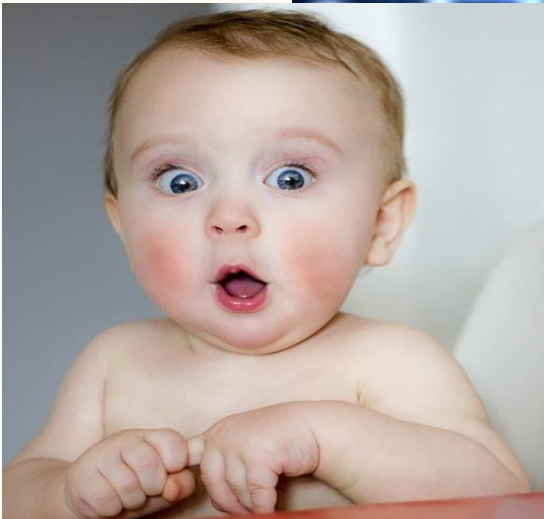


THE 21ST CENTURY BRAIN

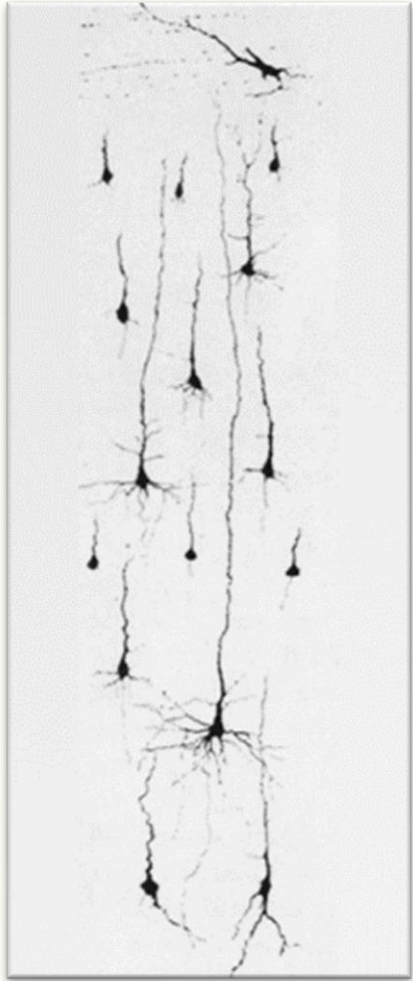


THE IMPACT OF TECHNOLOGY

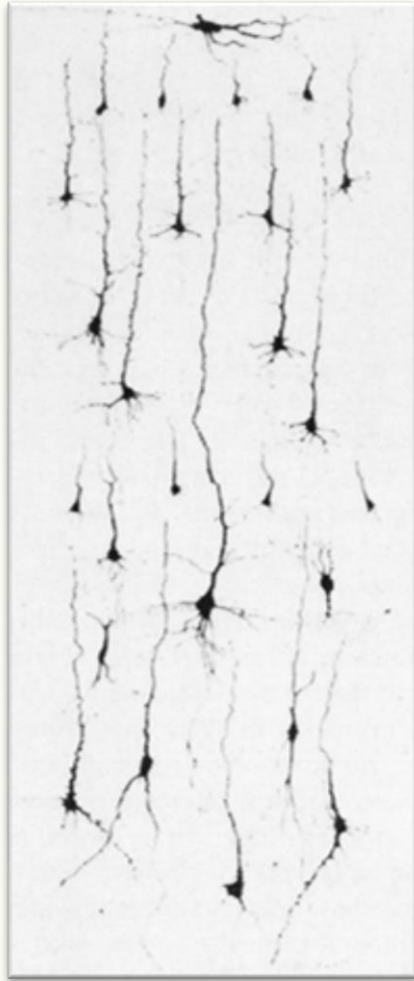
WHAT IS THE BASIS OF HUMAN UNIQUENESS?



(1) DEVELOPING A MIND...



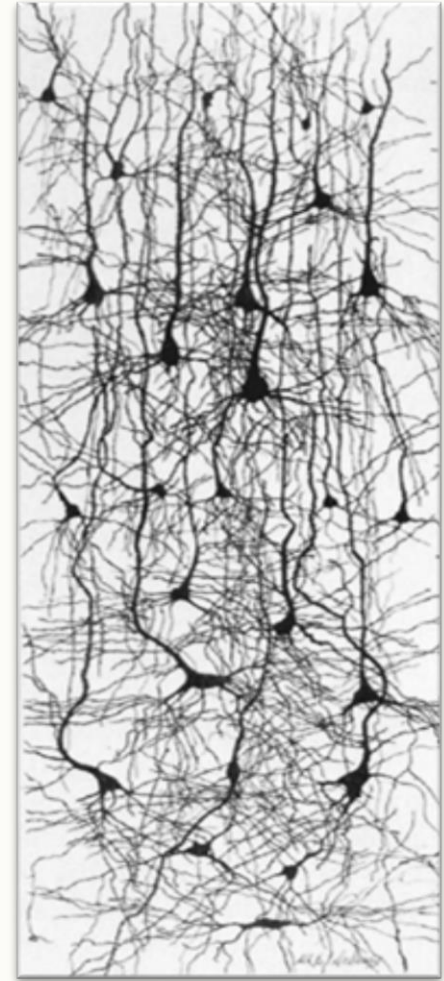
Newborn



3 Months



15 Months



2 Years

EXPERIENCES LEAVE THEIR MARK ON THE BRAIN...

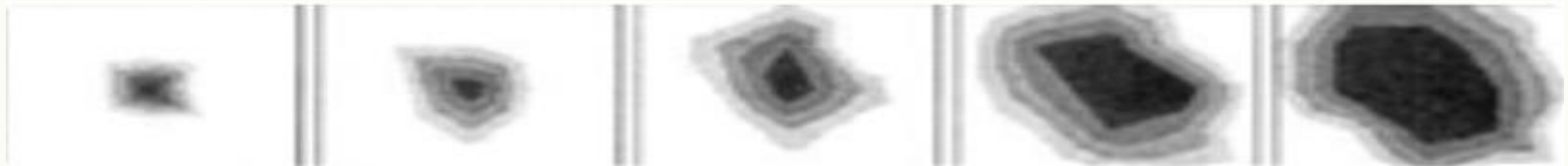


‘THINKING IS... MOVEMENT CONFINED TO THE BRAIN’

Control



Physical Practice



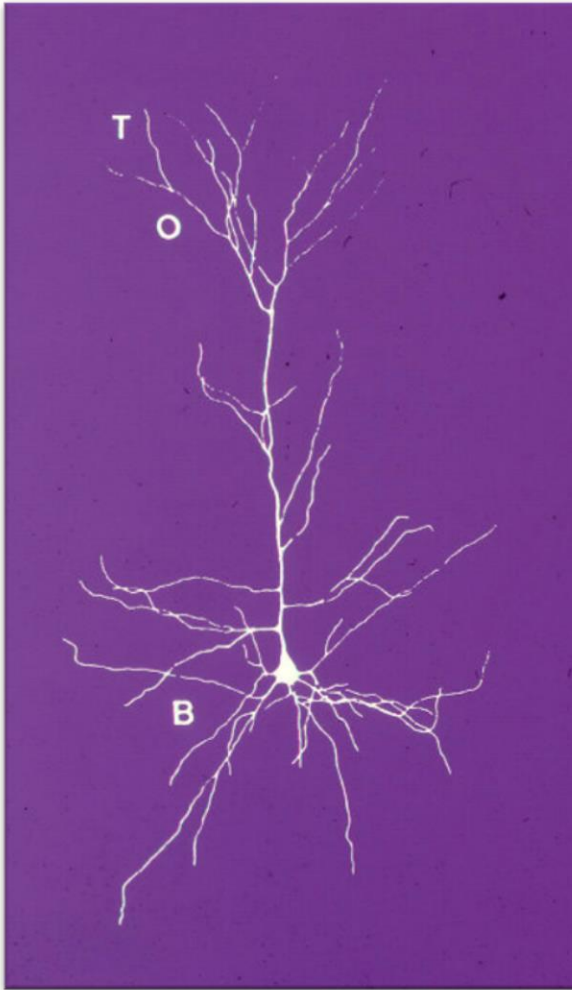
Mental Practice



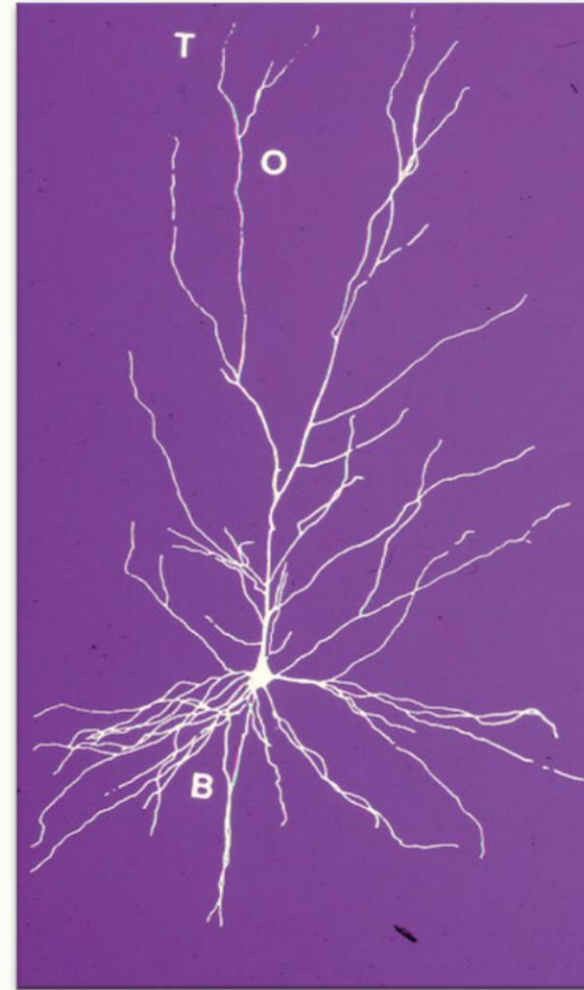
AN 'ENRICHED' ENVIRONMENT...



EFFECTS OF AN 'ENRICHED' ENVIRONMENT



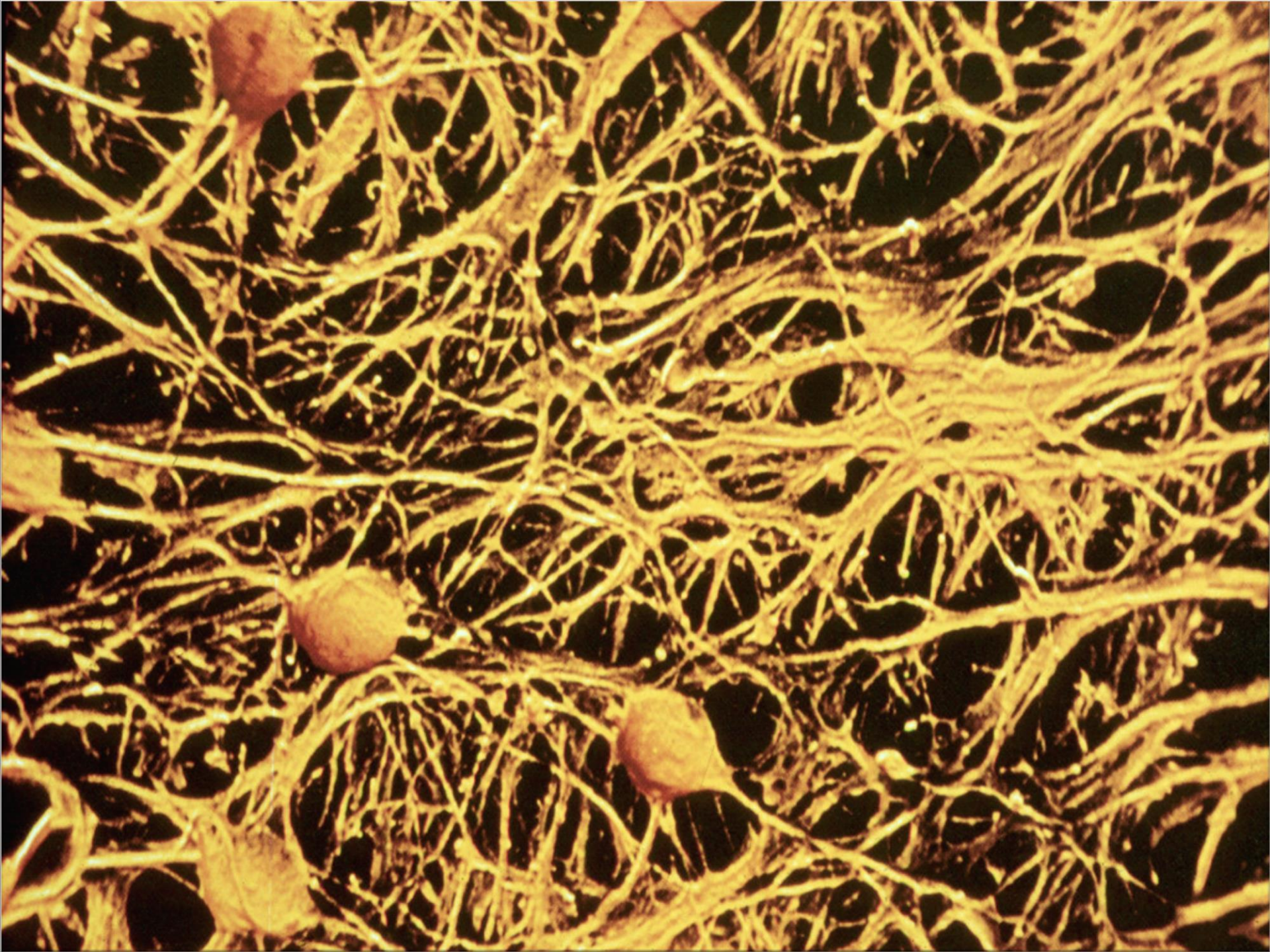
Standard



'Enriched'

CONNECTIONS GIVE EVER DEEPER MEANING OVER TIME...







**THE BIOLOGICAL BASIS OF THE MIND IS THE
PERSONALISATION OF THE BRAIN THROUGH UNIQUE
DYNAMIC CONFIGURATIONS OF NEURONAL
CONNECTIONS,
DRIVEN BY UNIQUE EXPERIENCES**

(2) THE 21ST CENTURY ENVIRONMENT IS UNPRECEDENTED...



Daily Media Usage (standard deviation) for Children, Preteens and Teens Shown in Hours: Minutes

Media/technology usage item	4- to 8-year-olds	9- to 12-year-olds	13- to 18-year-olds
Online	0:27 (0:44)	1:01 (1:11)	1:24 (1:53)
Using computer (not online)	0:23 (0:38)	0:53 (1:07)	1:37 (1:49)
E-Mail	0:06 (0:25)	0:22 (1:02)	0:56 (1:49)
IM/Chat	0:04 (0:22)	0:24 (1:19)	1:21 (2:35)
Telephone	0:20 (0:37)	0:41 (0:55)	1:14 (1:47)
Text messaging	0:07 (0:42)	0:41 (1:37)	2:25 (3:19)
Video games	0:50 (1:05)	1:12 (1:21)	1:06 (2:01)
Music	0:42 (0:46)	1:16 (1:44)	2:49 (2:56)
Television	2:05 (1:28)	1:52 (1:27)	1:55 (1:45)
Tech toys	0:59 (1:01)	0:41 (0:55)	0:41 (1:09)
TOTAL TECH ^a	7:11 (4:45)	9:57 (7:34)	18:28 (11:30)

Rosen et al., (2014) Media and technology use predicts ill-being among children, preteens and teenagers independent of the negative health impacts of exercise and eating habits, Computers in Human Behavior, 35, 364-375,

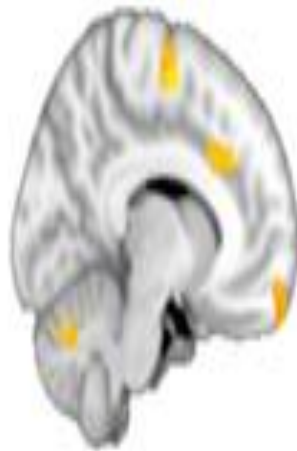




(3) THE BRAIN WILL BE CHANGING CORRESPONDINGLY IN NEW WAYS



DLPFC



cerebellum+SMA+rACC+OFC



cerebellum+DLPFC



SMA

*Yuan K, Qin W, Wang G, Zeng F, et al. (2011)
Microstructure Abnormalities in Adolescents with Internet Addiction Disorder.*

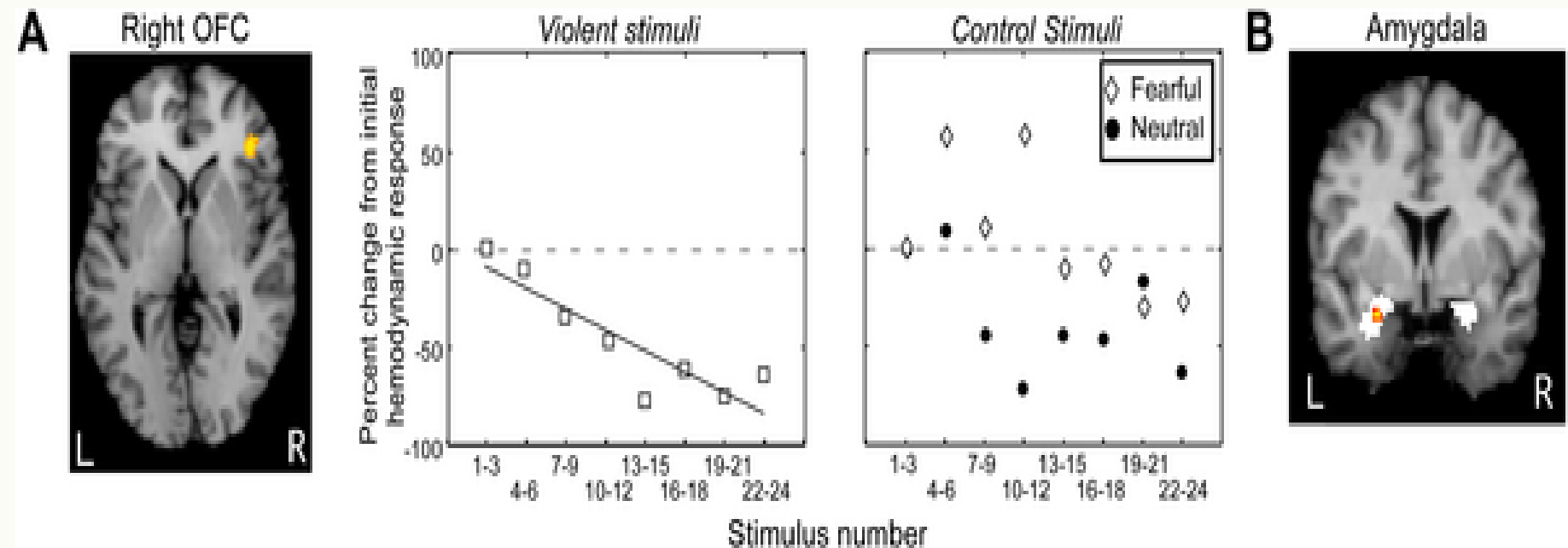
THE ENVIRONMENT OF THE SCREEN:

Gaming



AGGRESSION...

Repeated Exposure to Media Violence Is Associated with Diminished Response in an Inhibitory Network.



ATTENTION



Research Article

Television and Video Game Exposure and the Development of Attention Problems

Edward L. Swing, Douglas A. Gentile, Craig A. Anderson, David A. Walsh

Pediatrics Vol. 126 No. 2 pp. 214 -221

Research Article

Video game playing, attention problems, and impulsiveness:

Evidence of bi-directional causality

Douglas A. Gentile, Edward L. Swing, Choon Guan Lim, and Angeline Khoo

Psychology of Popular Media Culture, 1, 62-70.

ADDICTION?



BRITONS ADDICTED TO THE INTERNET, OFCOM WARNS



- The average person checks their phone 200 times a day - that's once every six and a half minutes
- 73% of Brits say they'd struggle to go a day without checking their phone or computer
- One in four people spend more time online than they do asleep
- 70% of 16-24-year-olds say they prefer texting to talking
- The average teenager sends 3,400 electronic messages a month from their bed

The Telegraph, 4 August 2016

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Children who love video games have brains like gamblers

Certain children's brains could be hard-wired to spend hours playing video games, according to a study which reignites the debate over whether the habit should be considered an addiction.



Researchers studied 154 healthy 14-year-olds, who played video games for an average of 12 hours a week, and scanned their brains while they played two games. Photo: ALAMY

By Nick Collins, Science Correspondent

6:38AM GMT 16 Nov 2011

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[f Recommend](#) 16

[Tweet](#) 49

[in Share](#) 3

[+1](#) 0

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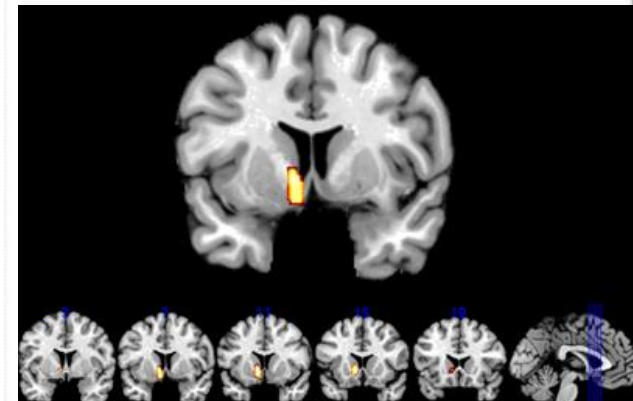
Nick Collins »

IN SCIENCE NEWS



Satellite images of

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THE NEURAL BASIS OF VIDEO GAMING

Kuhn, S. et al.,
Translational Psychiatry
(2011)
53, 1-5



DOPAMINE

Arousal

Addiction

Reward

INHIBITION

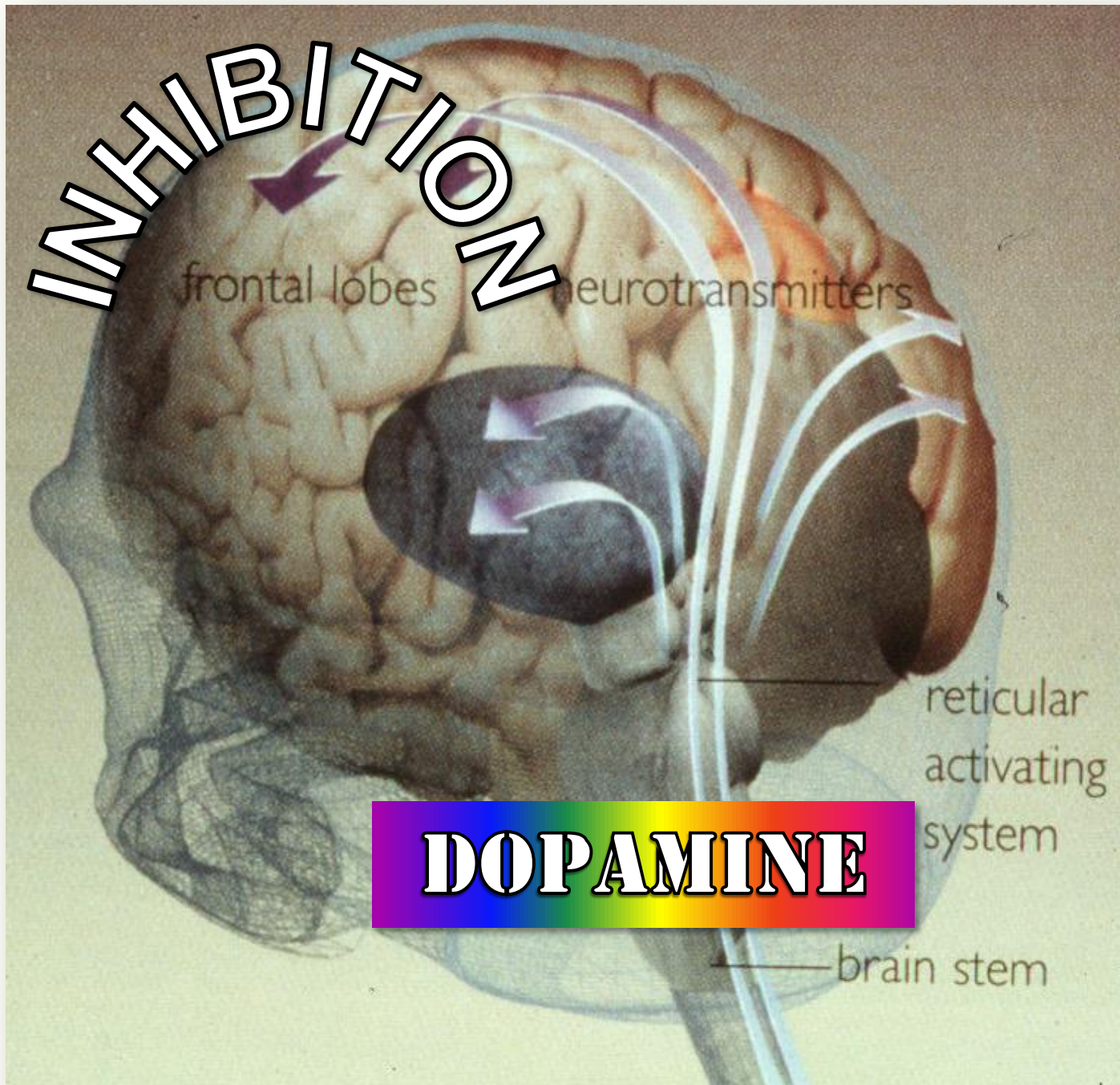
frontal lobes

neurotransmitters

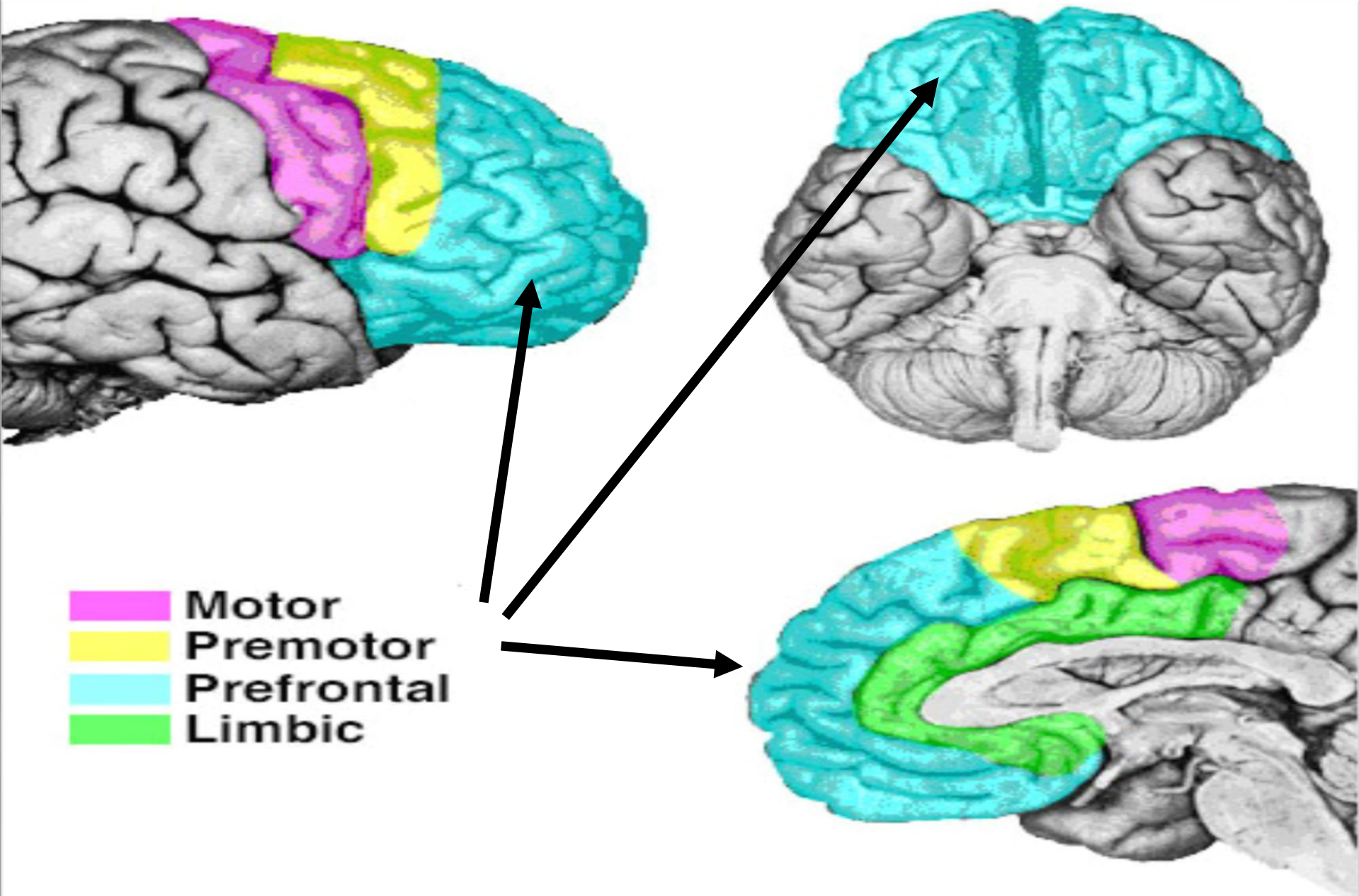
reticular
activating
system

DOPAMINE

brain stem

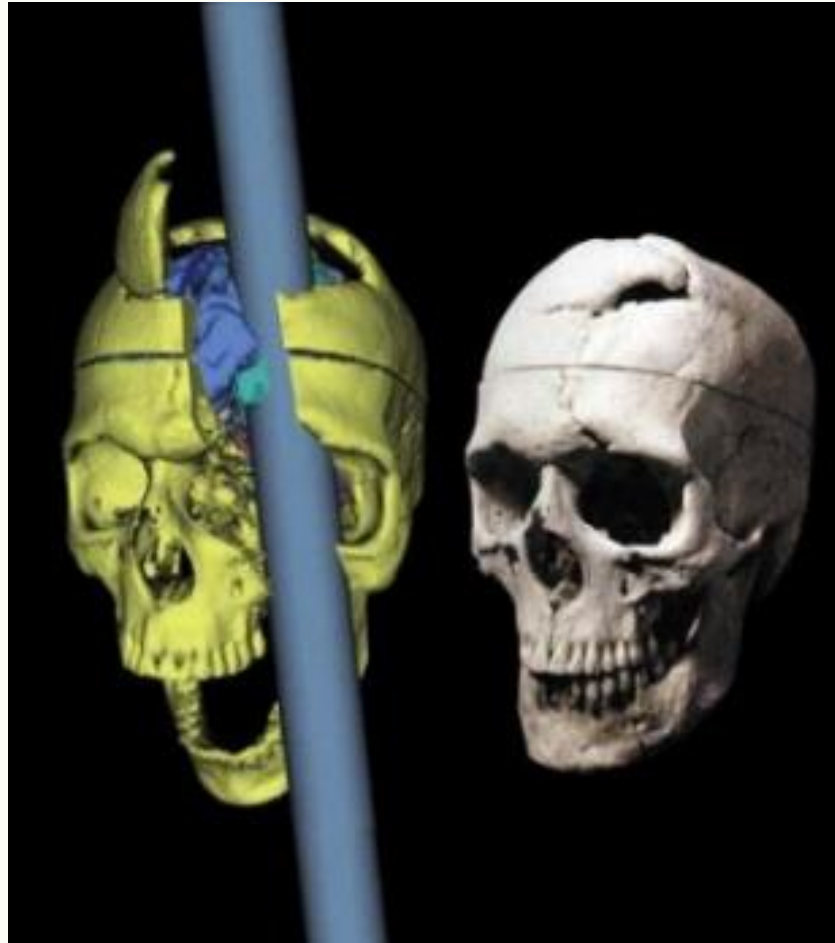


RISK-TAKING



THE CASE OF PHINEAS GAGE

**Damage to Prefrontal Cortex
Led to Excessive Recklessness**



Research Article

Inverse Association Between BMI and Prefrontal Metabolic Activity In Healthy Adults

Volkow ND, Wang GJ, Telang F, Fowler JS, Goldstein RZ, Alia-Klein N, Logan J, Wong C,
Thanos PK, Ma Y, Pradhan K.

How to cite: Obesity (2009) Inverse Association Between BMI and Prefrontal Metabolic Activity In Healthy Adults. (1):60-5. doi:
10.1038/oby.2008.469. Epub 2008 Oct 23.



Research Article

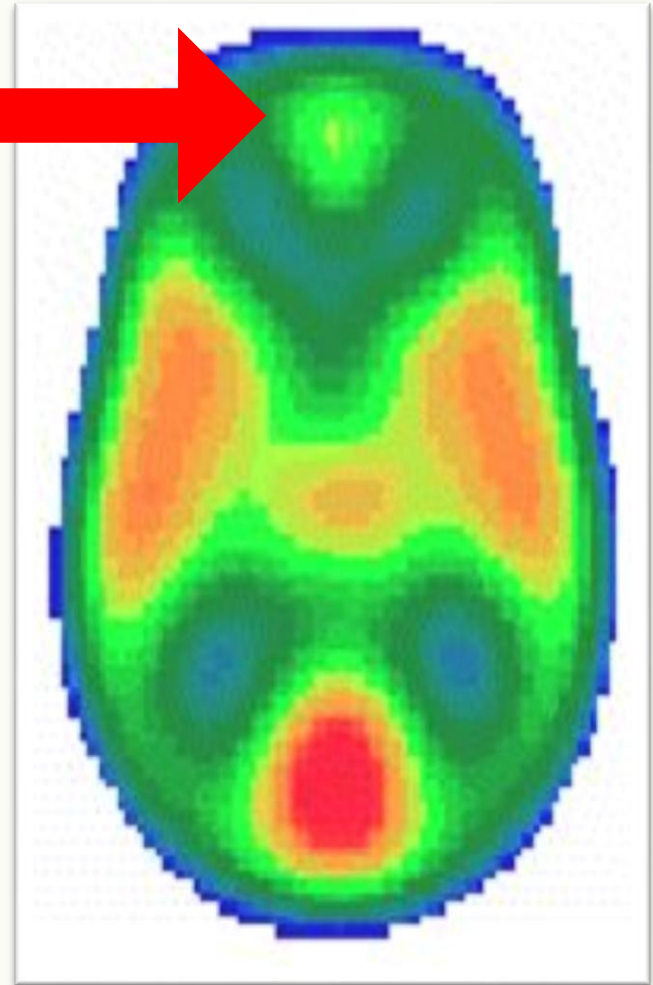
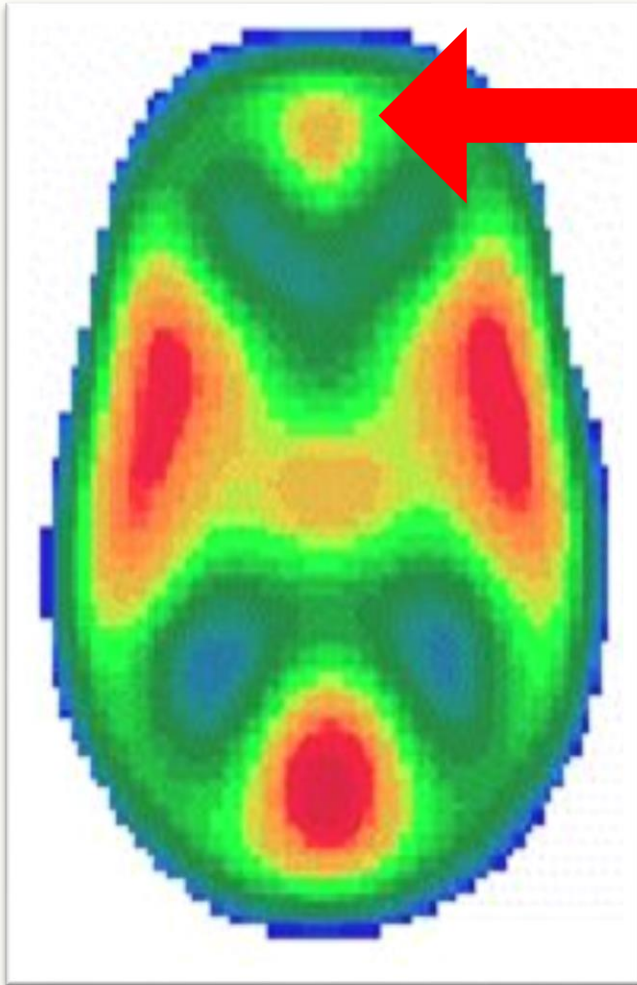
Decision-Making in Obesity: A Study using the Gambling

Pignatti R, Bertella L, Albani G, Mauro A, Molinari E, Semenza C.

How to cite: Eat Weight Disord. (2006) Decision-Making in Obesity: A Study using the Gambling
11(3):126-32

**WITHOUT
SCHIZOPHRENIA**

**WITH
SCHIZOPHRENIA**



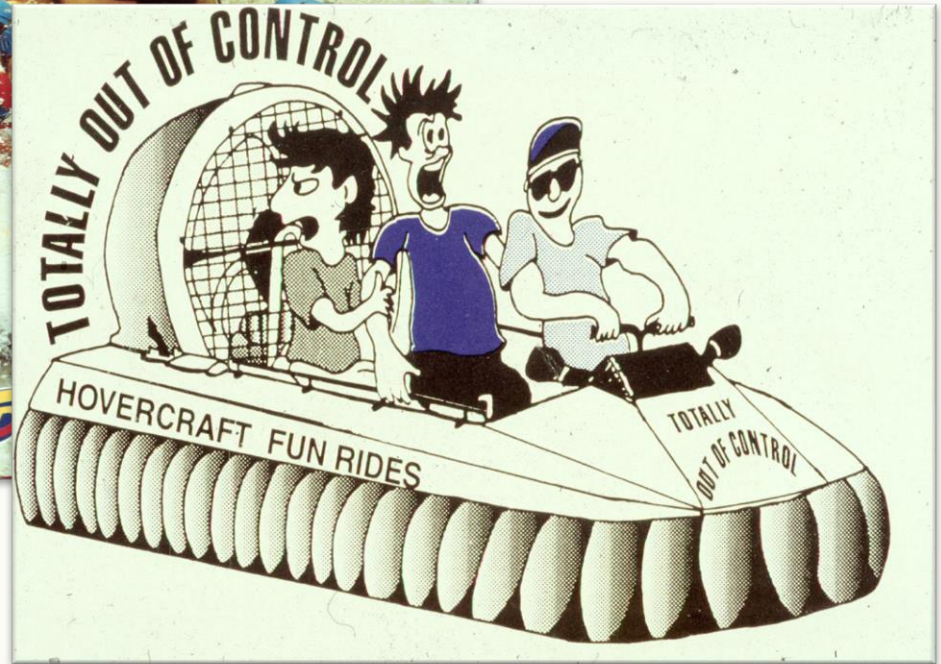


A COMMON FACTOR:

The Press of the Senses?



Having a sensational time



Letting yourself go...

TWO BASIC MODES FOR THE HUMAN BRAIN

‘MEANINGLESS’

Prefrontal Under-function?

- **Strong feelings**
- **Sensory**
- **Here-and-now**
- **External stimuli dominant**
- **Little ‘meaning’**
- **Reduced sense of self**
- **No time-space**
- **Infants and children**
- **More**

DOPAMINE

**YOU
ONLY
LIVE
ONCE**

(1) Intense stimulation of screen: fast response

(2) High arousal, high levels of dopamine release

(3) Reward seeking addictive behaviour

(4) Dopamine released

(5) Dopamine causes PFC hypo-function

(6) Conditions of childhood, schizophrenia, obesity

(7) Drive: sensation over cognition

(8) Greater appeal of a screen environment?



THE MINDSET OF THE FUTURE

Wilson et al. (2014) Science July 4th

In 11 studies, we found that participants typically did not enjoy spending 6 to 15 minutes in a room by themselves with nothing to do but think, that they enjoyed doing mundane external activities much more, and that many preferred to administer electric shocks to themselves instead of being left alone with their thoughts. Most people seem to prefer to be doing something rather than nothing, even if that something is negative.

THE ENVIRONMENT OF THE SCREEN:

Social Networking Sites



- Words: 10% of total interaction
- Eye contact
- Body language
- Tone (pitch/rate/volume)
- Pheromones?
- Physical contact?

NOT AVAILABLE ON FACEBOOK



A LINK BETWEEN AUTISTIC TYPE BEHAVIOUR AND THE SCREEN?

- **A link between atypical brain wave responses in problematic face recognition, characteristic of autism, and also of heavy internet users (He et al., 2011)**
- **A link between autistic spectrum disorders and an under-functioning prefrontal cortex, indicative of a more literal take on the world (Amodio & Frith 2006)**
- **A link between early screen experiences and later development of autism (Waldman et al., 2006)**
- **A link between autistic conditions and an appeal of screen technologies (Finkenauer et al., 2012).**
- **A link between autistic spectrum disorder and compulsive video game use (Mazurek & Engelhardt 2013)**

Research Article

Computers in Human Behavior

Yalda T. Uhlsa, Minas Michikyanb, Jordan Morrisc, Debra Garciad, b, Gary W. Smalle, Eleni Zgourouf, Patricia M. Greenfielda

Computers in Human Behavior, Volume 39, October 2014, Pages 387-392,.



**FIVE DAYS AT OUTDOOR EDUCATION CAMP WITHOUT SCREENS
IMPROVES PRETEEN SKILLS WITH NONVERBAL EMOTION CUES.**

HISTORY OF BLOGGING...



1999:

I just have to tell someone about this thing my cat did today...



2004:

OMG! Cat pictures!



2005:

Moving cat pictures!



2007:

1:00pm. My cat just sneezed!

1:02pm. Cat sneezed again!

1:04pm. Cat hasn't sneezed recently. Getting worried.

THE 'SOMETHING' ABOUT SOCIAL NETWORKING



MORE THAN THIRD OF TEENAGE GIRLS IN ENGLAND SUFFER DEPRESSION AND ANXIETY

A major survey of 14 year-olds carried out for the Department for Education:



37% reported feeling unhappy, worthless or unable to concentrate a rise since a study in 2005 “We have seen a very disturbing change in admissions to hospital for self-harm in under-16s that have gone up by 52%” - Marjorie Wallace, CEO of Sane

The Guardian, 22nd August 2016

AS INDIVIDUAL AS YOU ARE...



vidual as you are.





DEVELOPING AN INNER NARRATIVE... AND IDENTITY





THE 'REAL' YOU?

THE ENVIRONMENT OF THE SCREEN:

Search Engines

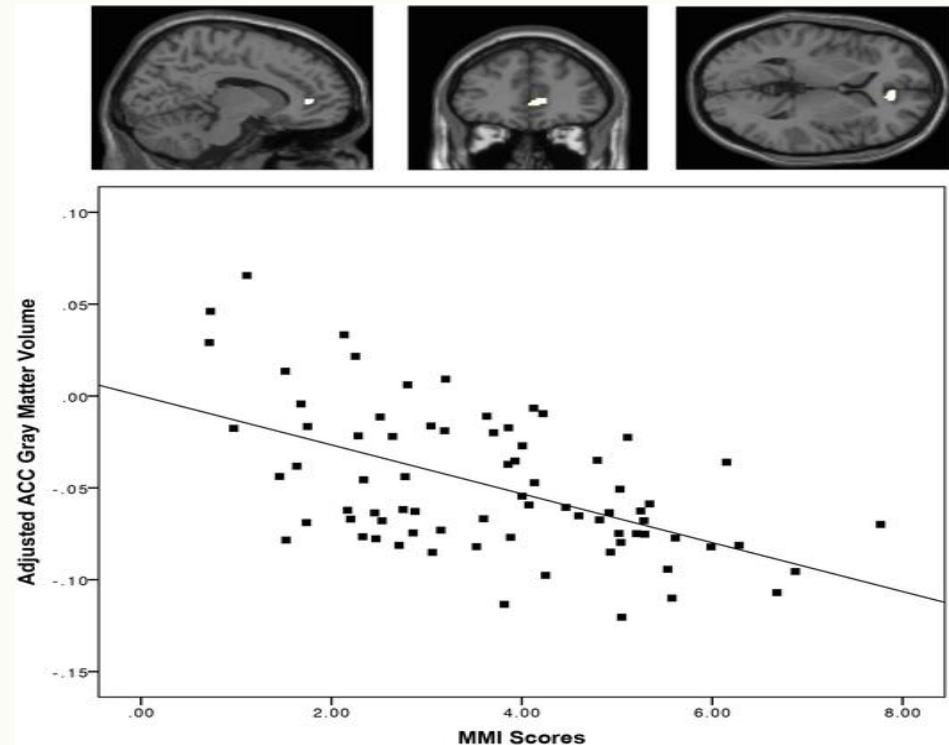


Research Article

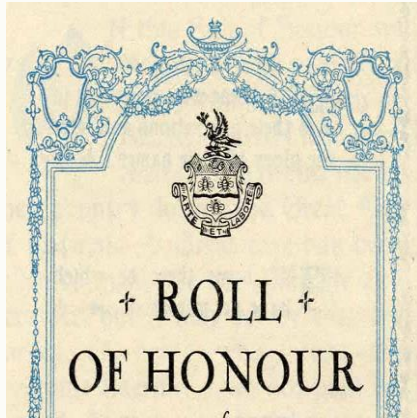
Higher Media Multi-Tasking Activity Is Associated with Smaller Gray-Matter Density in the Anterior Cingulate Cortex

Kep Kee Loh, Ryota Kanai

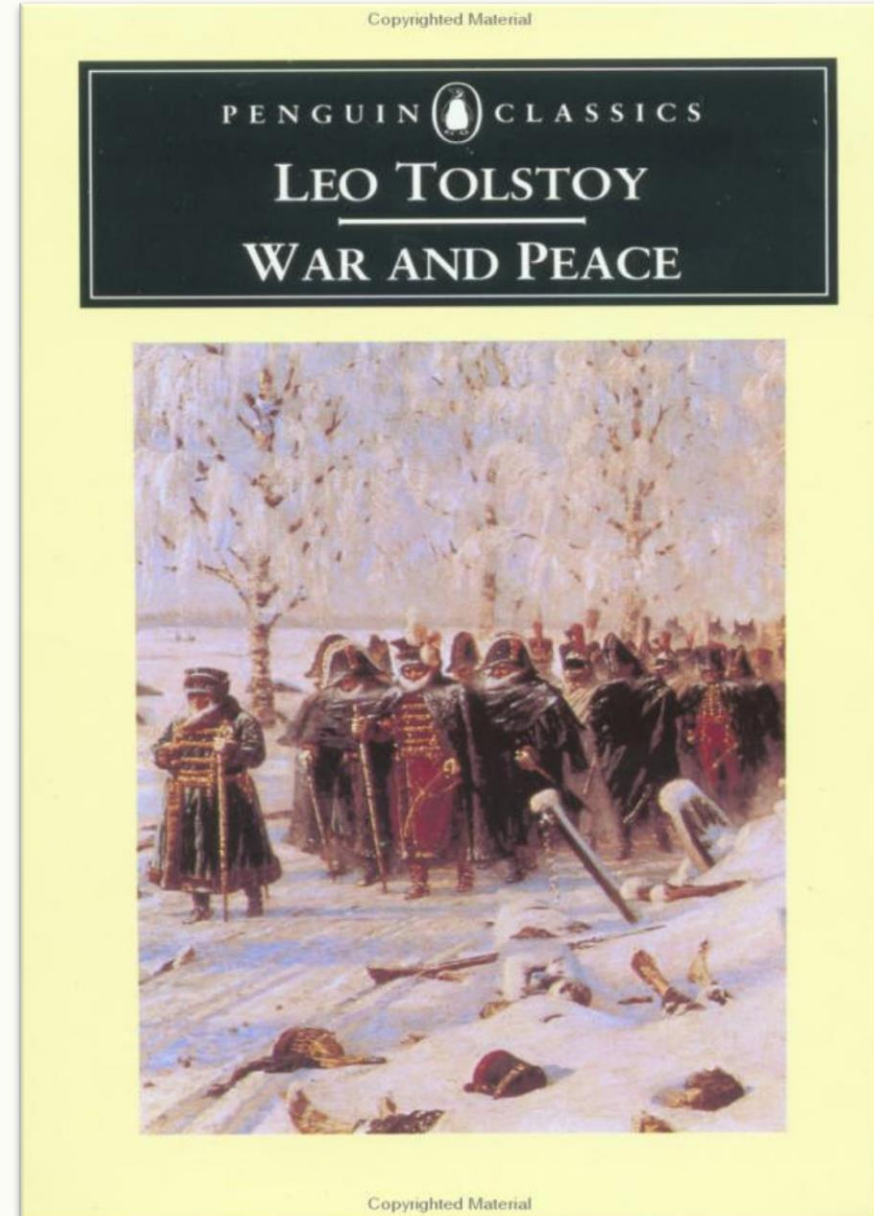
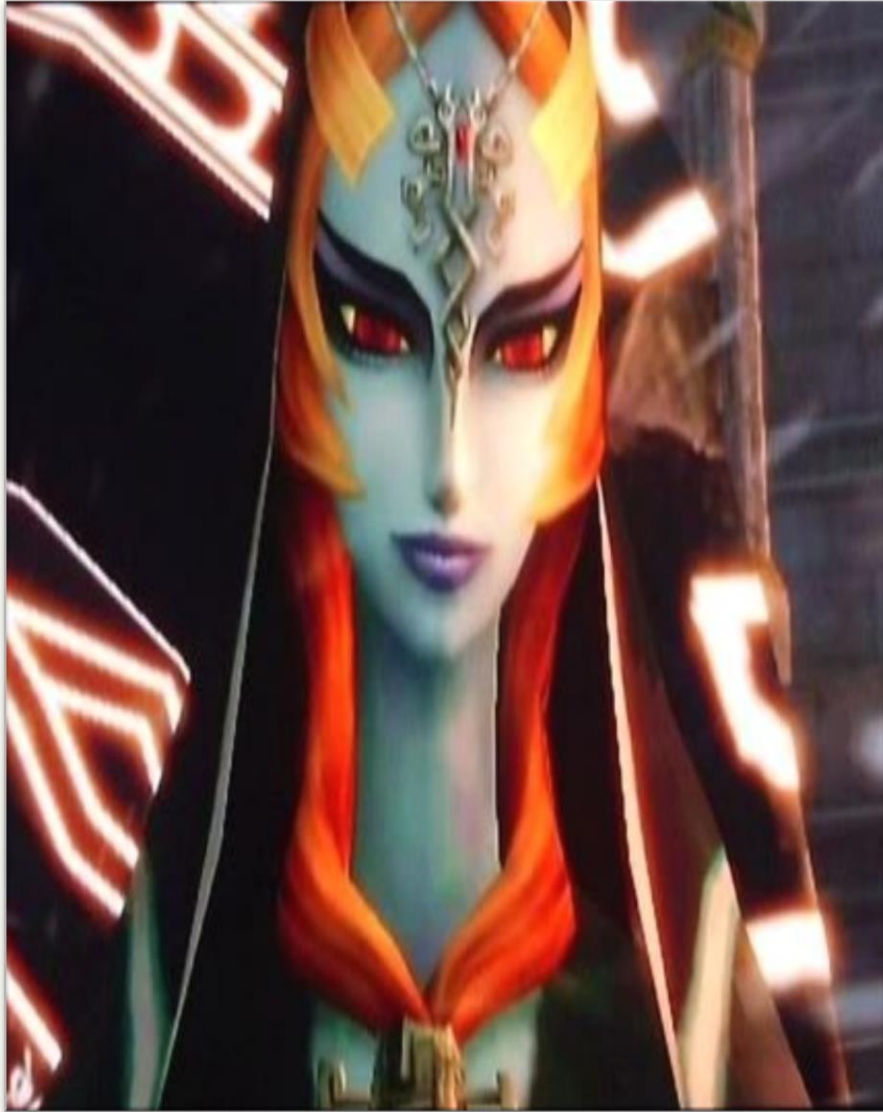
How to cite: Loh KK, Kanai R (2014) Higher Media Multi-Tasking Activity Is Associated with Smaller Gray-Matter Density in the Anterior Cingulate Cortex. PLoS ONE 9(9): e106698. doi:10.1371/journal.pone.0106698



WHAT IS HONOUR?



PRINCESS MARYA...



ERIC SCHMIDT

(Chairman, Google)

‘I worry that the sort of overwhelming rapidity of information...is in fact affecting cognition. It is affecting deeper thinking. I still believe that sitting down and reading a book is the best way to really learn something. And I worry that we’re losing that...’

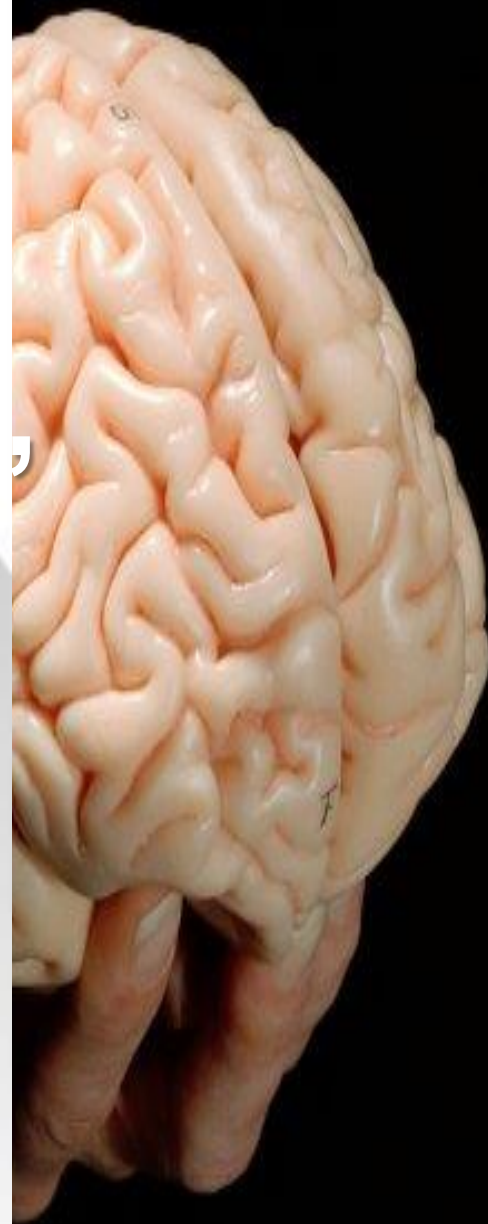


MIND CHANGE



How digital technologies are
leaving their mark on our brains

SUSAN GREENFIELD

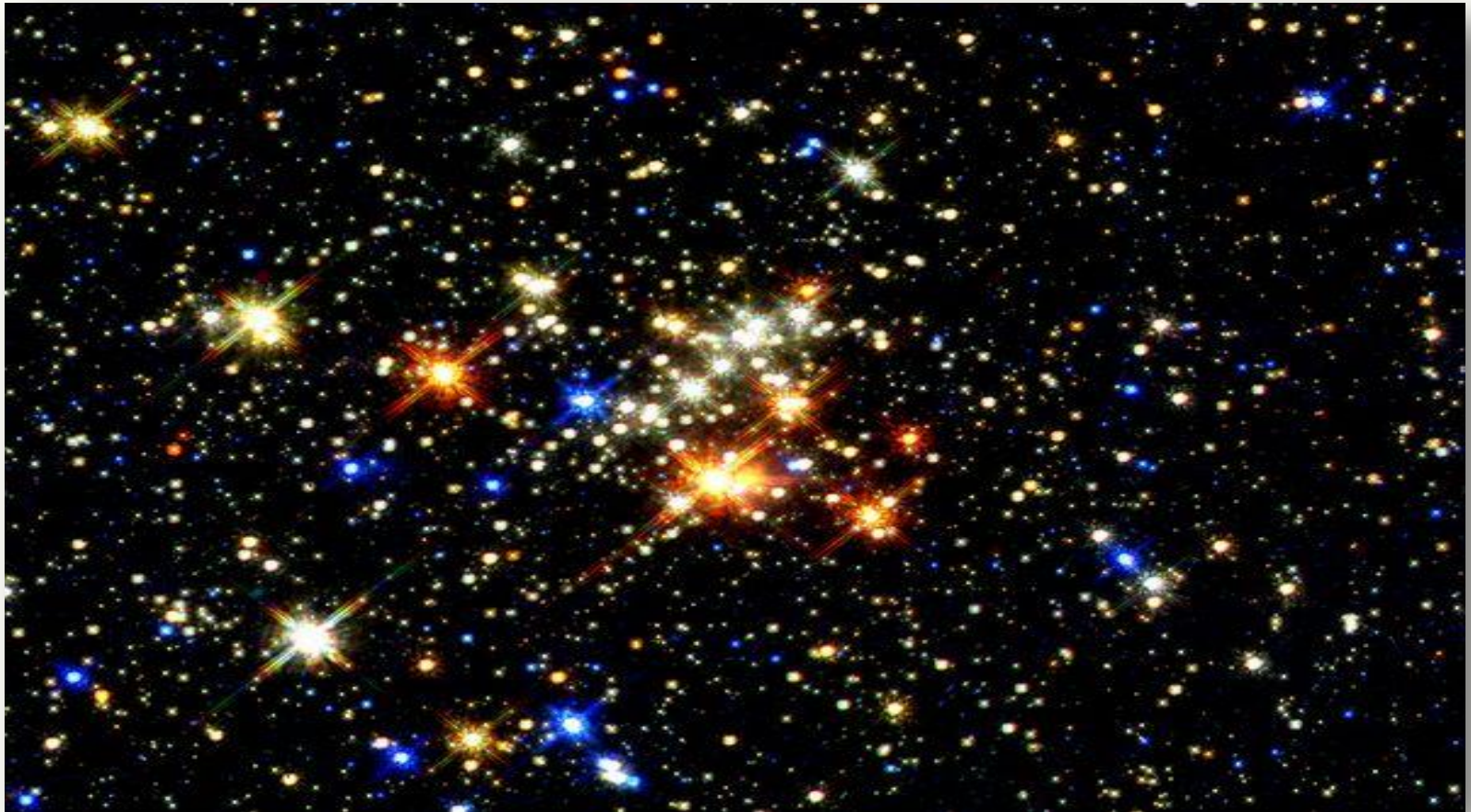


THE MIND OF THE FUTURE?

- **Short attention span**
- **Sensation at premium**
- **Addictive**
- **Reckless**
- **Low empathy**
- **Poor interpersonal skills**
- **Weak sense identity**
- **Efficient information processing**
- **Icons not ideas**
- **Poor critical thought**



(4) BUILDING THE BEST FUTURE?



“We are all in the gutter, but some of us are looking at the stars...” *Oscar Wilde*

RISK-MANAGEMENT



RISK MANAGEMENT:

Generating an Individual Life Story...



‘From the moment we become aware of others, we demand to be told stories that allow us to make sense of the world, to inhabit the mind of someone else. In old age we tell stories to make small museums of memory. It matters not whether the stories are true or imaginary.

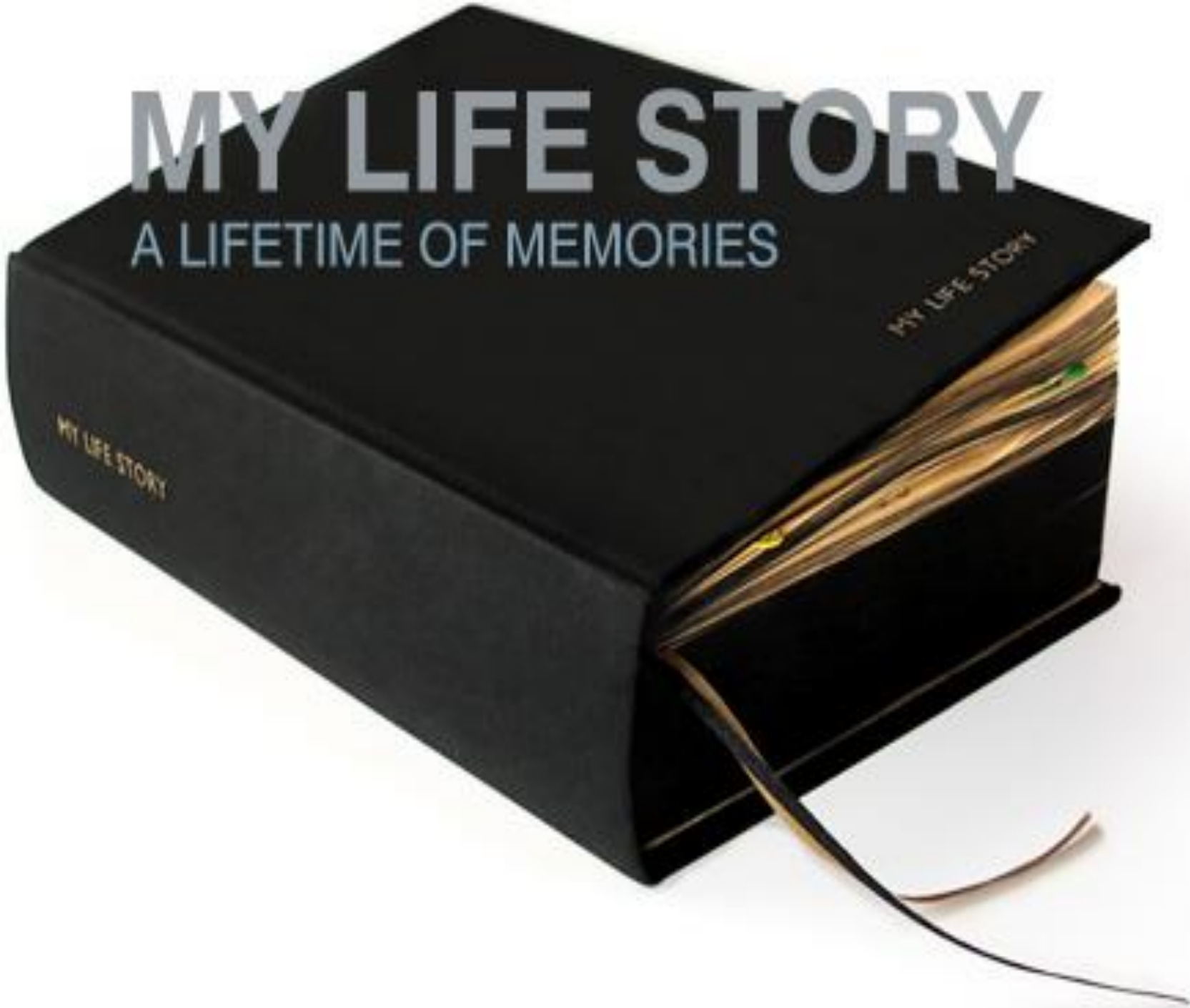
The narrative, whether oral or written, is a staple of every culture the world over. But stories demand time and concentration; the narrative does not simply transmit information, but invites the reader or listener to witness the unfolding of events’.

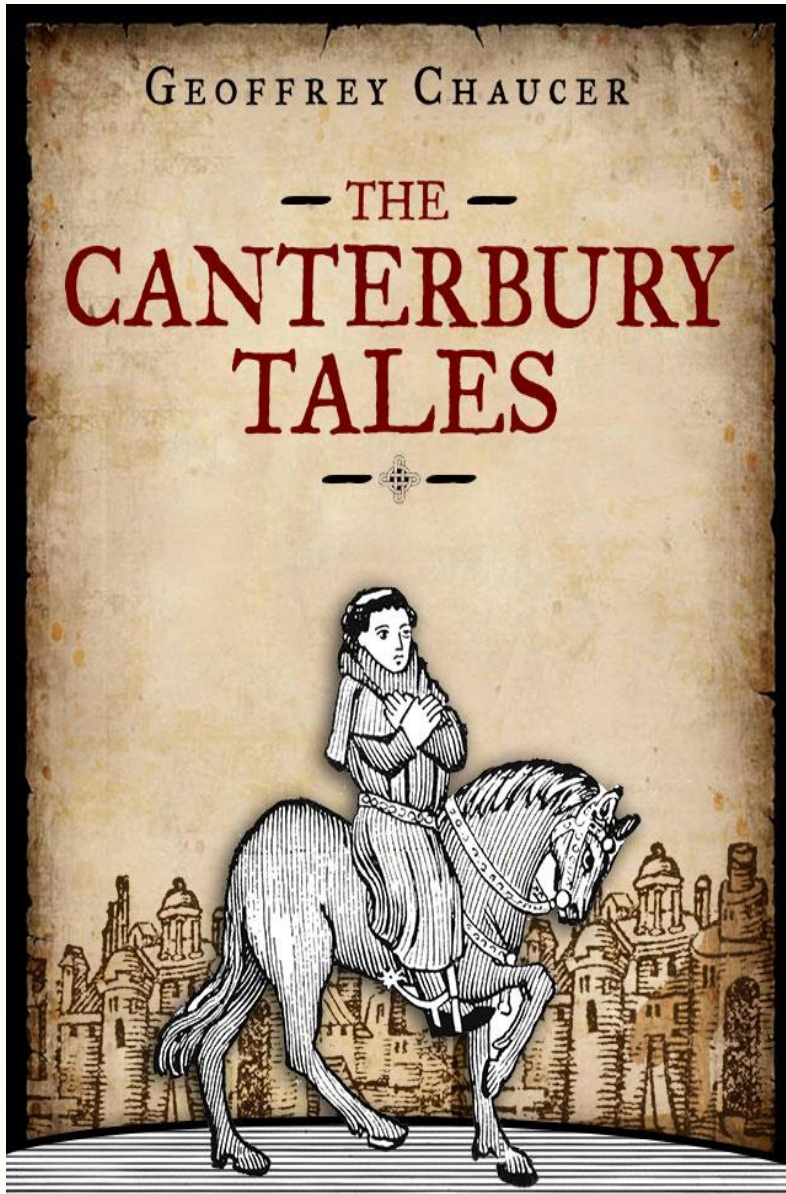
BEN MACINTYRE



MY LIFE STORY

A LIFETIME OF MEMORIES





**Provide a conceptual framework:
‘meaning’**

**Enhances attention span and
imagination**

**‘Imagination should be used not
to escape reality, but create it’.**

COLIN WILSON

**Provide a temporal sequence:
‘thinking’**

RISK MANAGEMENT:

Slowing Down



RISK MANAGEMENT:

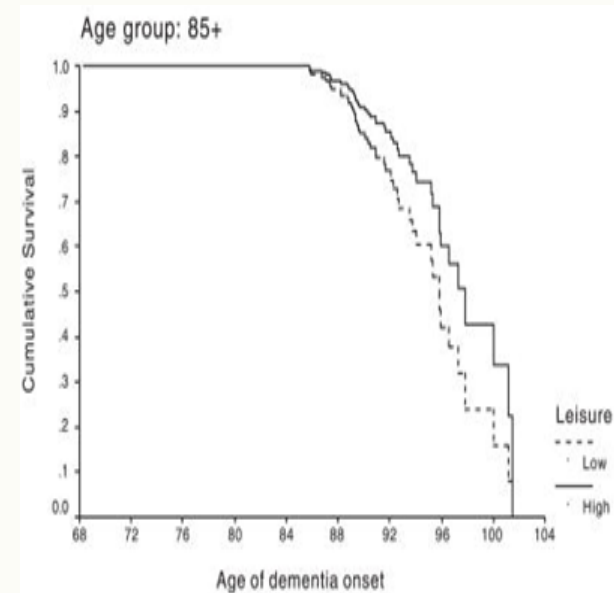
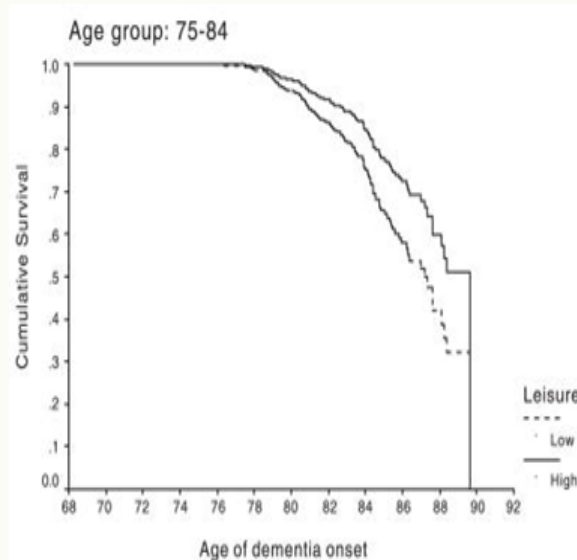
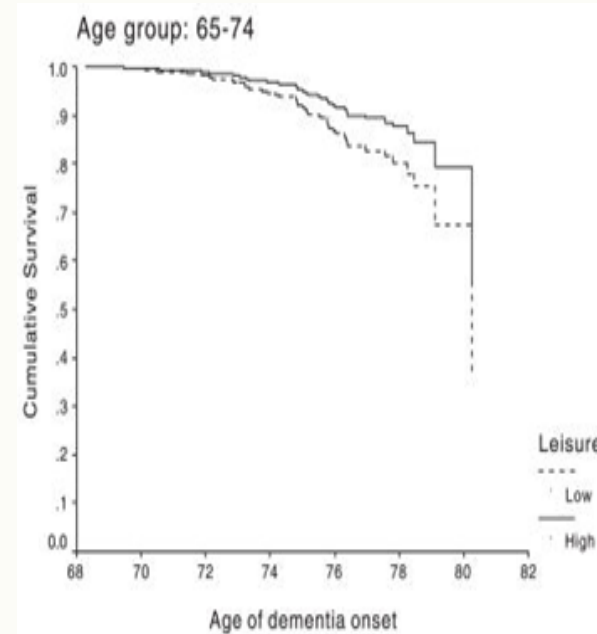
Cognitive Enhancement Through Exercise







COGNITIVE RESERVE AND LIFESTYLE



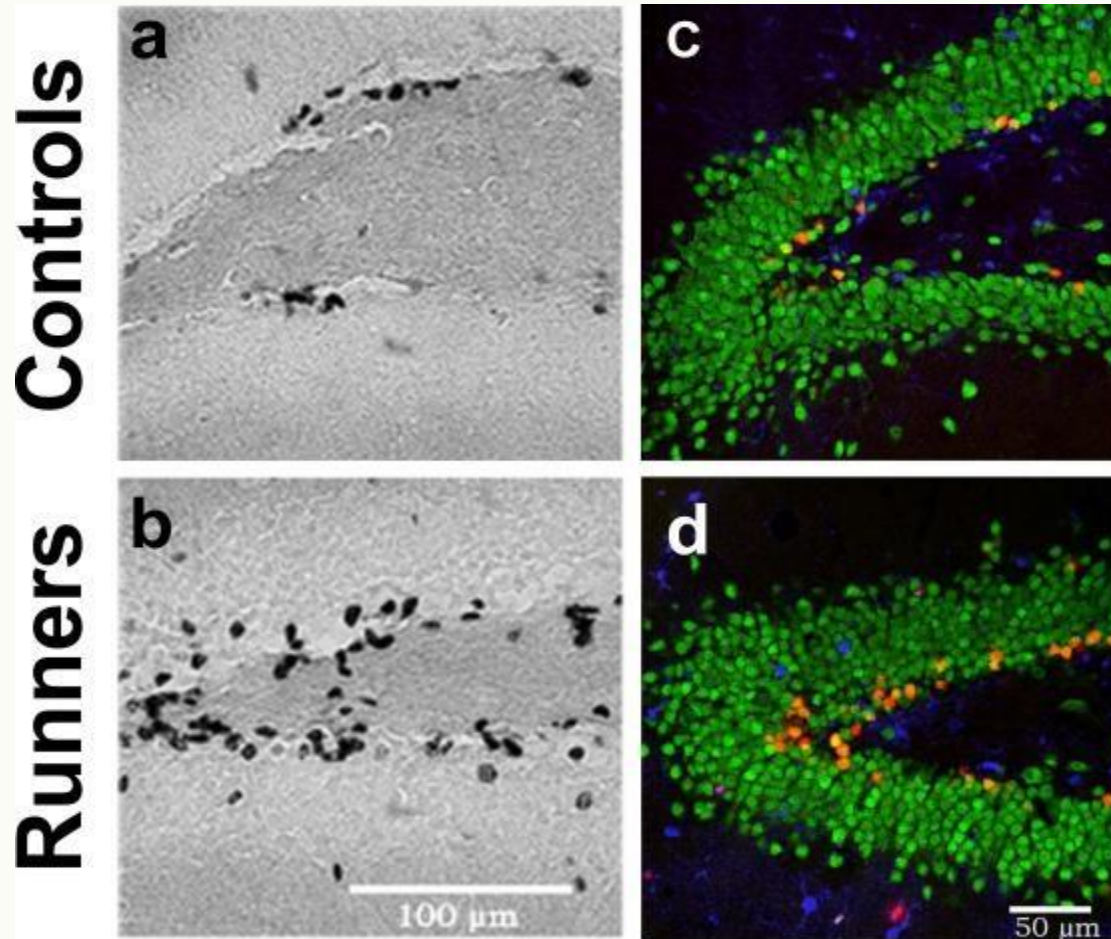
Scarmeas and Stern, J

THE COGNITIVE BENEFITS OF INTERACTING WITH NATURE



*Marc G. Berman, John Jonides, and Stephen Kaplan
Psychological Science, 2008. 19 1207-12.*

RUNNING ENHANCES 'NEUROGENESIS': PRODUCTION OF NEW NEURONS

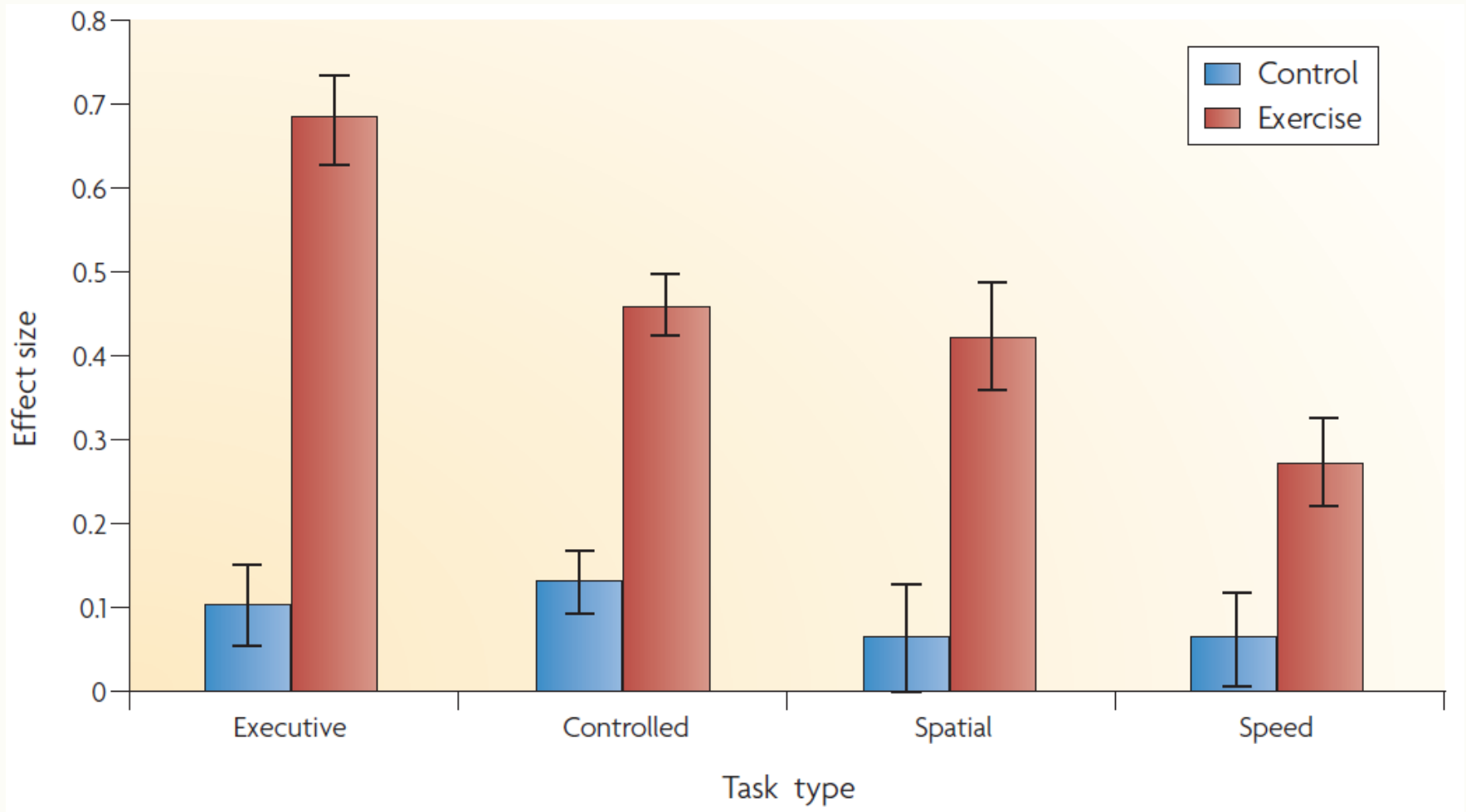


More dividing cells

More newly
born neurons

Lazarov, O. Mattson MP, Peterson DA, Pimplikar SW, van Praag H. When Neurogenesis Encounters Aging and Disease. Trends Neurosci. (2010) 33(12): 569-579.

EXERCISE-TRAINING EFFECTS ON COGNITION IN OLDER ADULTS

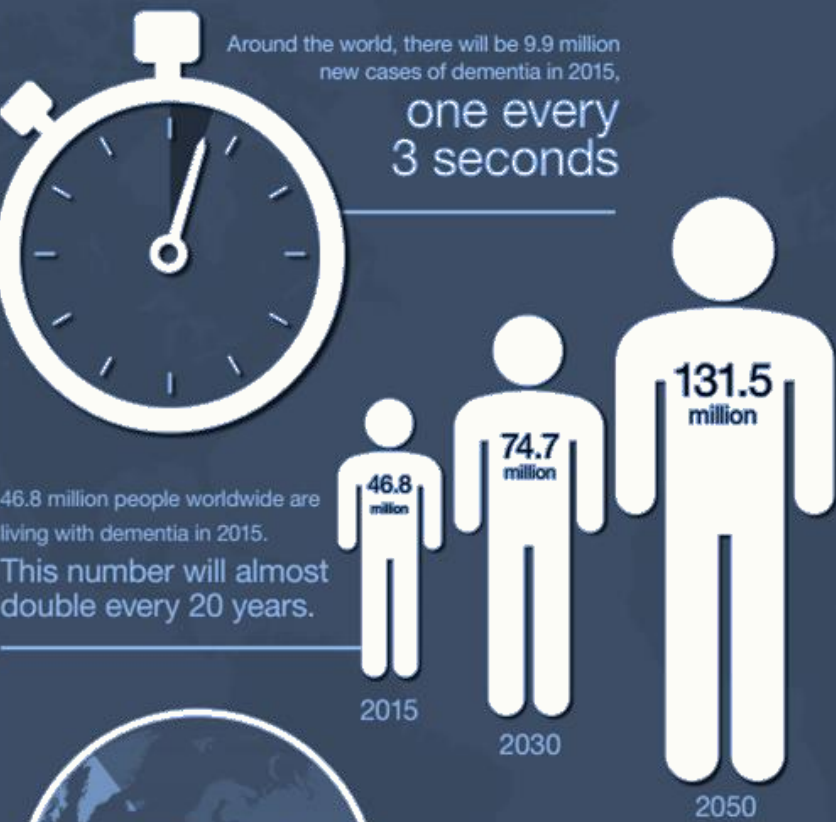


Charles H. Hillman, Kirk I. Erickson and Arthur F. Kramer

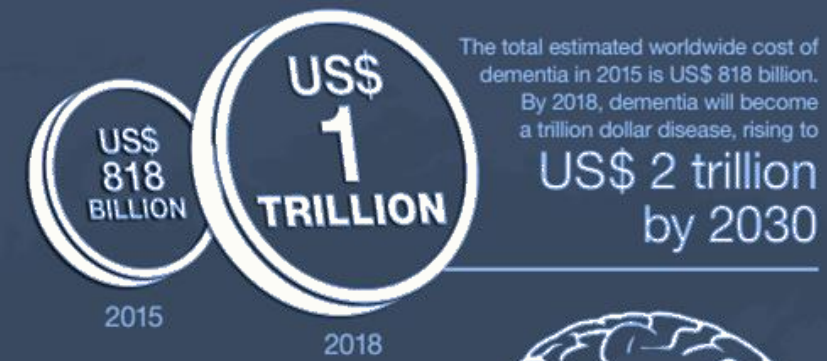
THE SCOURGE OF DEMENTIA



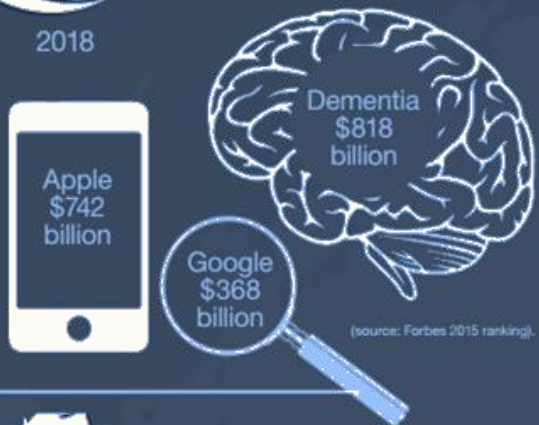
The global impact of dementia



Much of the increase will take place in low and middle income countries (LMICs): in 2015, 58% of all people with dementia live in LMICs, rising to 63% in 2030



If global dementia care were a country, it would be the 18th largest economy in the world exceeding the market values of companies such as Apple and Google



ALZHEIMER'S:

THE CURRENT POSITION



DIAGNOSTIC:

A blood marker detecting increased probability of eventual onset

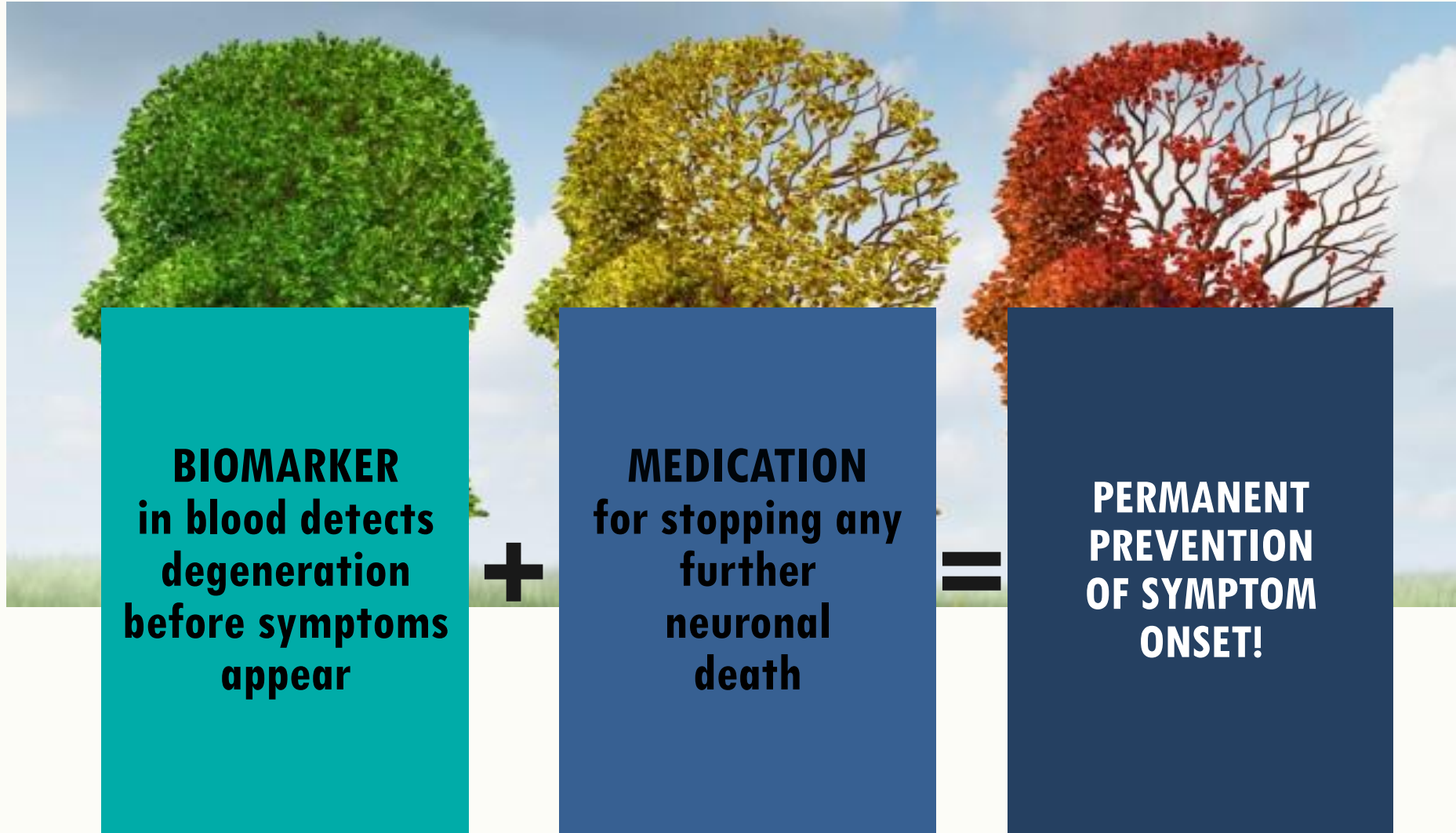
THERAPEUTIC:

A medication that only slows down early stage progression

**NEURODEGENERATION IS AN INAPPROPRIATE
REACTIVATION OF DEVELOPMENT THAT
BECOMES TOXIC IN THE CONTEXT OF THE
MATURE BRAIN**



THE LONG-TERM GOAL



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susan.greenfield@neuro-bio.com

info@neuro-bio.com



CELEBRATING THE AGEING MIND





**“Above all, don’t fear difficult moments.
The best comes from them”**

Rita Levi-Montalcine (1909-2012)

MORE INFORMATION CAN BE FOUND:



www.susangreenfield.com



www.neuro-bio.com