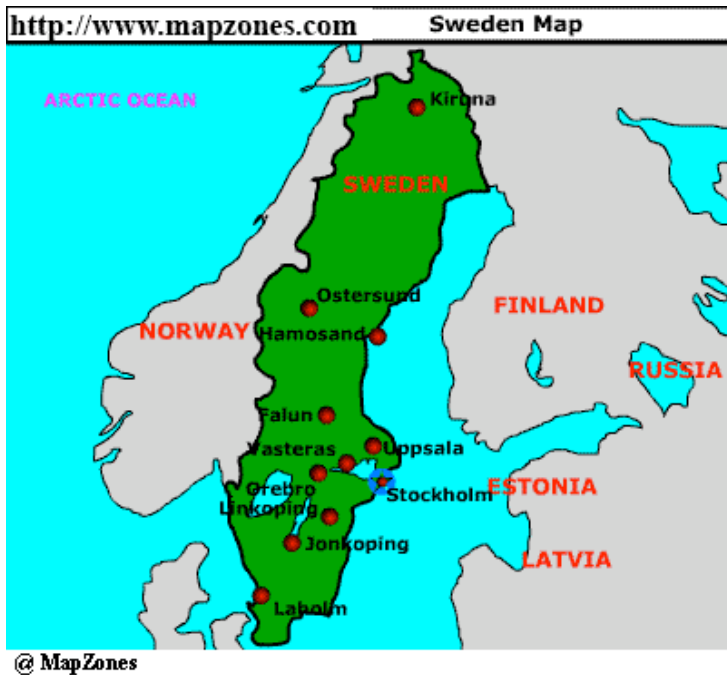
The test that was used, *Fitnessgram*, uses criterion-referenced standards to evaluate fitness. These standards represent a level of fitness that offers some degree of protection against diseases that result from sedentary living. Achievement of the fitness standards is based upon a test score falling in the Healthy Fitness Zone (HFZ). Each of the six tasks measures a different aspect of fitness, and the HFZ represent minimal levels of satisfactory achievement on the tasks. **THE X-AXIS IS THE NUMBER OF FITNESS STANDARD REACHED BY EACH INDIVIDUAL.**

Higher academic achievement is associated with higher levels of fitness in grade 5,7,9. The relationship between academic achievement and fitness in grade 5,7,9 was **greater in mathematics** than in reading, particularly at high fitness levels.

Grade 9 SAT 9 and Physical Fitness Scores



Sweden The Proof



Love to measure and keep records

1.2 million boys born 1950-76; finished H.S. 15 and entered military 18. 270,000 brothers, 1300 identical twins

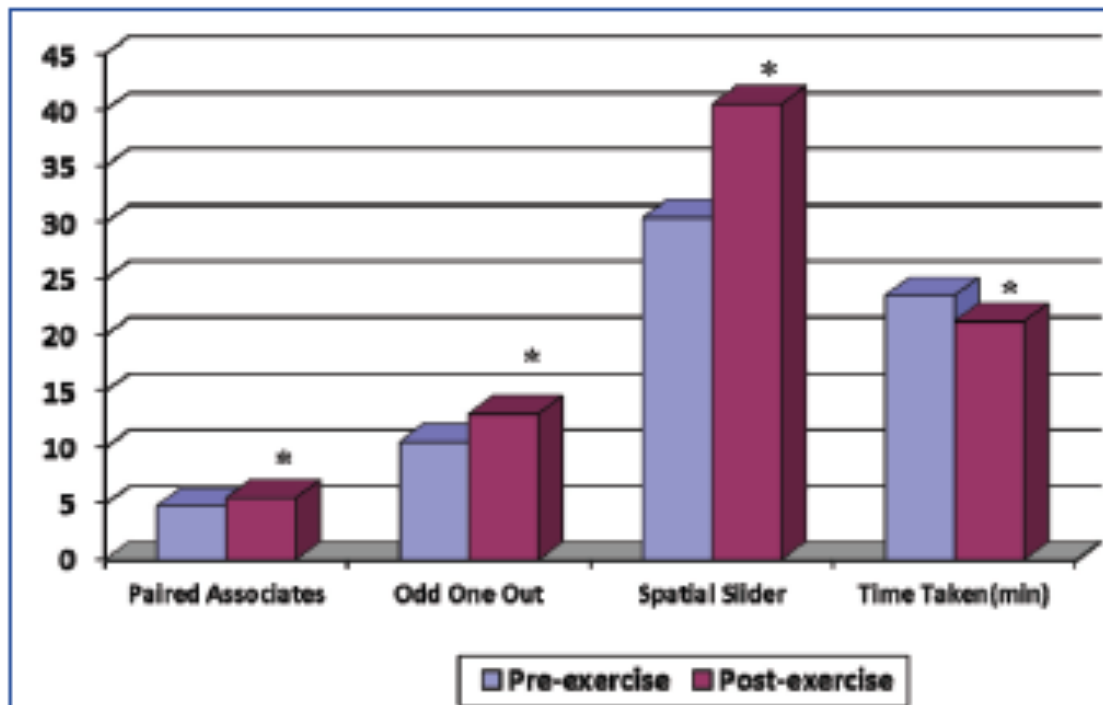
Tested cardio (ergonometric) muscle (knee, elbow, hand) and cognitive appraisal-both at 15 and 18.

Those that improved cardio fitness improved IQ and smarts. Not as much with muscle strength. Also those that improved went on to be better education, more satisfaction with life, and higher socio-economic standing.

Brothers, identical twins showed the same association-those that improved their physical fitness improved their brain power. Its not just about the genes.

"We believe the present results provide scientific support for educational policies to maintain or increase physical education in school curricula as a means to stem the growing trend toward a sedentary lifestyle, which is accompanied by an increased risk for diseases and perhaps intellectual and academic underachievement," write researchers Maria Aberg and colleagues of the University of Gothenburg in Gothenburg, Sweden in the Proceedings of the National Academy of Sciences. 2009 Nov 30. [Epub ahead of print]

Effect of 30 minutes of Exercise at 70% on Cognition



[Table/Fig-2]: Effects of acute aerobic exercise on different cognitive test scores

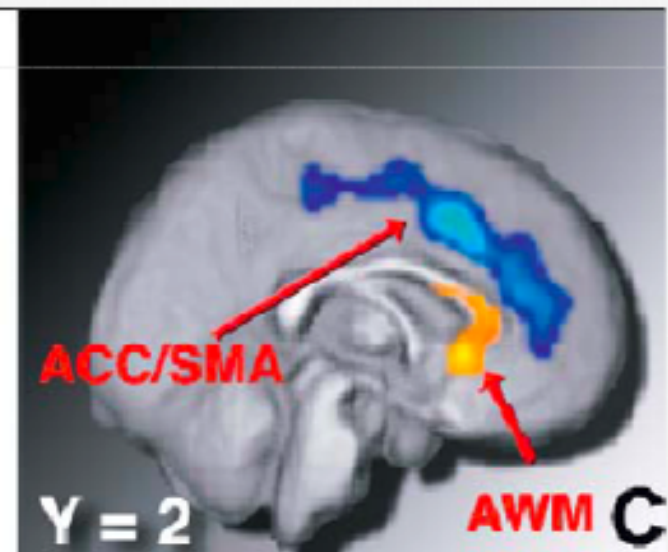
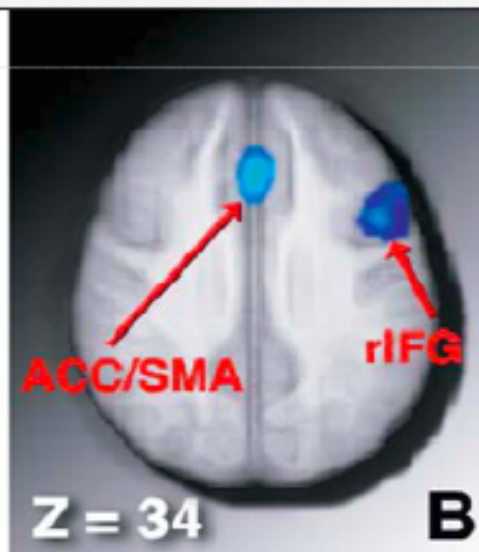
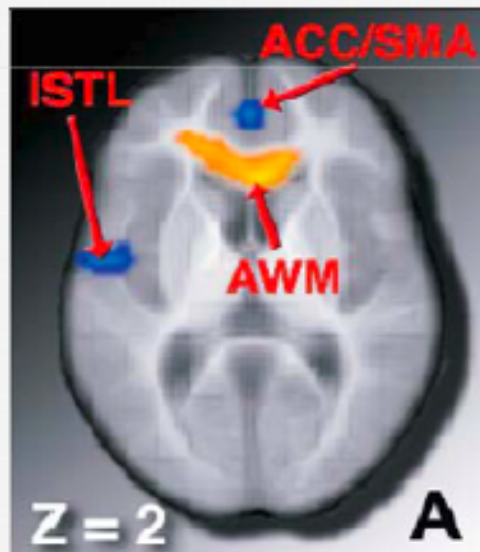
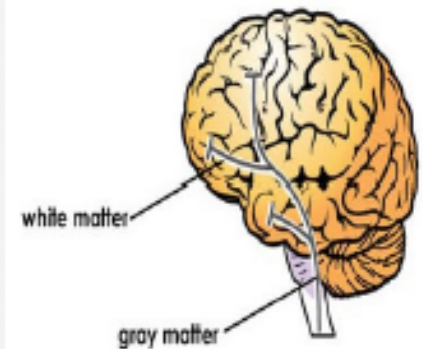
* p<0.05 compared to baseline

Name of the test	Pre-exercise Score	Post-exercise Score	'p' Value
Spatial Span (memory)	6.1±1.0	6.1±0.7	1.000
Paired Associates (memory)	4.8±1.0	5.5±1.1	0.010
Grammatical Reasoning (reasoning)	14.6±4.6	16.7±4.1	0.142
Odd One Out (reasoning)	10.5±3.0	13±3.1	0.003
Feature Match (concentration)	113±29.8	109.9±26.2	0.836
Polygon (concentration)	39.8±20.1	43.5±25.7	0.728
Spatial Search (planning)	7.9±1.7	8.1±1.3	0.726
Spatial Slider (planning)	30.4±17.8	40.5±13.9	0.043
Time Taken (Seconds)	23.5±2.55	21.2±1.48	0.03

[Table/Fig-1]: Cognitive test scores (Mean ± SD) before and after aerobic exercise

Brain Volume Increases With Exercise

Gray Matter Increases for Aerobic Exercisers



Colcombe SJ, Erickson KI, Scalf PE, Kim JS, Prakash R, McAuley E, Marquez DX, Hu L, Kramer AF. Aerobic exercise training increases brain volume in aging humans. *J Gerontol A Biol Sci Med Sci*. 2006 Nov;61(11):1166-70.

No Age Difference

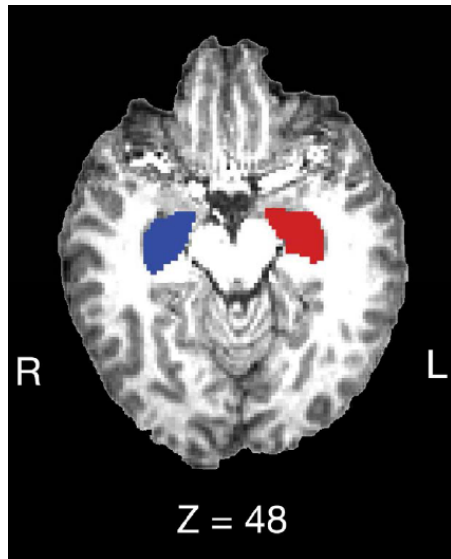
Participants (144 community members aged 19 to 93) were randomly assigned to one of two experimental conditions: (a) exercise (15 min of moderate intensity stationary cycling) or (b) control (15 min completing ratings of neutral IAPS images). Before and after the manipulation, participants completed tests of working memory and momentary affect experience was measure. Intensity between 65-70% max HR

Better Reaction Time and positive affect after 15 minutes of exercise.

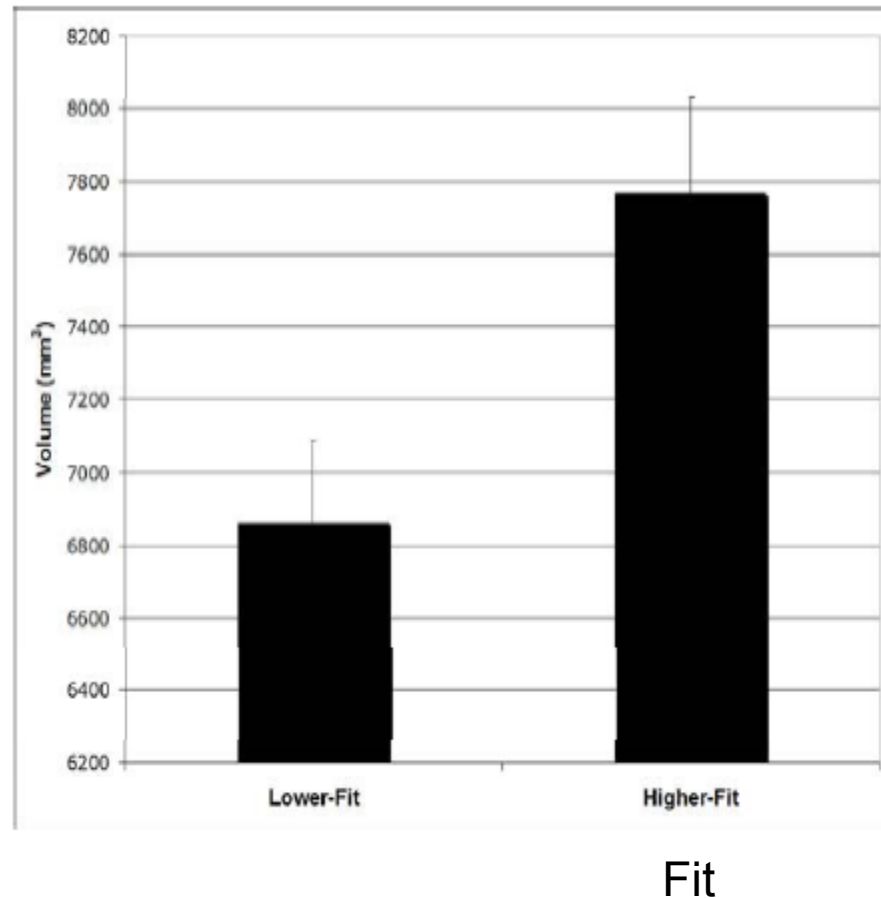
Exercise holds immediate benefits for affect and cognition in younger and older adults. Hogan CL, Mata J, Carstensen LL.

Psychol Aging. 2013 Jun;28(2):587-94.

Fitness, Hippocampus Size, and Memory

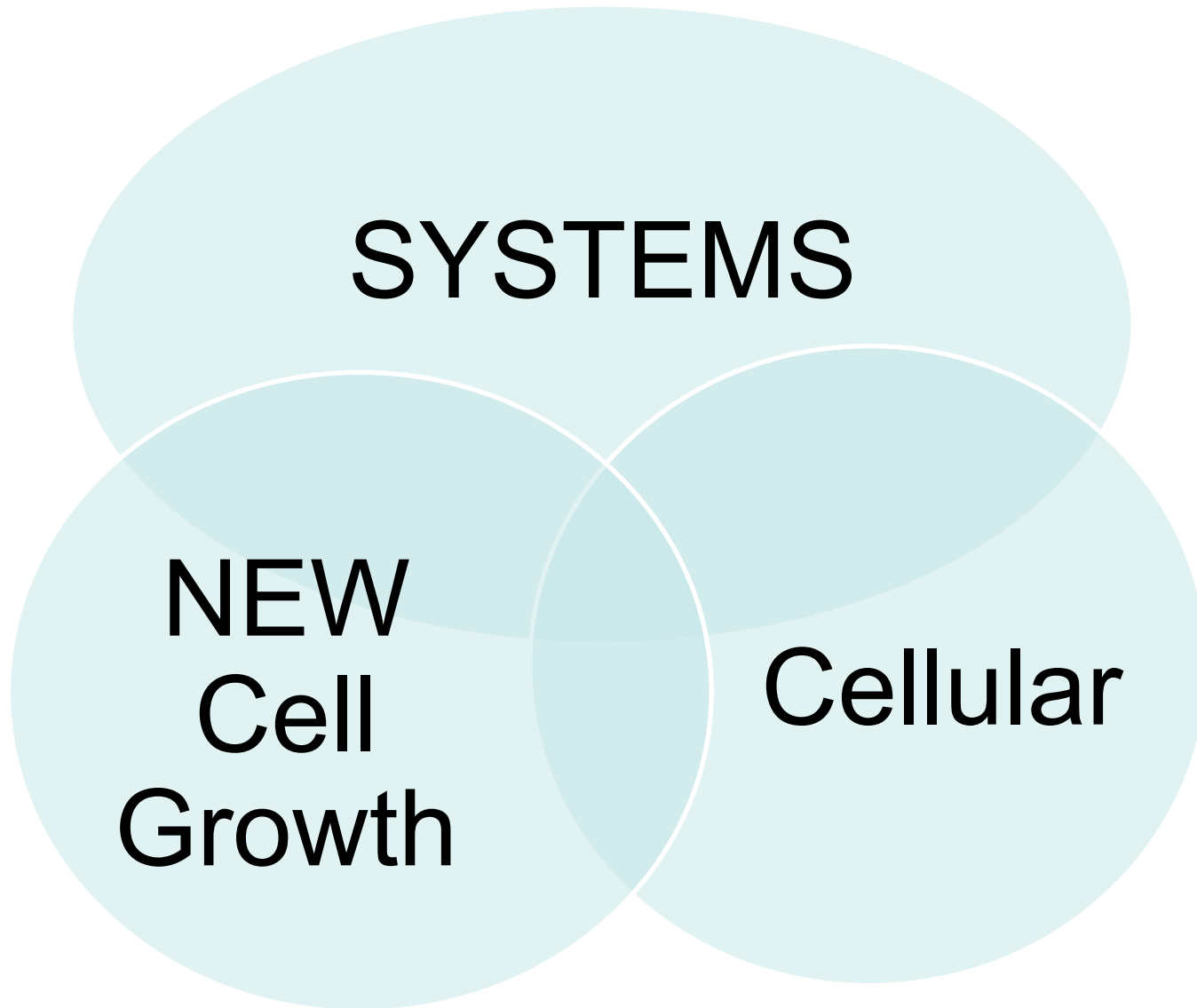


- Kids who were fit and who had better memory, also had larger hippocampi
- Fitness increases neurons, connectivity- 28 fit 21 non



Chaddock L, Erickson KI, Prakash RS, Kim JS, Voss MW, Vanpatter M, Pontifex MB, Raine LB, Konkel A, Hillman CH, Cohen NJ, Kramer AF. [A neuroimaging investigation of the association between aerobic fitness, hippocampal volume and memory performance in preadolescent children](#). Brain Res. 2010 Aug 21. [Epub ahead of print]

EXERCISE OPTIMIZES LEARNING



EXERCISE PREPARES THE LEARNER



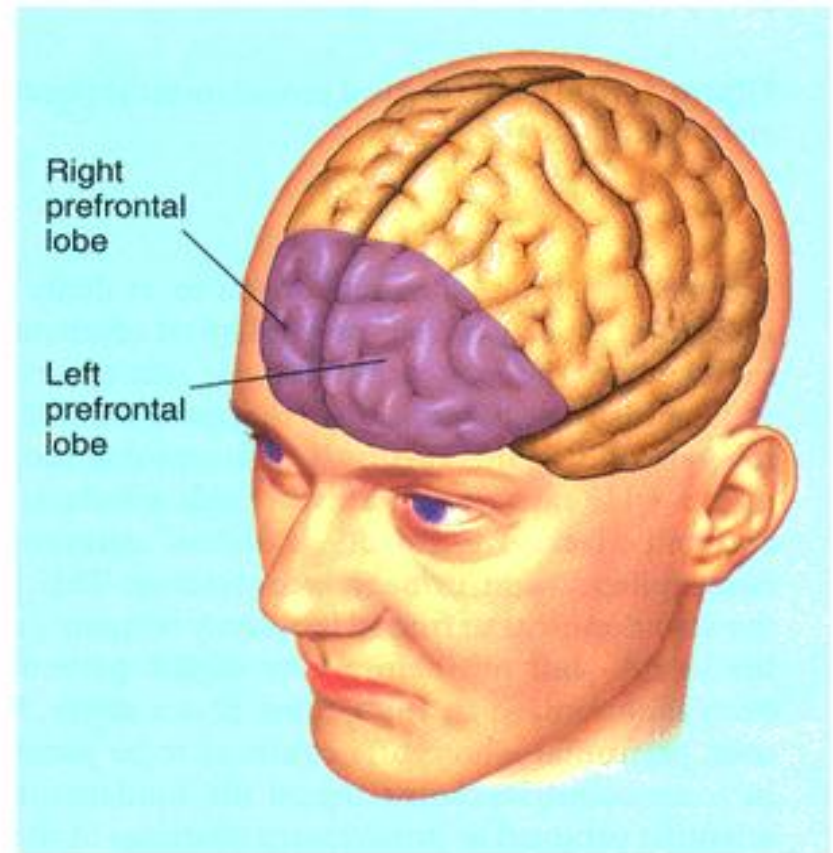
Improves Impulse Control
Improves Behavior
Improves Attention
Decreases Nudginess
Improves Arousal - Lessens Fatigue
Improves Motivation
Helps Mood and Anxiety Regulation
Combats Depression
Improves Self-esteem
Reverses "Learned Helplessness"
Combats Toxic Effects of Stress Hormones



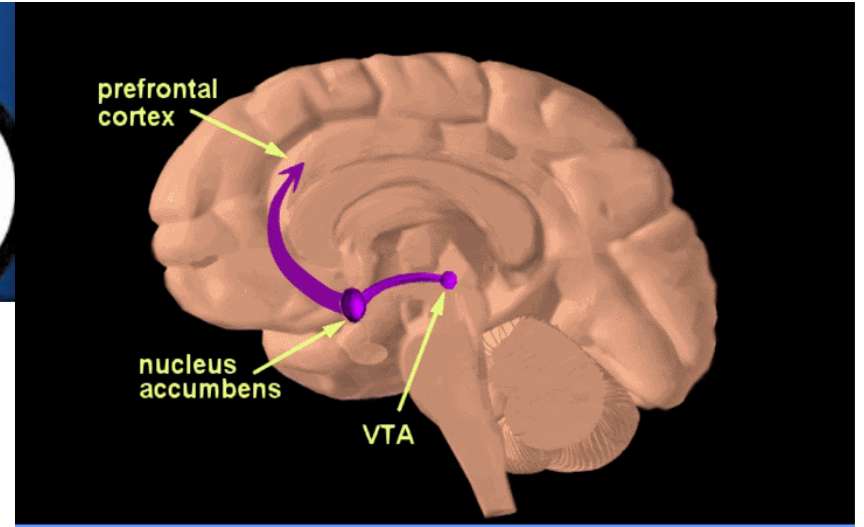
The Prefrontal Cortex

Major Role in Executive Function

- EXERCISE particularly affects our Executive Function
 - Planning
 - Organization
 - Initiate or delay a response
 - Consequence evaluation
 - Learning from mistakes
 - Maintain the focus
 - Working Memory
- Dysfunction in these areas leads to disruption in the organization and control of behavior



http://www.driesen.com/prefrontal_cortex.htm



The Prefrontal Cortex Major Role in Executive Function

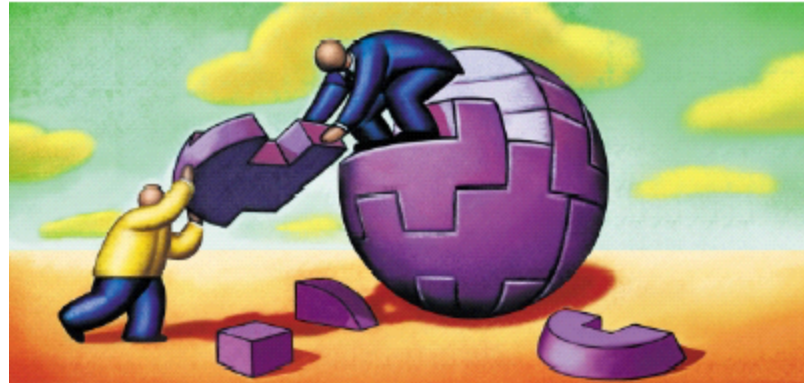
**Planning
Organization
Initiate or delay a response**

Executive function relates to abilities to differentiate among conflicting thoughts, determine good and bad, better and best, same and different, future consequences of current activities, working toward a defined goal, prediction of outcomes, expectation based on actions, and social "control" (the ability to suppress urges that, if not suppressed, could lead to socially-unacceptable outcomes).

The prefrontal cortex is the brain center most strongly implicated in qualities like **sentience, human general intelligence, and personality.**

**Dysfunction in these areas leads to disruption
in the organization and control of behavior.**

NERVE CELLS WIRING TOGETHER ARE THE BUILDING BLOCKS OF LEARNING

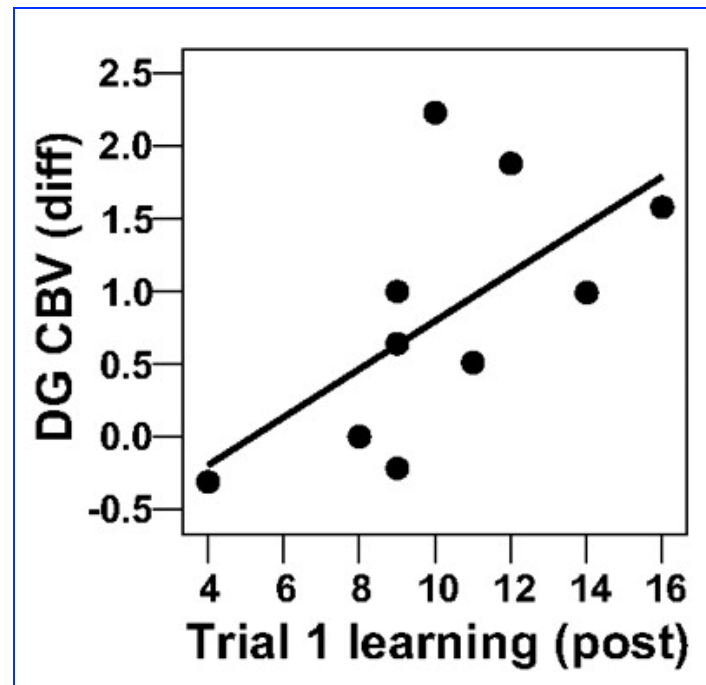
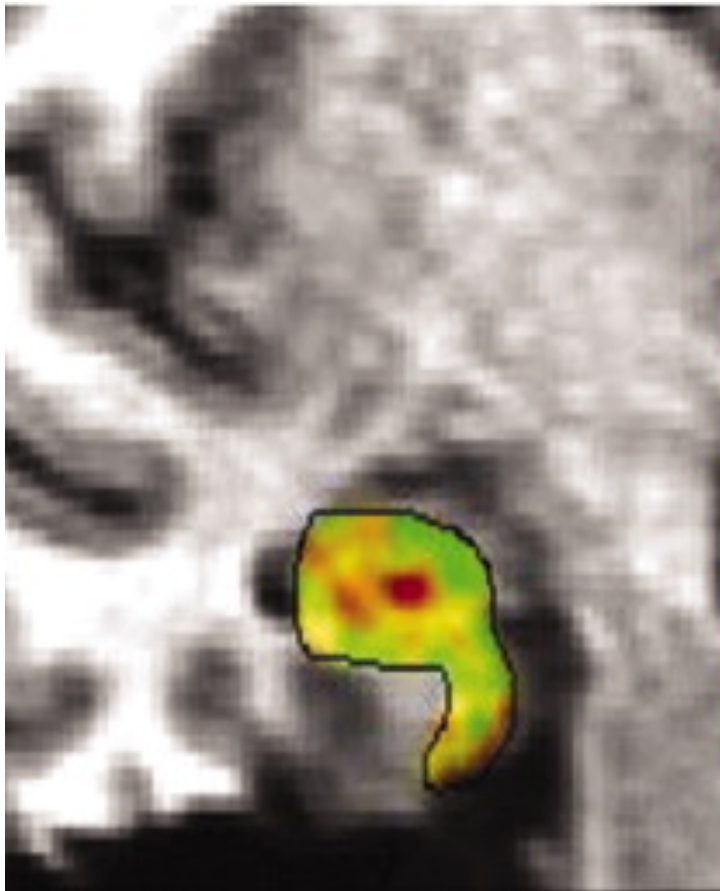


Cells optimally ready to bind

- **Increased Vascular Bed- more Oxygen, Glucose available, easier removal of the breakdown products.**
- **Increased Serotonin, Dopamine, BDNF and other nerve fertilizers (Miracle Gro) that strengthen the wiring of cells together**
- **Body/brain interaction: IGF-1, FGF, VEGF all come from the muscles acting and send off these messengers which impact the brain – potentates release of Neurotransmitters**

Exercise promotes hippocampus blood flow in humans

Age 21-45, below average fitness
12 weeks: 4X/wk aerobic training; VO2-max



Rey auditory verbal learning test

Pereira et al.,
PNAS 2007

(BDNF) is the mother of all growth factors but others come up from the periphery to have very important actions in the brain.

BDNF encourages the neurons to grow therefore it is referred to as Miracle Grow for the brain.

The Growth Factors as a team gives the synapses the tools they need to take in information, process it, associate it, remember it and put it into context.



BODY  BRAIN

IGF-1 Insulin-like Growth Factor

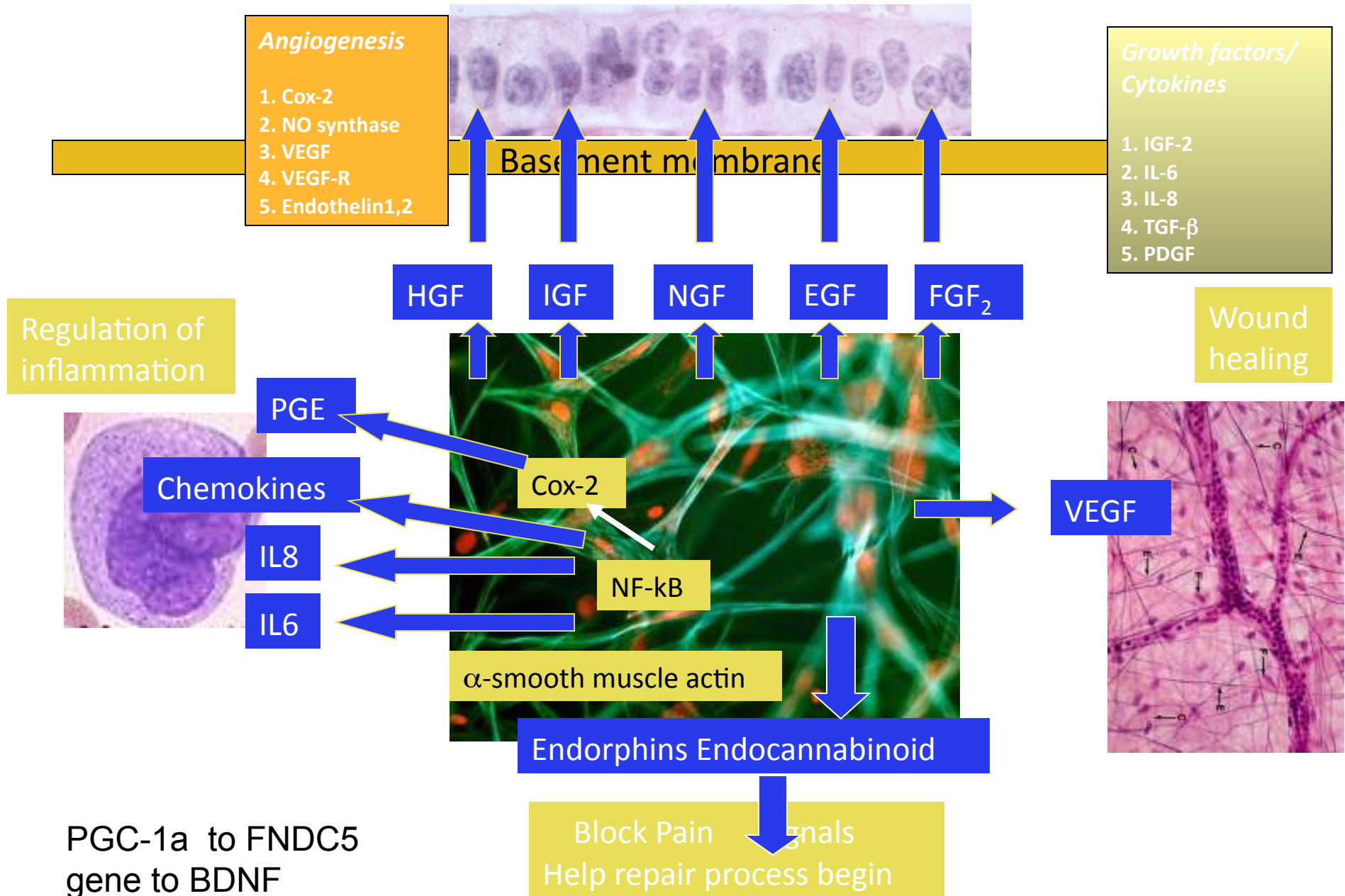
VEGF Vascular endothelial factor

FGF-2 Fibroblast growth factor

ANP- Atrial Natriuretic Factor

ALL THESE COME FROM MUSCLE CONTRACTION AND TRAVEL TO THE BRAIN AND HAVE AN EFFECT ON LEARNING AND BRAIN CELL HEALTH AND GROWTH

Repair and Recovery: Stress then Growth





RE-WILDING TAKING PLACE
THEY ARE CANARIES IN THE
COAL MINE. LOWER THEIR
INTERNAL STATE OF NOISE
AND CHAOS

CENTER FOR DISCOVERY, HARRIS,
NY 1000 ACRE FARM

+350 ADOLESCENT AUTISTIC KIDS

ALL VIOLENT – FAILURES OF
PROGRAMS

MOVEMENT MEASURED UP TO 65%
OF WAKING TIME

DIET

SLEEP

BIOPHILLIA

SMALL TRIBES

MINDFULNESS

CONNECTIONS





The Board Meeting of the Future

BY JOHN J. MEDINA If you wanted to create a work environment in direct conflict with what the brain is equipped to do, you'd design the standard cubicle. Instead, imagine a brain-friendly workplace where board meetings are conducted on treadmills, desks are equipped with stationary bicycles, and people wear gym clothes, not suits.

AT BOARD MEETINGS, people wear gym clothes and walk on treadmills at about 1.8 miles per hour—to cool down right after a period of intense physical activity.

TREADMILLS are installed in the office. Morning and afternoon exercise breaks are encouraged.

WORKSTATIONS include stationary bicycles that fit under the desks. Employees keep their legs moving while answering e-mail.

IN A COMPETITIVE climate, exercise is as close to a magic productivity bullet as you'll get.

The Brain's Active History

If our ancestors sat still in the savanna for eight hours straight—heck, for eight minutes—they became somebody's lunch. Our brains developed while we walked about 12 miles a day, seven days a week, for several million years.

Clinical Proof Food for Thought

YOU LEARN 20% faster immediately after exercise than after sitting still.

AN ACTIVE LIFESTYLE reduces the risks for Alzheimer's disease, dementia, anxiety, and depression—and for hospital visits. It doesn't take a brain scientist to see the inverse relationship between exercise and health care costs.

STUDY PARTICIPANTS who jog for 30 minutes two or three times a week for 12 weeks improve their cognitive performance. When they stop the exercise regimen, the cognitive benefits evaporate.

THE GOOD of exercise demonstrates people, and even Japanese

How Exercise Jogs the Brain

EXERCISE INCREASES blood's access to brain regions for learning called derived neurons (BDNF), which Miracle-Gro-like want more of. In fact, you can't

THE BRAIN'S Sons—higher valued by business where—respect. They help us design a safe hitting his performance review.

JUST AS ROAD to goods and makes it a self get to overcome the blood, on. Thanks to exercise, natural has more than one cleanup job.



EXERCISE AND COGNITION

- Improves working, short term and long term memory
- Improves ability to switch plans
- Decreases distractions
- Improves reading comprehension and analysis
- Enhances creativity