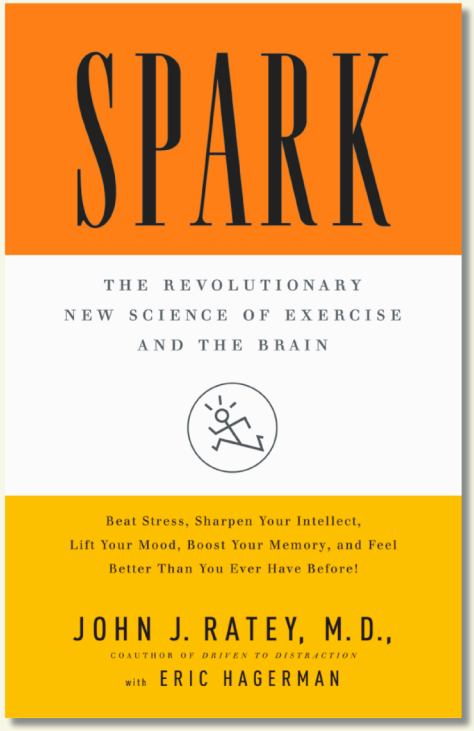
Harnessing the Psychiatric Effects of Exercise

John J. Ratey, MD

Exercise and the brain- the crucial connection!



SPARK: The Revolutionary New Science of Exercise and the Brain
By Dr. John Ratey
with Eric Hagerman
January 10, 2008
Hardcover $24.99 (In Canada: $31.99)

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SPARK is a groundbreaking exploration of the connection between exercise and the brain's performance that shows how even moderate exercise will supercharge mental circuits to sharpen thinking, enhance memory, beat stress, and much more. Dr. John J. Ratey is a Harvard professor and author of the bestseller Driven to Distraction.

COGNITION: Dr. Ratey shows how exercise improves our ability to learn and in fact makes us smarter. After a new fitness program was instituted in an Illinois school district of 19,000, test scores soared—first in the world in science and sixth in math.

HORMONAL FLUCTUATIONS: Exercise is particularly important for women during each stage of the life cycle because it tones down the negative consequences of hormonal changes that some experience and enhances the positive effects for others.

STRESS: Too much stress can sever connections between neurons. Dr. Ratey explains how exercise counteracts this breakdown by increasing blood flow to the brain and creating a surge in protective neurochemicals.

ANXIETY: While anti-anxiety drugs stifle anxiety, they don't help you learn a different response to the underlying fear. Exercise has been proven not only to reduce anxiety but to rewire certain pathways and prevent anxiety.

MOOD: About 18 percent of adult Americans experience depression at some point in their lives. Using cutting-edge studies, Dr. Ratey shows that exercise is better than drugs like Zoloft in reducing depression. Exercise elevates endorphins, boosts dopamine, and regulates all of the neurotransmitters targeted by antidepressants.

AGING: Exercise can also help stave off memory loss and Alzheimer's and keep the mind sharp. New research illustrates that women who exercise decrease their chances of dementia by 50%.

ADHD: Exercise increases dopamine, which in turn improves focus and attention. Dr. Ratey explains why he prescribes exercise for treating ADHD in kids and adults.

ADDICTION: Exercise is the perfect antidote to addiction, again because it increases dopamine and so improves the brain's ability to satiate.

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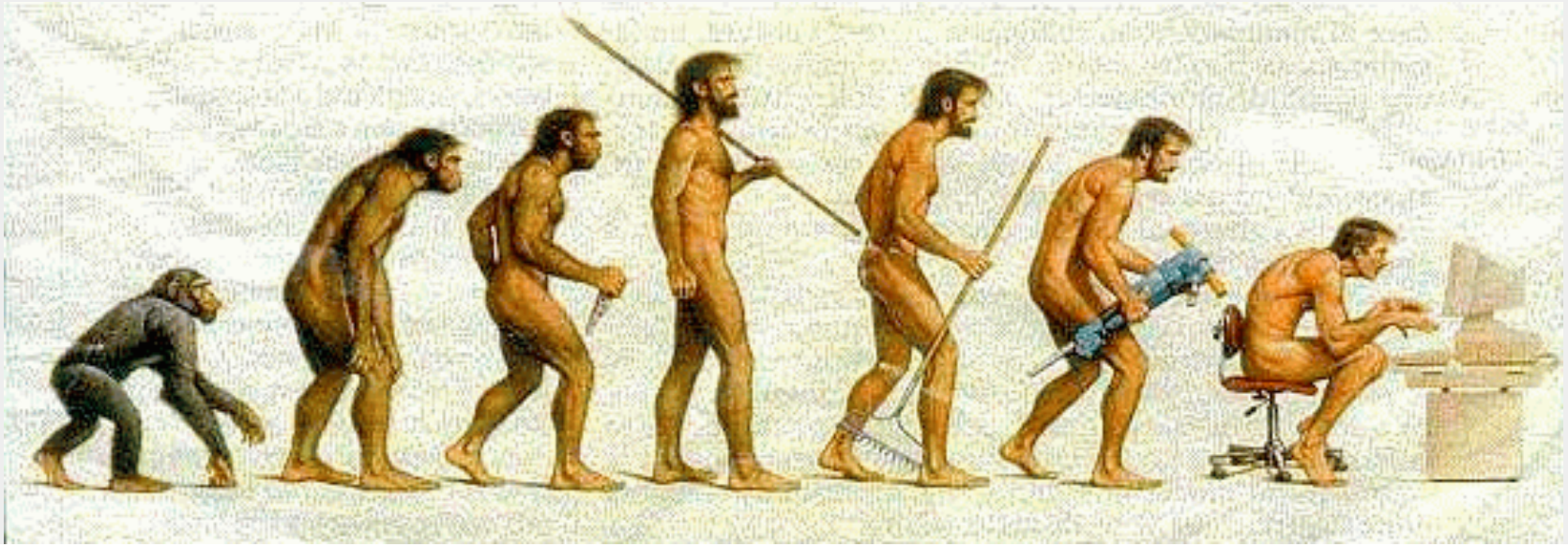
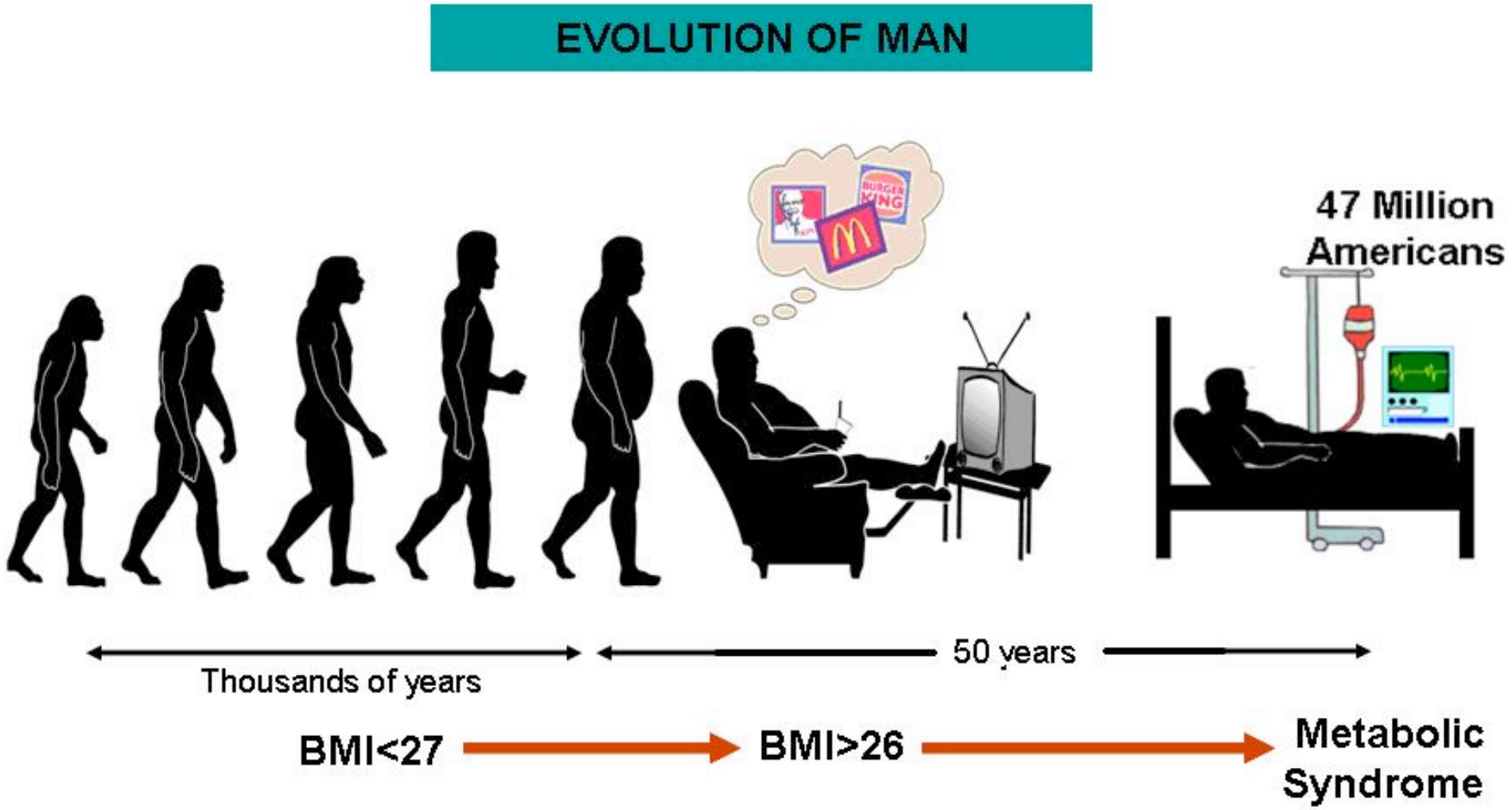
Hunters & Gatherers

- Our early ancestors predominately consisted of **hunter-gatherer** types ensuring the **“Running Man”** as a standard of fitness for their survival.
- **If you did not run, you did not eat**.
- Individuals who could out-run & out-plan their peers would survive.

Learning From History

- Evolutionary history teaches us that early humans could not have survived without the ability to perform demanding physical work.
- Individuals who could out-run & out-plan their peers would survive.

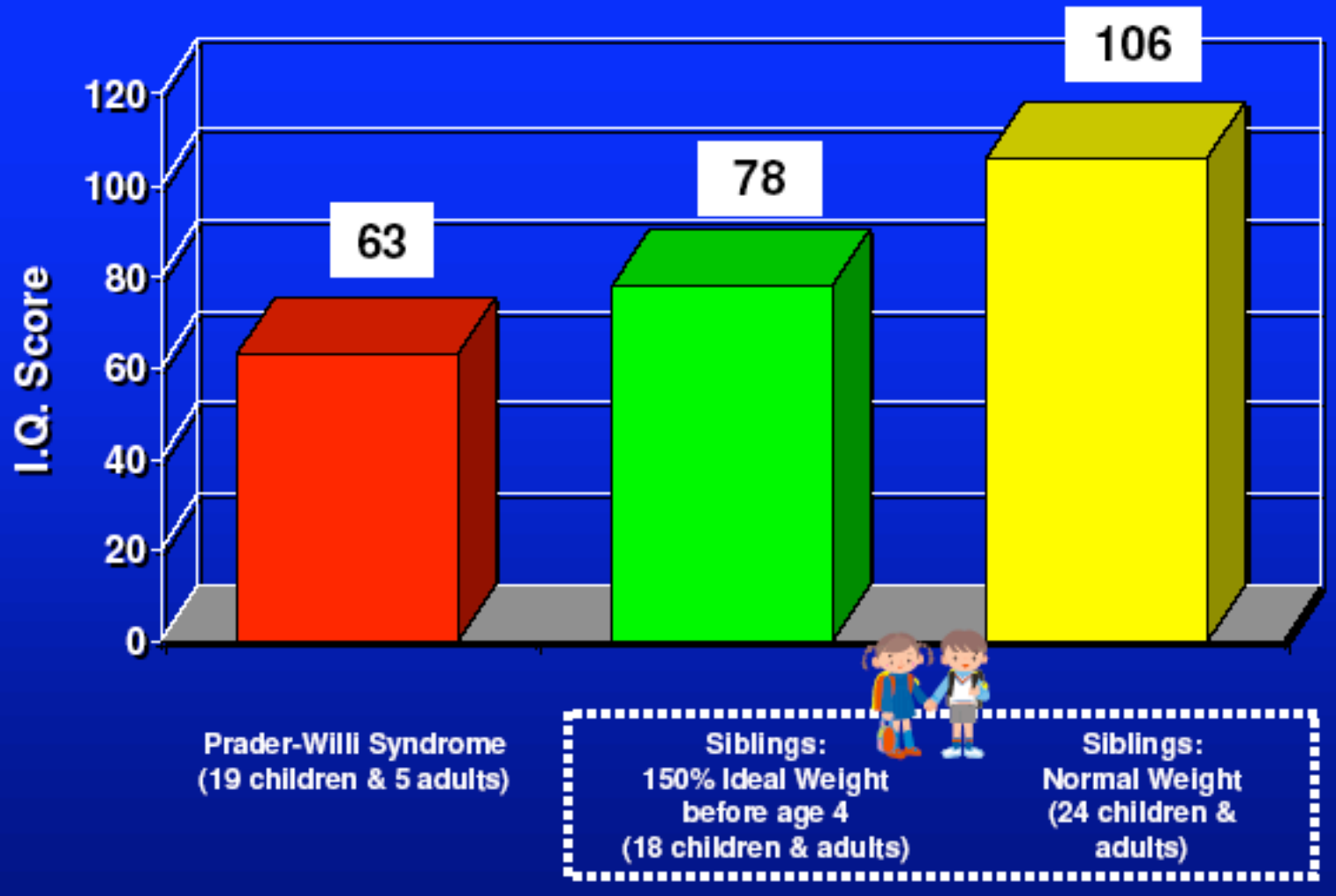




Most Americans will become overweight, 90% of men and 70% of women.

An email from a German doctor who had gone to a conference in Illinois: 'One afternoon I decided to go for a walk. I noticed there were hardly any sidewalks on this road. On two occasions people stopped their car and asked if I was OK. The second stopper was a police car. The policeman found it hard to believe I was just going for a walk.

Early-Onset Obesity and Its Effect on I.Q.



Source: Miller, et al, J of Ped, Vol. 149, Issue 2, Aug 2006, 192-198.e3

MY GENES MAKE ME DO IT

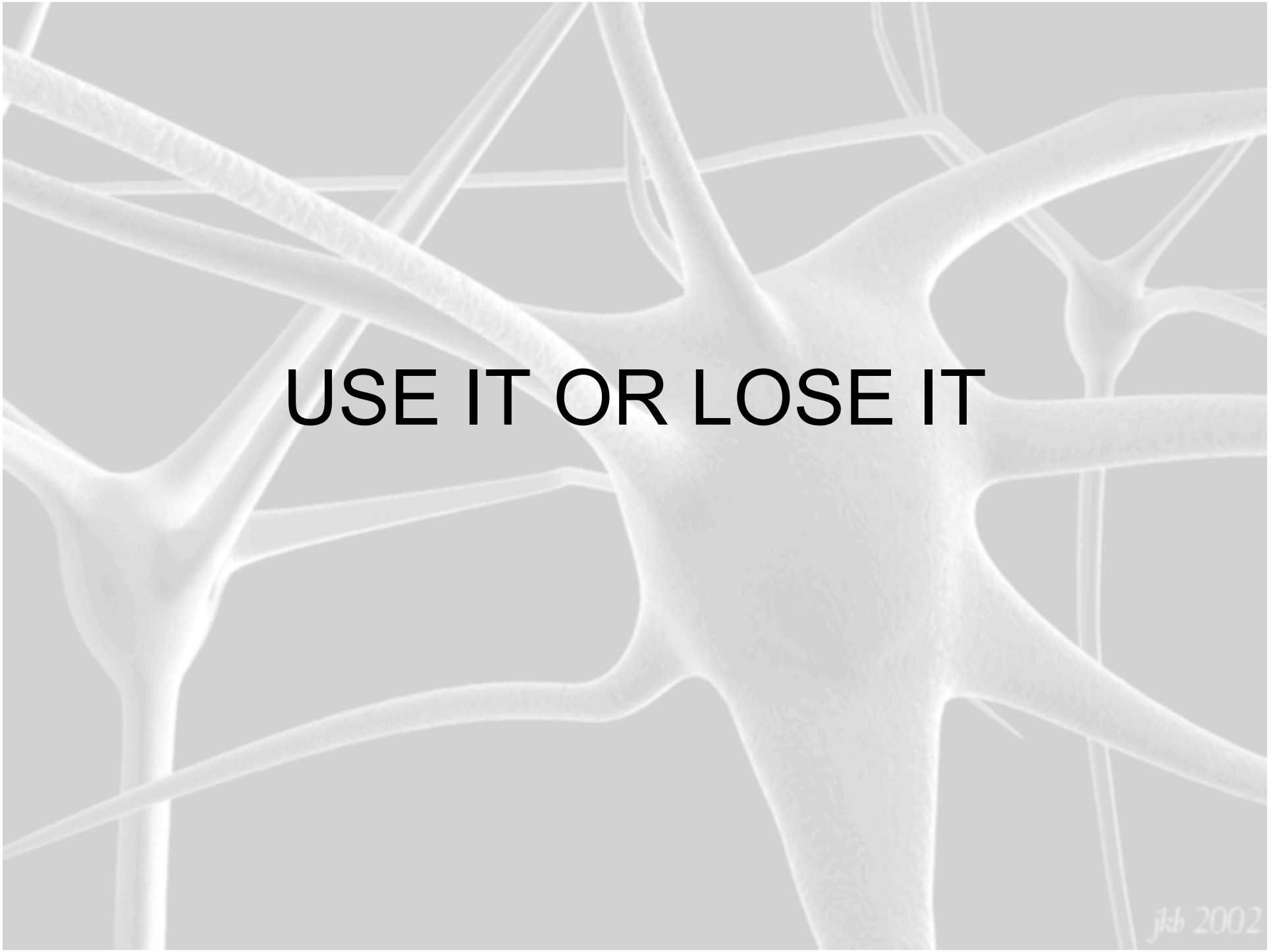
Thrifty Genes Evolved

They drive us to load up on calories and take it easy

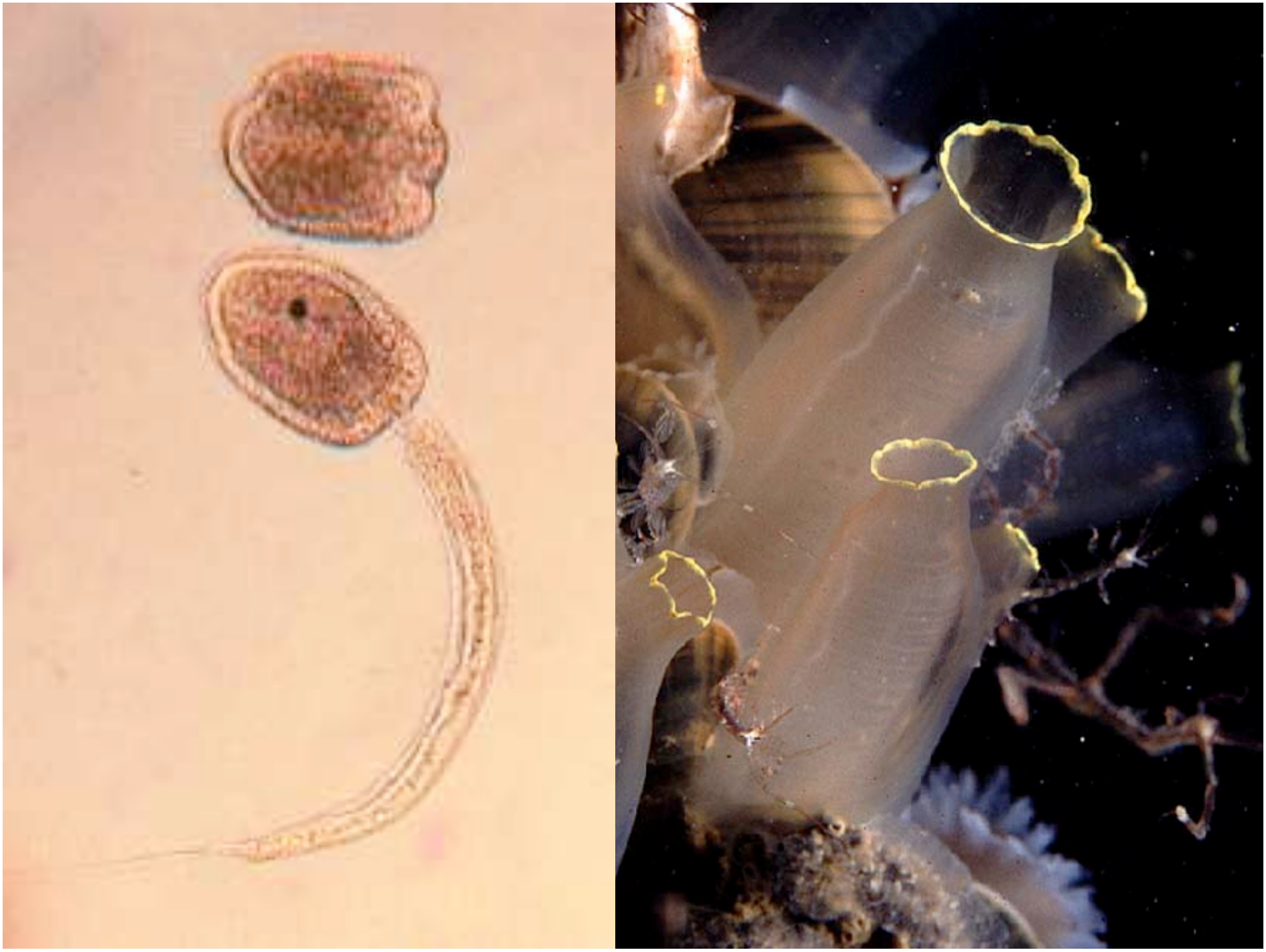
Because tomorrow we will have to **walk for days without food.**

Organisms & Movement

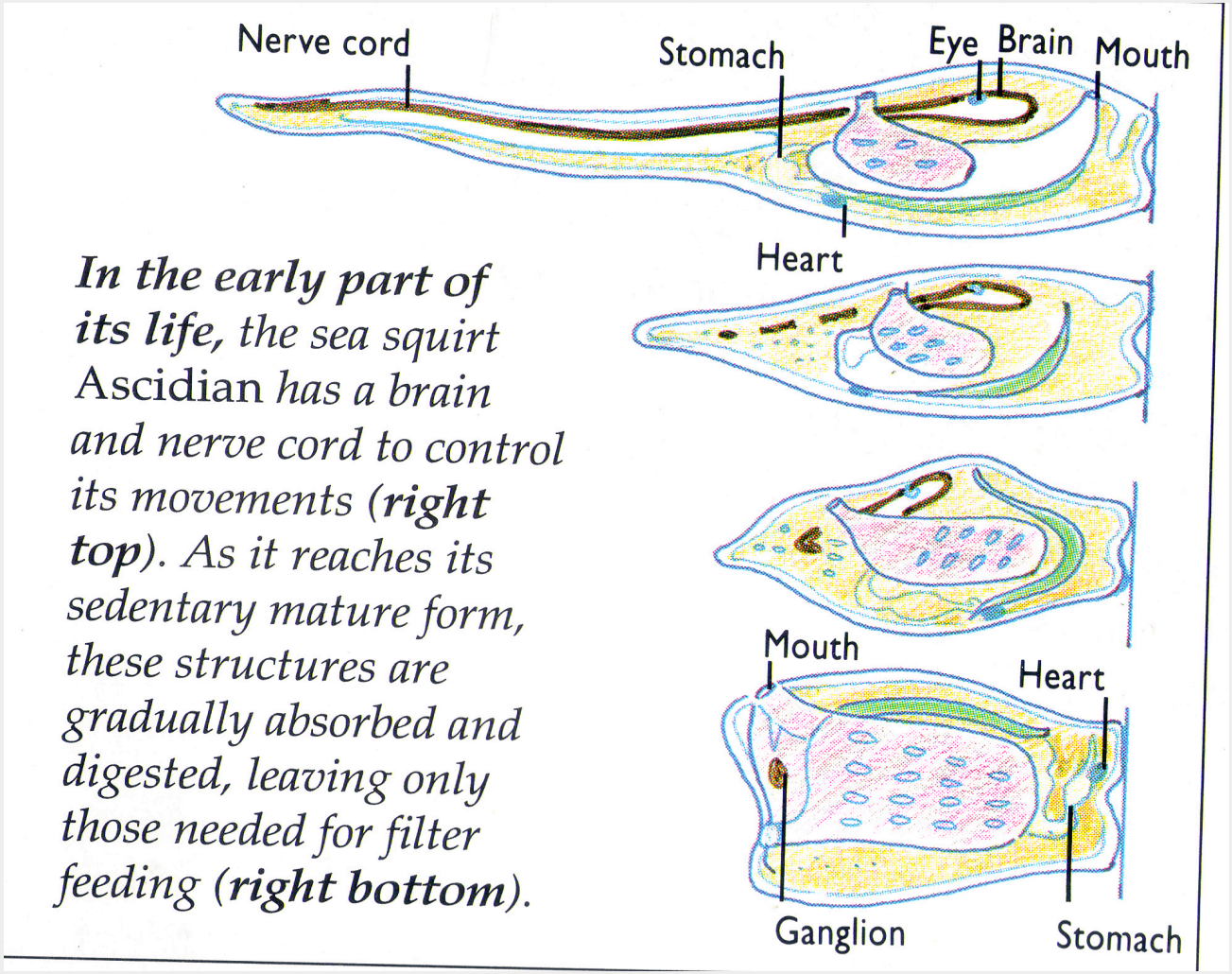
- Only an organism that moves from place to place requires a brain.
- An organism that stays still, responds automatically to changes in its environment, but has no need to direct its movements.
- Plants often have sophisticated reactions like turning their leaves to face the sun, but they do not have to move, so possess no brain.


USE IT OR LOSE IT
jkb 2002

NEURAL DARWINISM

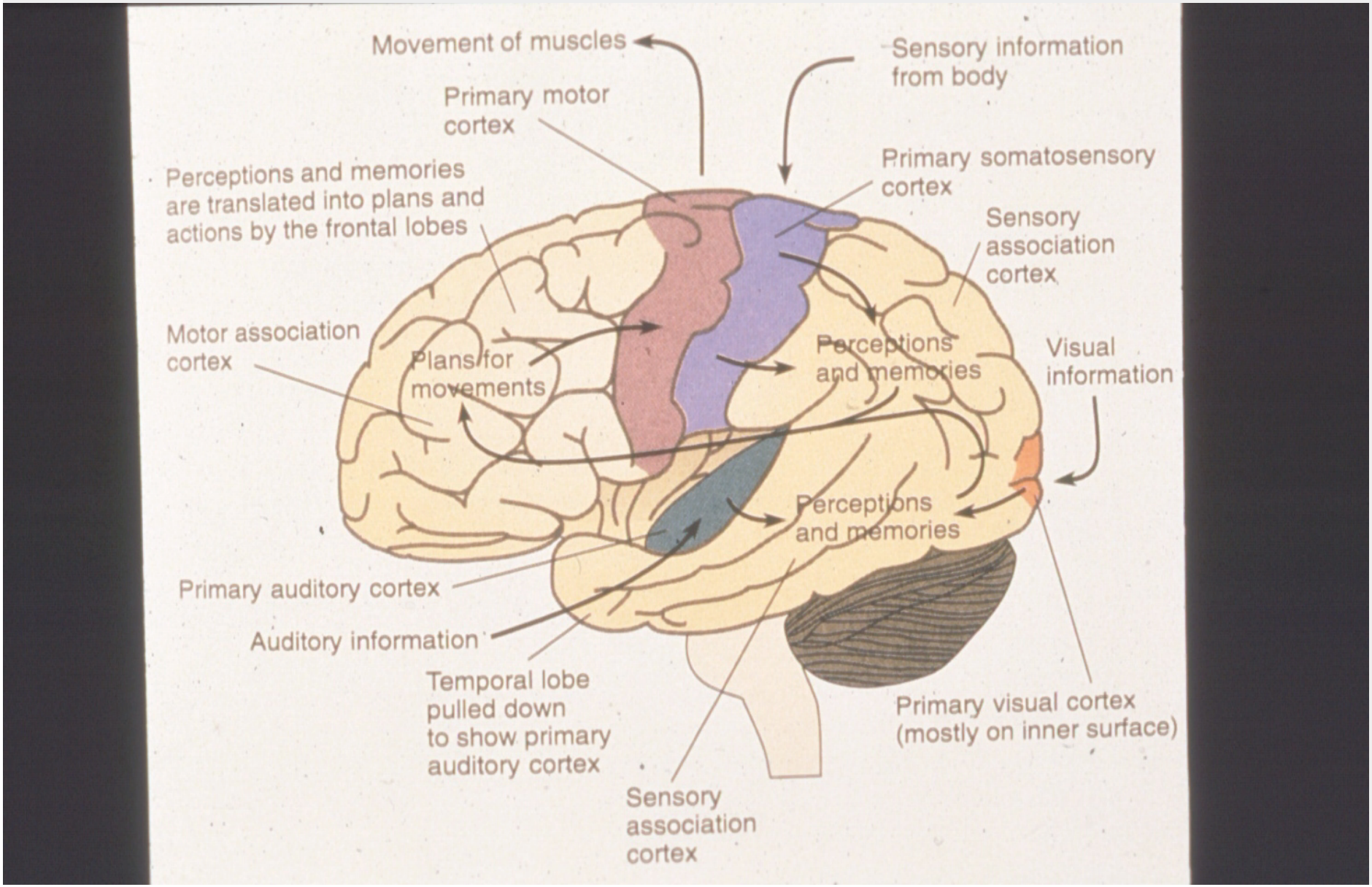


The life of a Sea Squirt



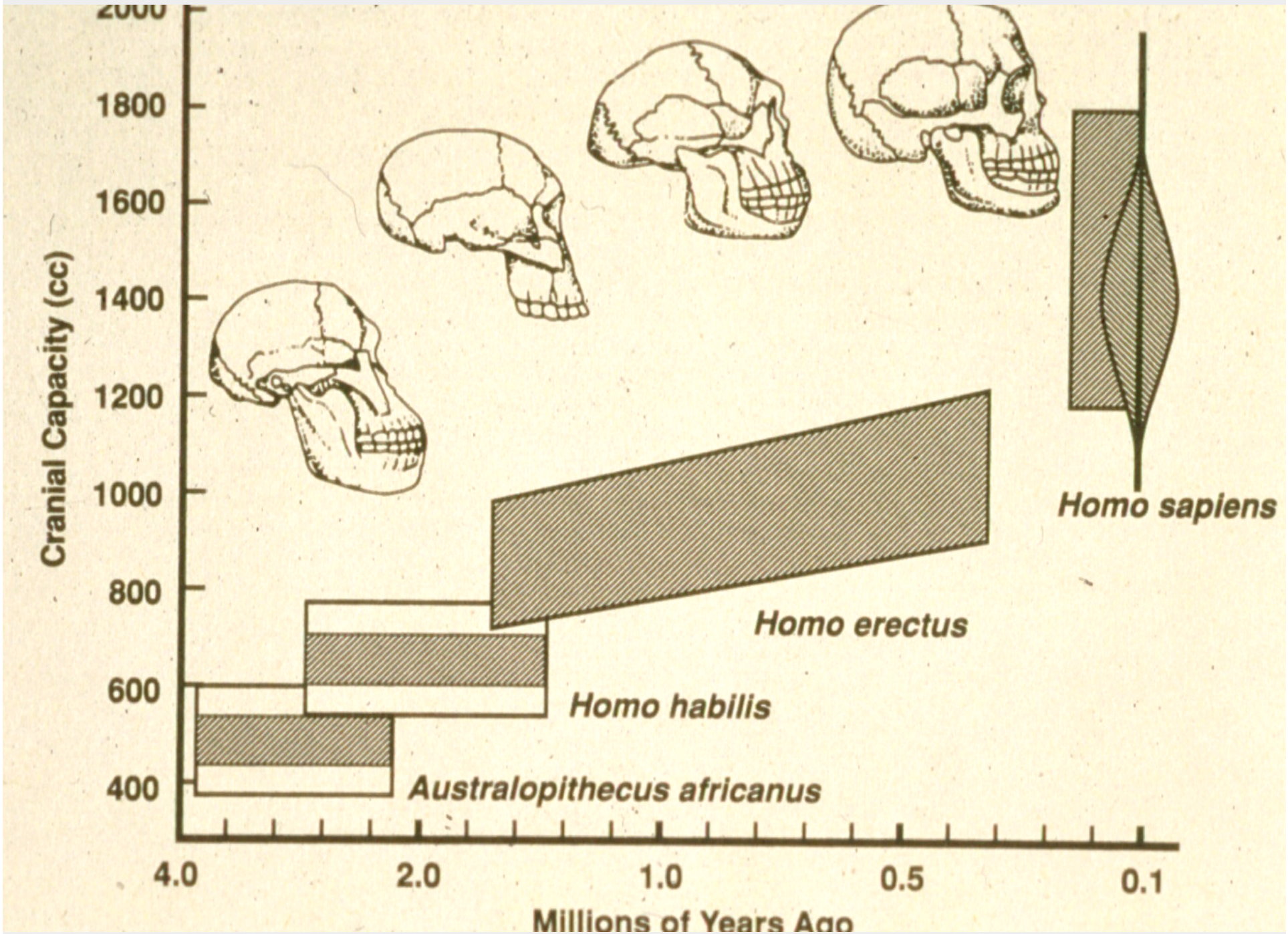
In the early part of its life, *the sea squirt* Ascidian *has a brain and nerve cord to control its movements (**right top**). As it reaches its sedentary mature form, these structures are gradually absorbed and digested, leaving only those needed for filter feeding (**right bottom**).*

ADAPTATION, MOVING, LEARNING

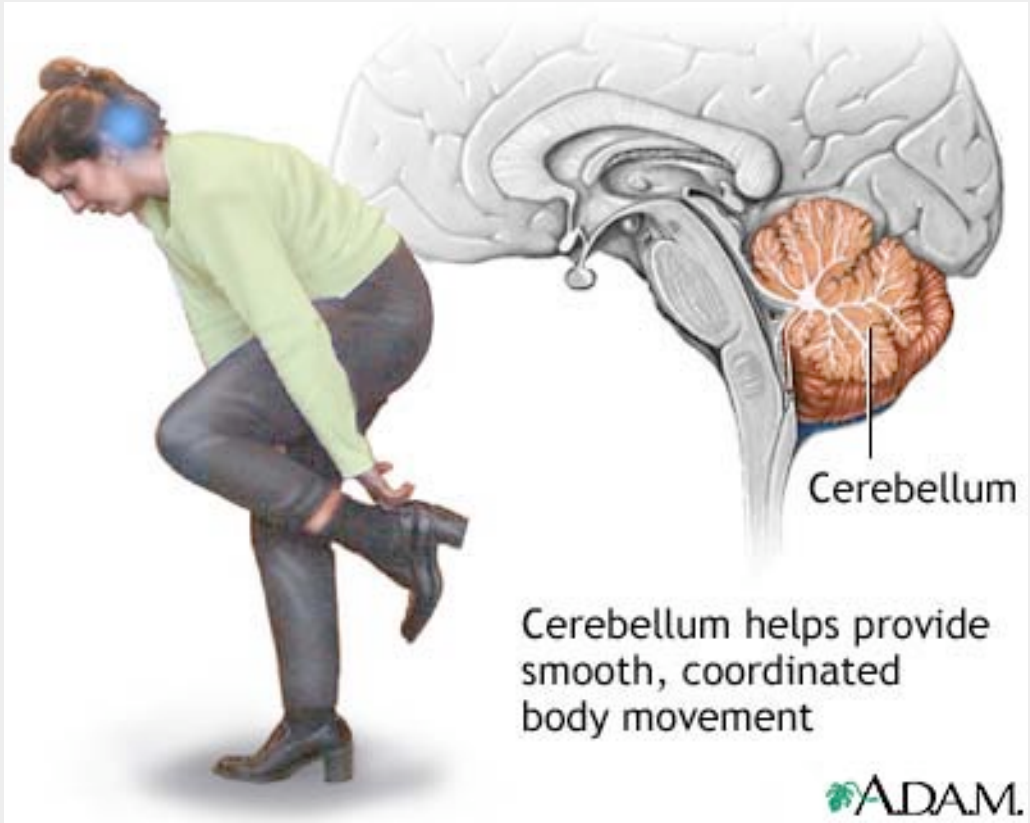


"*That which we call thinking is the evolutionary internalization of movement.*"

Llilnas, 2001

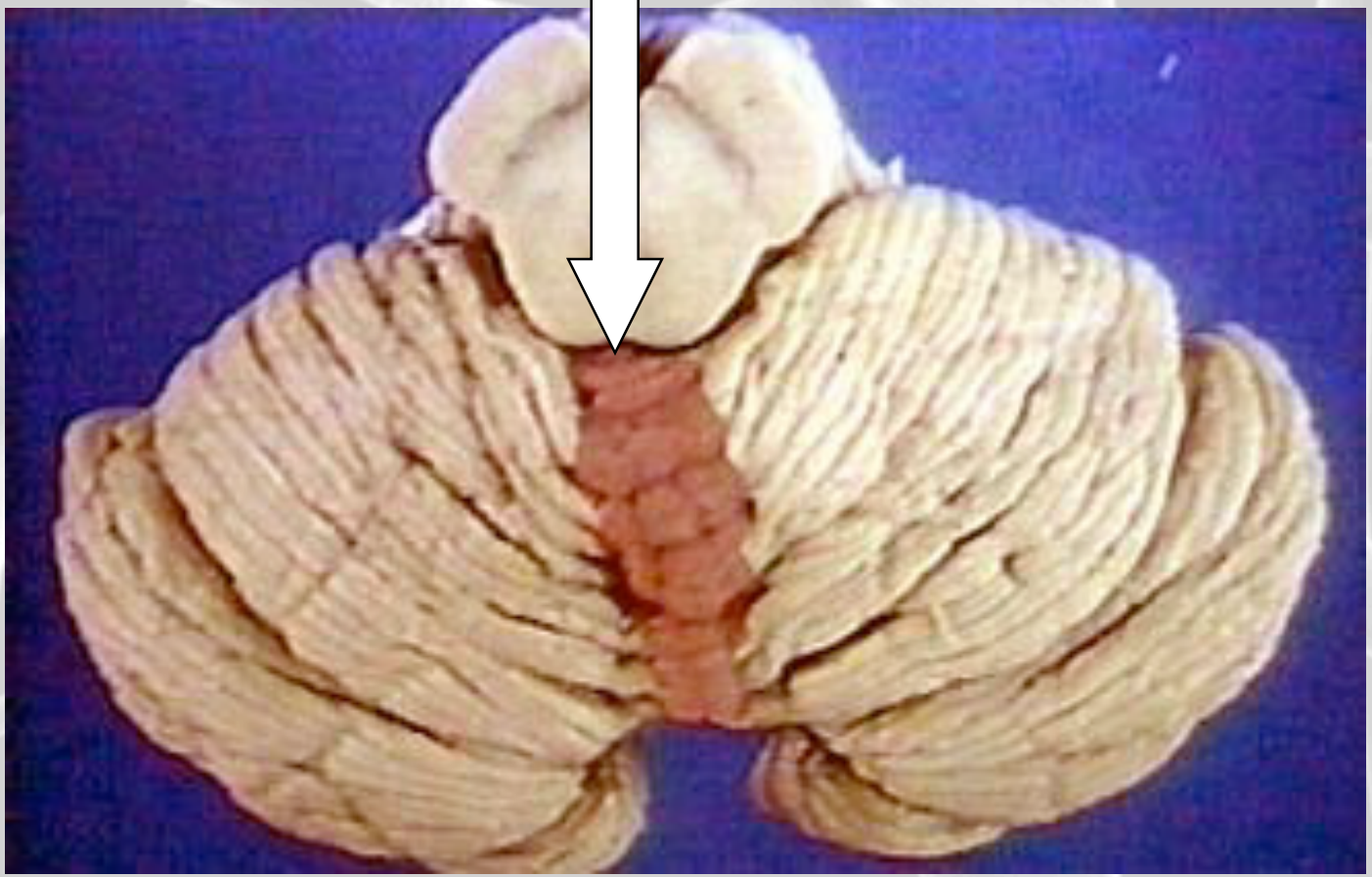

2000
1800
1600
1400
1200
1000
800
600
400
Cranial Capacity (cc)
Homo sapiens
Homo erectus
Homo habilis
Australopithecus africanus
4.0
2.0
1.0
0.5
0.1
Millions of Years Ago

Cerebellum: mood, schiz, autism

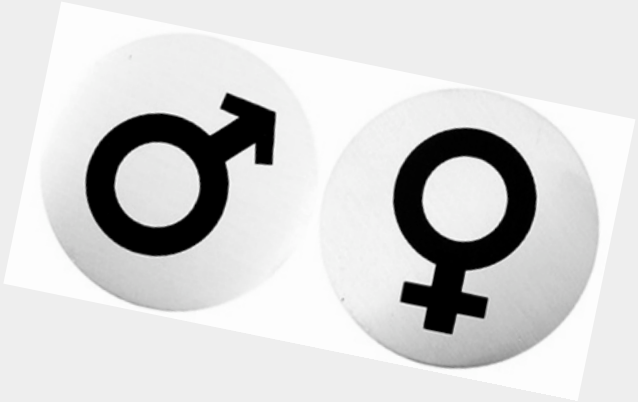


- wonder

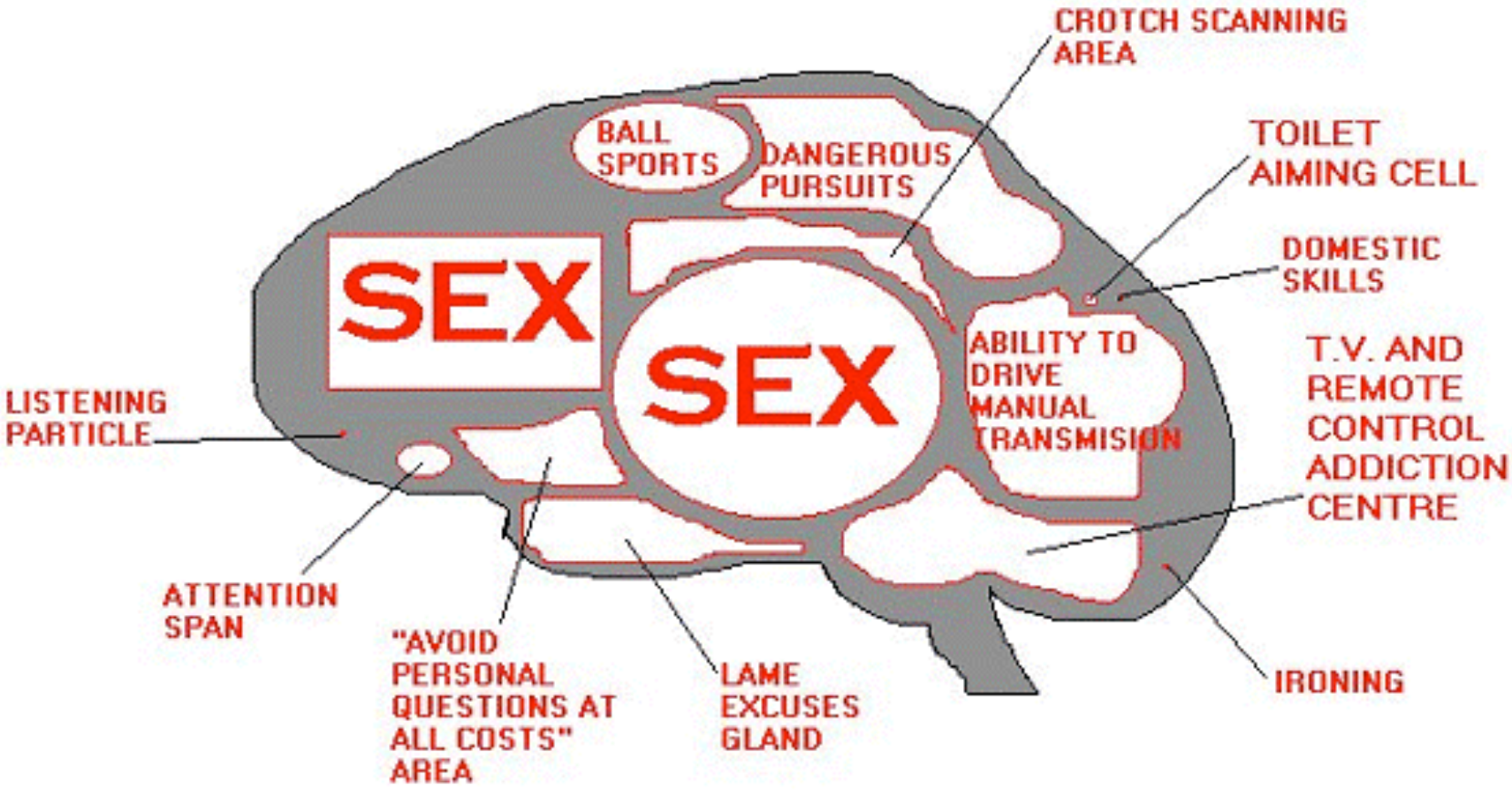
Vermis: a midline region of the cerebellum.



GENDER DIFFERENCES

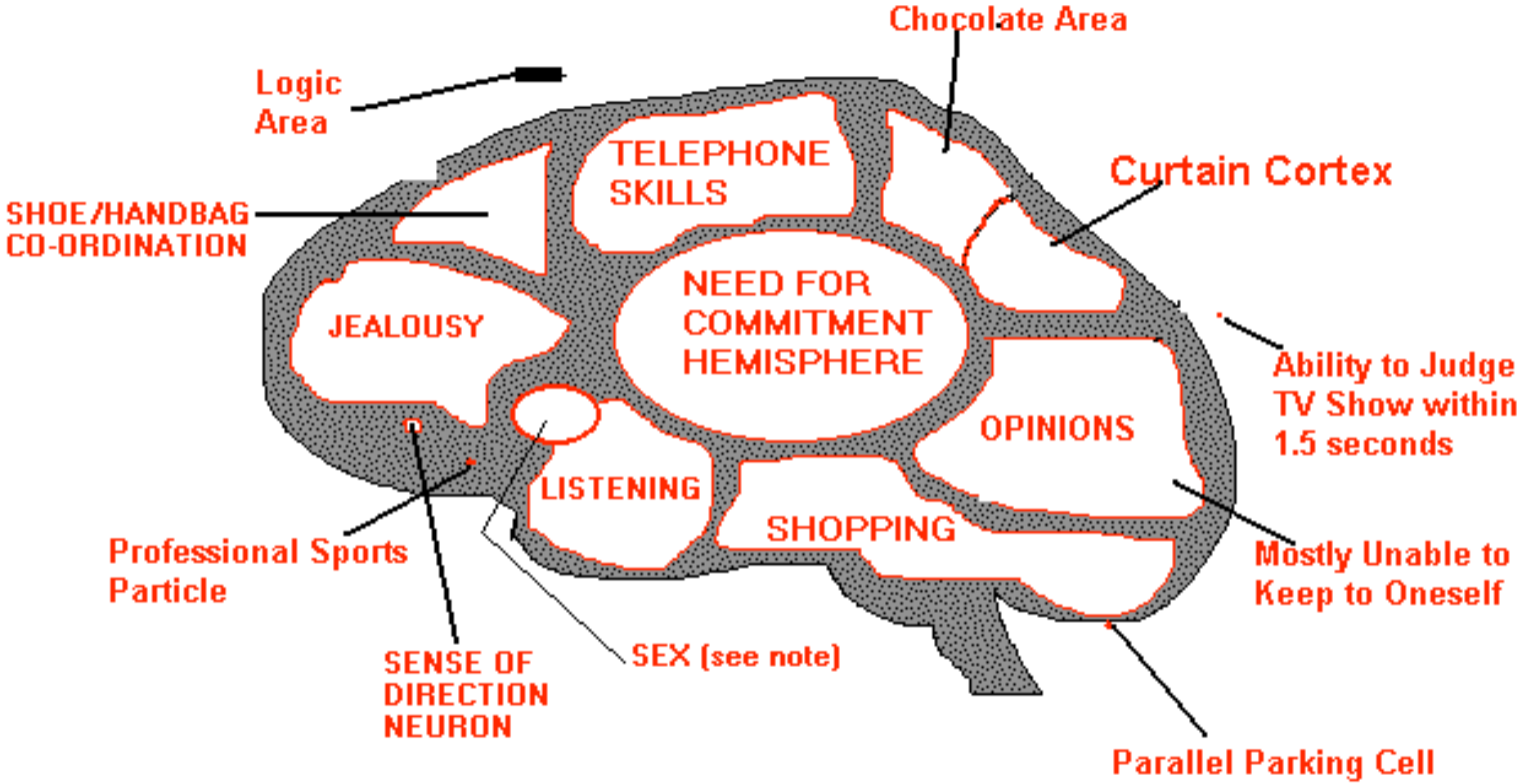


THE MALE BRAIN



Note: The "Listening to children cry in the middle of the night" gland is not shown due to its small and underdeveloped nature. Best viewed under a microscope.

THE FEMALE BRAIN



FOOTNOTE: Note how closely connected the small sex cell is to the listening gland.

Early Beliefs About Physical Activity and Exercise

- **Hippocrates**
  - The father of preventative medicine, wrote extensively about the benefits of exercise for a variety of ailments including mental illnesses.
  - “Eating alone will not keep a man well; he must also take exercise. For food and exercise, while possessing opposite qualities, yet work together to promote health.” Hippocrates, *Regimen*

Carl Cotman: BDNF is really the brain's wonder drug if you will. It essentially, if it's applied to cultured neurones, it increases their growth differentiation and protects them against insults. They're just a stronger cell. I mean it's almost like the equivalent of a fertilizer to a plant - it just makes the thing much healthier and stronger. And so when we looked after a few nights of exercise, I mean our initial expectation was that if we saw anything in sensory motor areas, we were going to be quite excited. But part of the great thrill of science is that sometimes you get clues that are given out, you know, that you never expected. And what we actually found is that some of the biggest increases were in these cognitive brain areas such as the hippocampus and inter-rhinal cortex that are involved in learning and memory.

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.

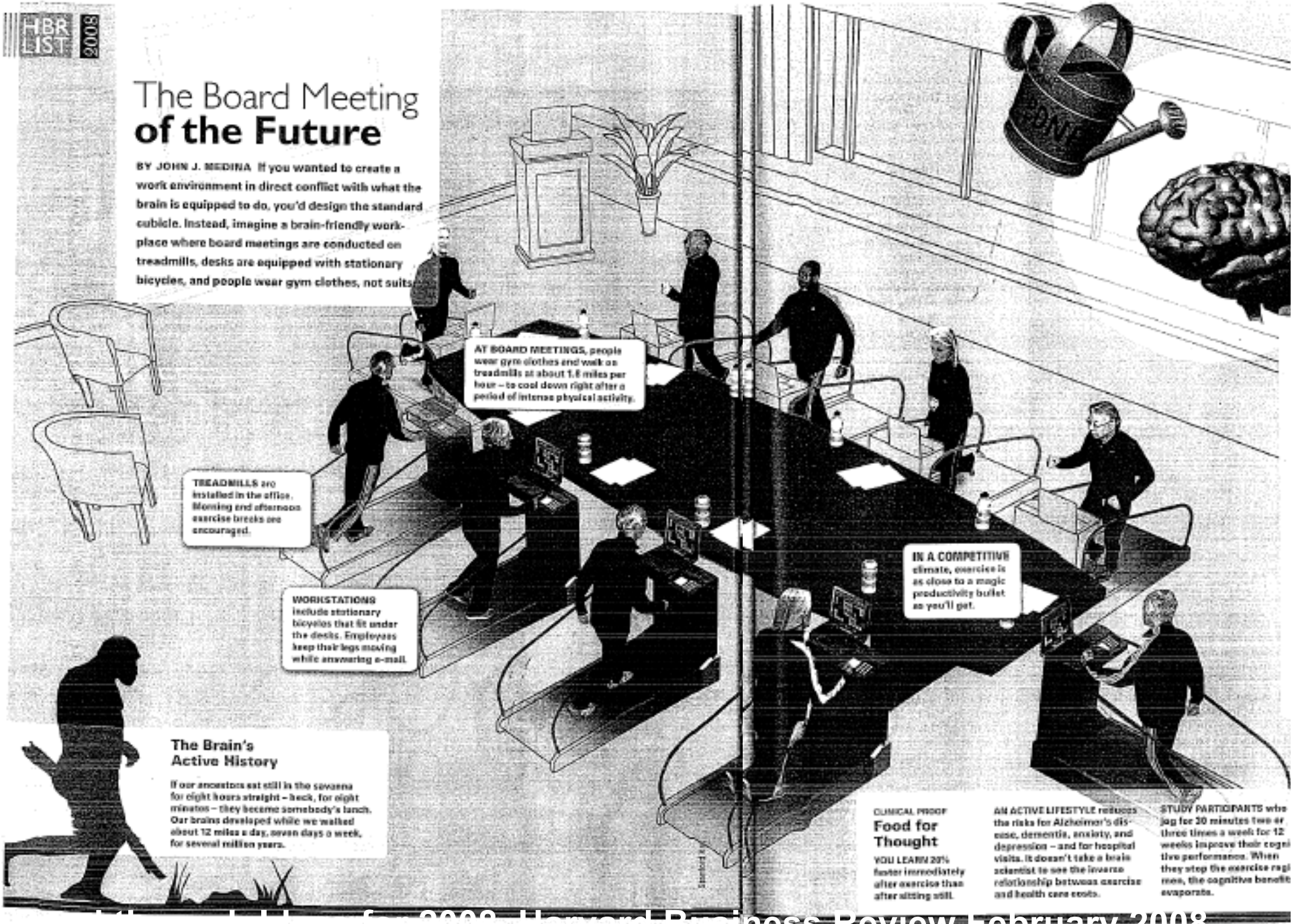
The results of a 2001 study by the California Department of Education showed 33 percent of freshmen in California were overweight or obese. When District 203 gathered its own data in a 2002 study of its own freshmen, only 3 percent were overweight or obese. 19,000 children in the district.

TIMSS (Trends in International Mathematics and Science Study) is an international benchmarking study 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.

HBR LIST 2008

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.



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.


TAEKWONDO

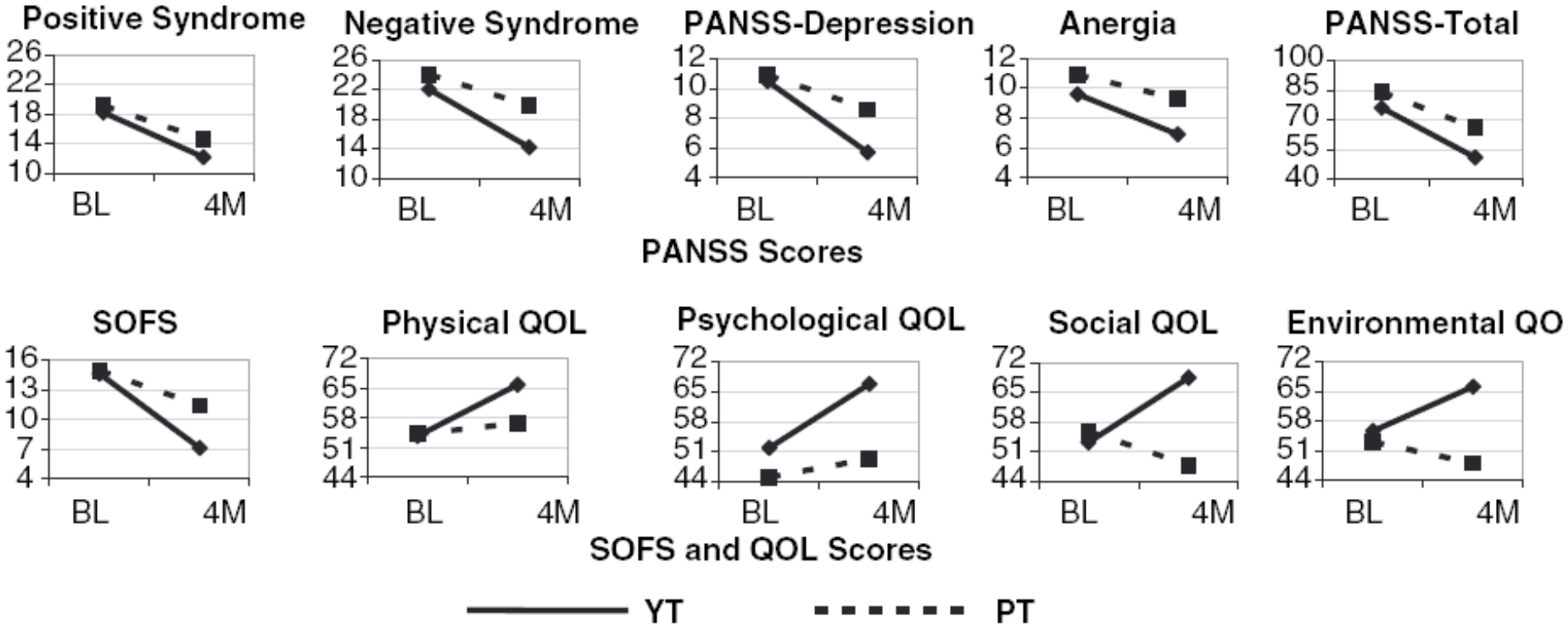
MARTIAL ARTS

ACHEVING RESONANCE-- BE ON THE SAME WAVELENGTH

OVERCOME IMPEDANCE– PUSH THROUGH REISTANCE= ALLOW FOR FLOW OF BACK AND FORTH

SUBTLE ==NOT DIRECT---- WAIT FOR THE FORCE FROM THE OTHER AND RESPOND IN AN EFFECTIVE WAY– TO ACHIEVE GOAL --- CONNECT --

Yoga Exercise Schizophrenia



Changes in psychopathology, social and occupational functioning and quality of life in YOGA and Physical Exercise groups overtime. BL, baseline; 4M, 4 months. The yogasanas were from the integrated yoga treatment developed by Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA) (28). It was a **1-h program** consisting of (a) Sithilikarana Vyayama; (b) asanas including surya namaskar; breathing practice; and (d) relaxation techniques. The ratio of Vyayama:asana:breathing practice was 1:1:1. **N=21** Meditation was not a part of the yoga module. The exercises were adapted from the National Fitness Corps – Handbook for Middle High and Higher Secondary Schools **N=20**. This **1-h module of PT** consisted of brisk walking, jogging and exercises in standing and sitting postures and relaxation. The subjects in both groups underwent training for 15 days (1 h a day; 5 days a week for 3 weeks). Then at home for 3 months and then evaluated.

Duraiswamy G, Thirthalli J, Nagendra HR, Gangadhar BN. Yoga therapy as an add-on treatment in the management of patients with schizophrenia – a randomized controlled trial. Acta Psychiatr Scand 2007: 116: 226–232

Math Balls

Colorado teacher Lisa Witt studied a dozen of her sixth-grade students in 2001 to demonstrate the benefits of the balls to a skeptical principal. Video studies of the students showed improved posture, more time spent on task and less squirming while they sat on the balls, she told the newspaper. “People are not meant to sit still.”

Mrs. Raabe’s fifth-grade class in Charlotte, North Carolina recently embraced ergonomic innovation in an attempt to increase attention spans and facilitate good posture. The classroom is now a sea of motion in which children bob and weave, sway and bounce their way through lessons perched atop brightly colored fitness balls.

Turns out, the balls do have a wellness significance. A Mayo Clinic study found that the balls can be used to burn calories, in effect attacking the growing problem of childhood obesity. With the balls, fidgety students or those with attention deficit disorder have an outlet for their excess energy. Concentration increases for everyone because of the noise reduction. And physical conditioning is improved because of the work involved in staying on top of the ball.

Intensity

- MET
  - 1 MET The ratio of the work metabolic rate to the resting metabolic rate.
  - One MET is defined as 1 kcal/kg/hour and is roughly equivalent to the energy cost of sitting quietly.
  - A MET also is defined as oxygen uptake in ml/kg/min with one MET equal to the oxygen cost of sitting quietly, equivalent to 3.5 ml/kg/min.

Light Intensity Activities

- Sitting in class (1.8)
- Studying (1.8)
- Typing on computer (1.8)
- Ironing (2.3)
- Ice fishing (2.0)
- Making bed (2.0)
- Cooking (2.5)
- Having hair done by someone else (1.0)
- Eating (1.5)

Vigorous Intensity Activities

- Jogging (4.5-18.0)
- Jumping rope (8.0-10.0)
- Tennis (5.0-8.0)
- Aerobics (5.0-10.0)
- Broomball (7.0)
- Racquetball (7.0-10.0)
- Basketball (4.5-8.0)
- Touch football (8.0)
- Shoveling snow (6.0)

Type of Activity	Calories/hour
Sleeping	55
Office Work	140
Housework, Mod.	160
Walking, 3 mph	280
Tennis	350+
Aerobics	450+
Bicycling, Mod.	450+
Jogging, 5 mph	500
Running	700+

Evolution of Physical Activity Guidelines

- “Every US adult should accumulate 30 minutes of moderate-intensity PA on most, preferably all, days of the week.” (Pate 1995)

CDC-ACSM recommendation on PA and Public Health (1993)

- →Moderate ok, short bouts ok, more attainable guidelines

Pedometers

- Used since the 1920's
- Counts steps while a person is running or walking
- Assesses vertical acceleration
- Range from $20-$25
- Walking or running requires 1,300 to 2,000 steps per mile
- Limitations:
  - Cannot assess intensity and cannot detect activities such as biking
  - Don't have time stamp or storage capacity

Polar S520 Heart Rate Monitor

$239.95

Buy Now!

Features

Free UPS 2nd Day Air
Same Day Shipping

The 520 was designed for the ultimate cross trainer or triathlete. The added cycling features let you track performance in all disciplines. The new distance based interval function helps guide you through your toughest workouts on the bike. With the Sonic Link™ technology and the new advanced PPP 4.0 software, you can download your heart rate and cycling data, as well as maintain a training log and even share your data through email.

Swim, Bike, Run -- Download. New dual position bike mount included. The S520 features a new lightweight stainless steel design for added durability.

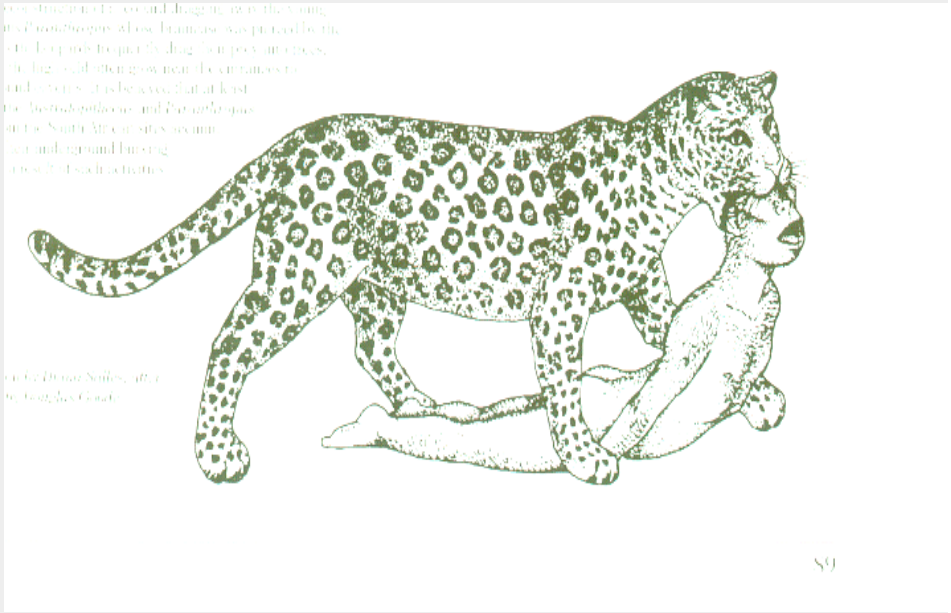
- Wireless cycling functions/speed and distance (Cadence optional)

Stress and the Brain

- Stress demands adaptation: mechanisms evolved to help our plastic brain grow to meet these challenges. Neurotransmitters, Growth Factors (HGH included), adding to blood supply.
- Three major types of stressors: what we call COGNITIVE OPERATIONS (thinking and feeling), DIETARY RESTRICTION and EXERCISE. They stress nerve cells and if a RECOVERY period follows: then we see brain and nerve cell growth. Just like our muscles.

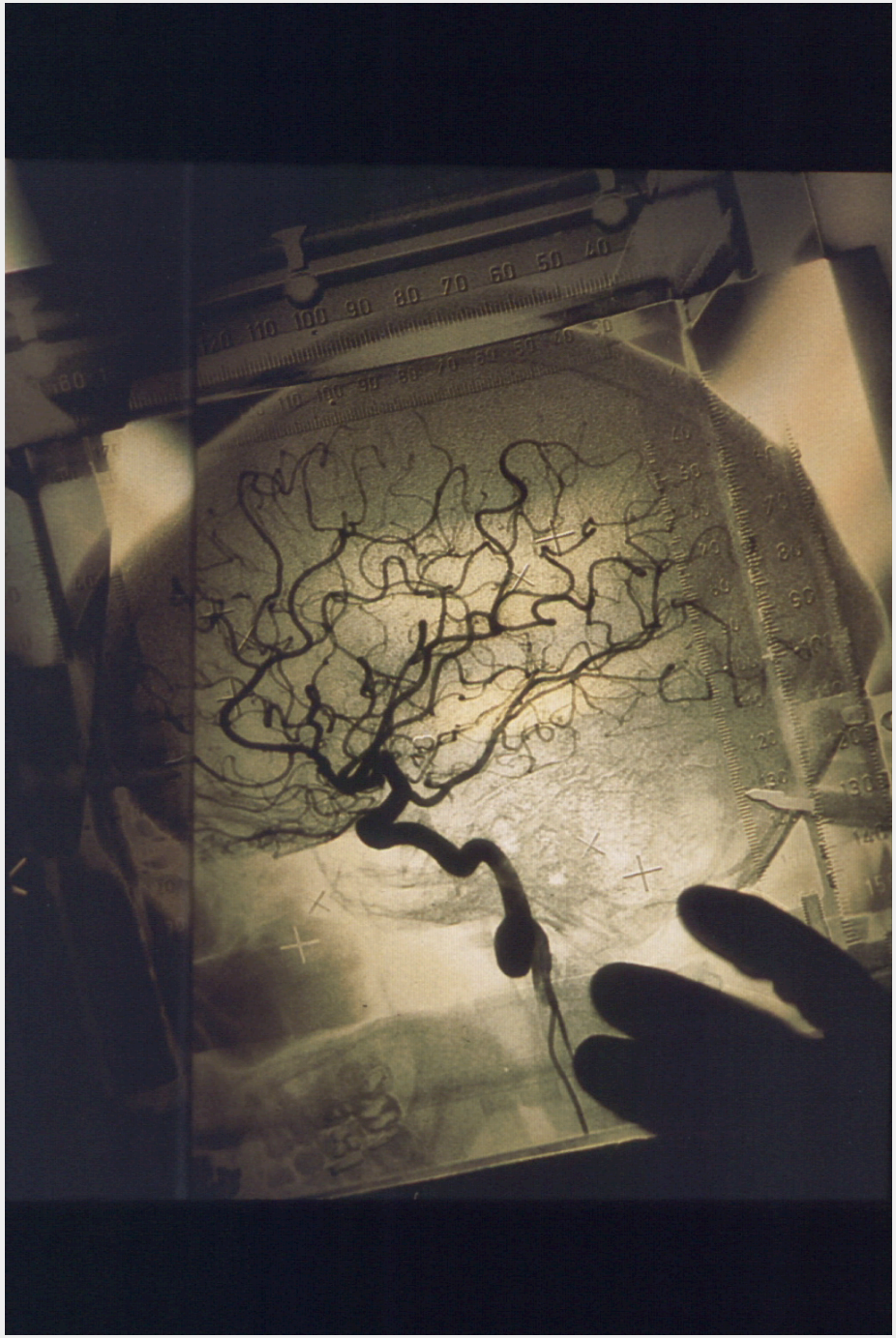
EXERCISE INTENSITY

- Foraging- moving at a walking pace- 60-70% HRM
- Hunting- jogging to running-- 70-85%
- The Escape, Kill or



MAD ABOUT FOOTBALL

- "Mental health sufferers are often locked inside themselves, and football allows them to open up," said film-maker Volfango di Biasi, who wants to de-stigmatise illnesses such as schizophrenia in the film.
  A 90-minute film called “Matti per il Calcio” (“Mad about Football”) documents the efforts of an Italian psychiatrist to treat people with schizophrenia and depression by recruiting them for a competitive football team. (Italian football resembles what Americans call soccer rather than American football.) According to a British newspaper, The Guardian, Mauro Raffaeli coaches the players – many of whom take psychiatric medication and have not been able to work – twice a week on the outskirts of Rome. Of the 80 players whom Raffaeli has worked with since the team was created in 1993, more than half have been able to reduce their use of medication and more than half have returned to work. The team has inspired the creation of 50 similar teams involving people with mental illnesses around Italy.



EXERCISE CHALLENGES BRAIN AND LEADS TO AN INCREASED LEARNING POTENTIAL

Angiogenesis, the growth of new capillaries from preexisting vessels, is a natural consequence of heightened physical activity and the associated increase in neural activity, and can be induced by exposure to a complex environment and/or aerobic exercise.