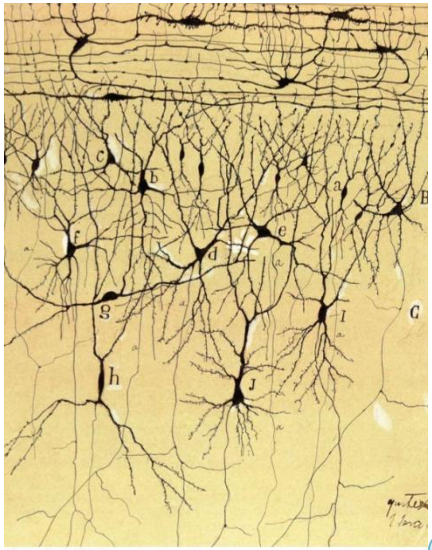
НЕРВНЫЕ КЛЕТКИ ВОССТАНАВЛИВАЮТСЯ ИЛИ КАК УЛУЧШИТЬ ПАМЯТЬ

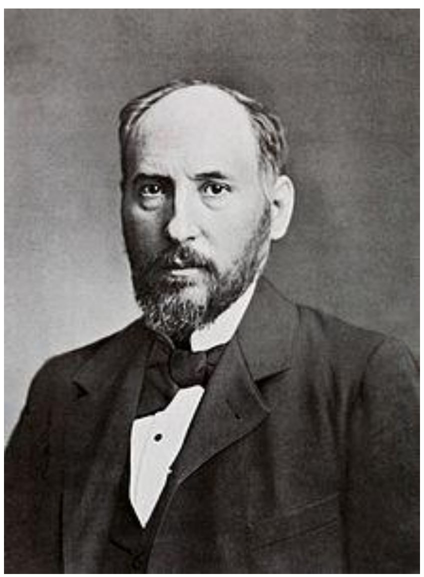
Выполнила: студентка 6 курса лечебного факультета Бузган Николетта.

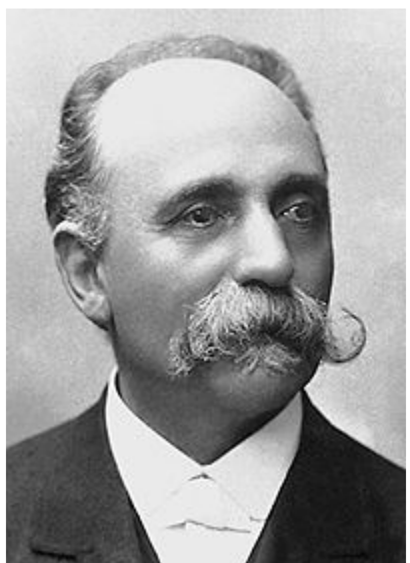


Santiago Ramón y Cajal
Capas 1ª y 2ª de la corteza olfativa de la circunvolución del hipocampo del niño, n. 1901
© Herederos de Ramón y Cajal

ИСТОРИЯ ВОПРОСА

"Как только развитие закончено, рост и регенерация аксонов и дендритов прекращаются. Центры взрослого мозга представляют собой нечто установленное, законченное и неизменное. Всё может умереть, ничто не может быть восстановлено», – Рамон-и-Кахаль, 1913





Нобелевская премия по физиологии или медицине 1906 «в знак признания трудов о строении нервной системы».

ПЕРВЫЕ ДОГАДКИ

- ***J. Altman****. Are new neurons formed in the brains of adult mammals? Science* ***1962****; 135, 1127–1128 (первое предположение о нейрогенезе в гиппокампе у мышей, получивших травму).*

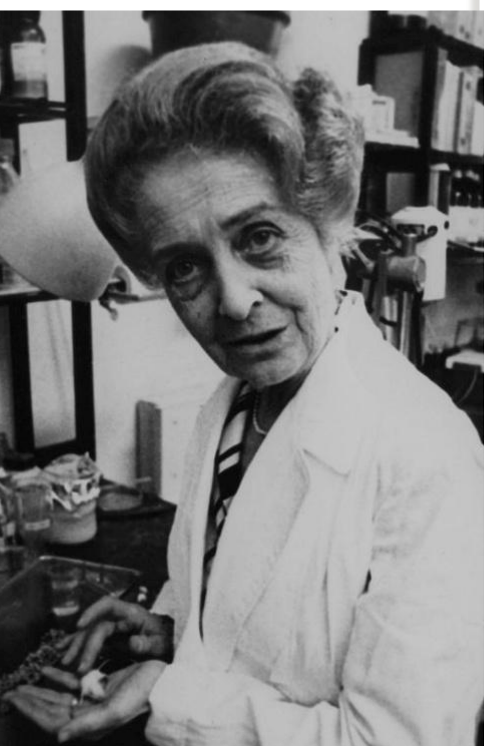
- ***F. Nottebohm****. From bird song to neurogenesis. Scientific American* ***1989****. 260: 74-9 (с наступлением сезона спаривания у самок канареек в ядрах мозга, связанных с вокализацией и обучением, резко возрастает число нейронов).*
- ***Eriksson*** *P. S., Perfilieva E., Bjork-Eriksson T., et al. Neurogenesis in the adult human hippocampus. Nat. Med. 1998;4: 1313–1317 (посмертный анализ активности гиппокампальных нейронов у людей, при жизни принимавших 5-бромодезоксиуридин).*

«Это было реальным шоком, потому что нам всегда преподавали, что взрослый мозг сохраняет тот же самый размер, с теми же самыми клетками, навсегда. Это было неоспоримым фактом знания мозга. Как их могло стать больше? Это противоречило всему, что я когда-либо изучал…» - писал Ноттебом.

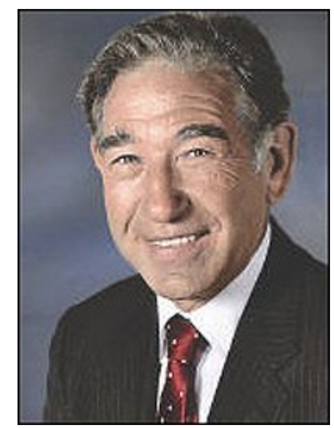
"The effects of wing bud extirpation on the development of the central nervous system in chick embryos", Journal of Experimental Zoology, 1934; 68:449-494.

"Для нормального развития нервной системы необходима гибель нервных клеток, только специальным образом запрограммированная".

Hamburger Viktor and Rita Levi-Montalcini. "Proliferation, Differentiation and Degeneration in the Spinal Ganglia of the Chick Embryo under Normal and Experimental Conditions." *Journal of Experimental Zoology,* 1949: 457–501

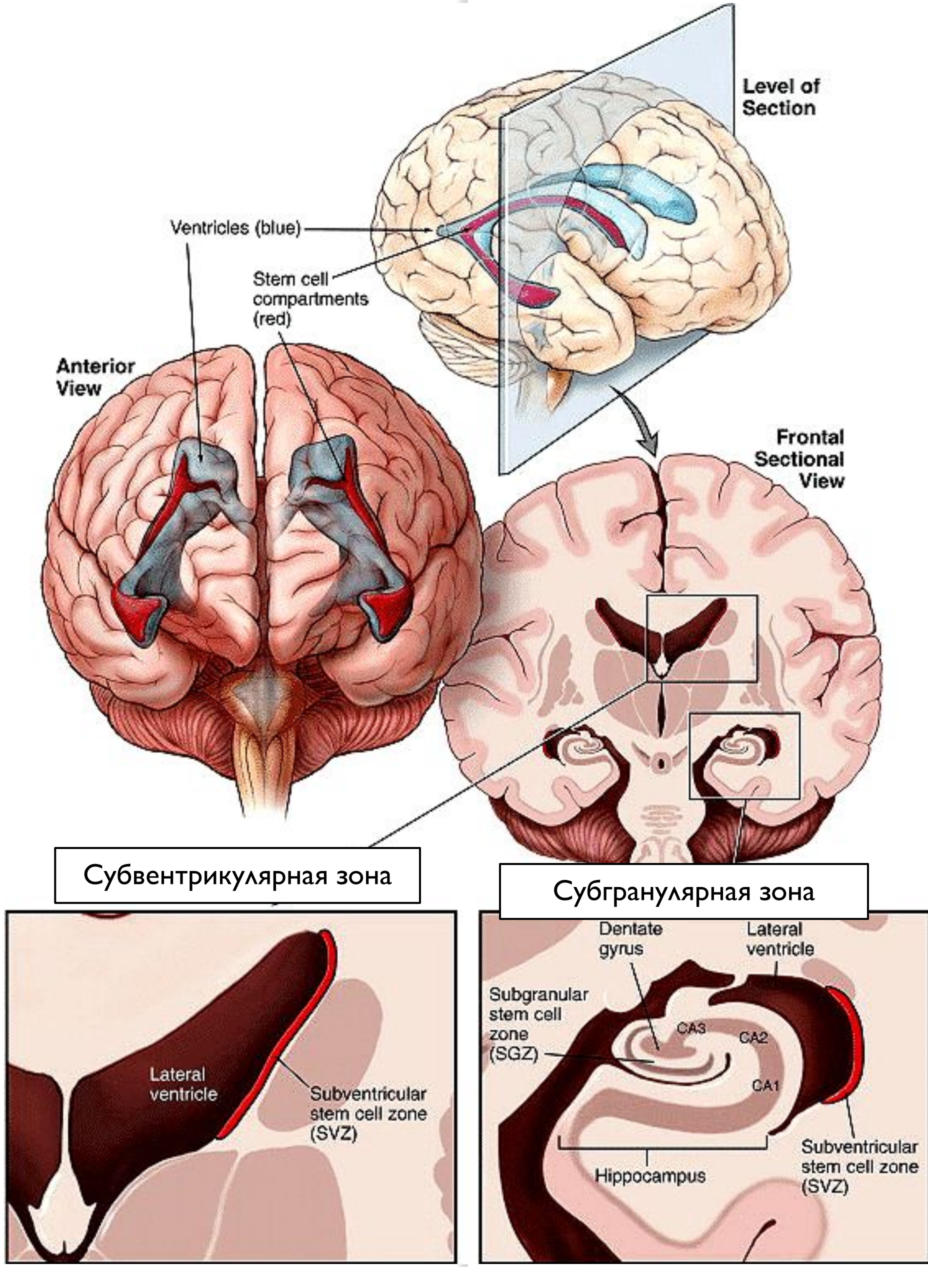


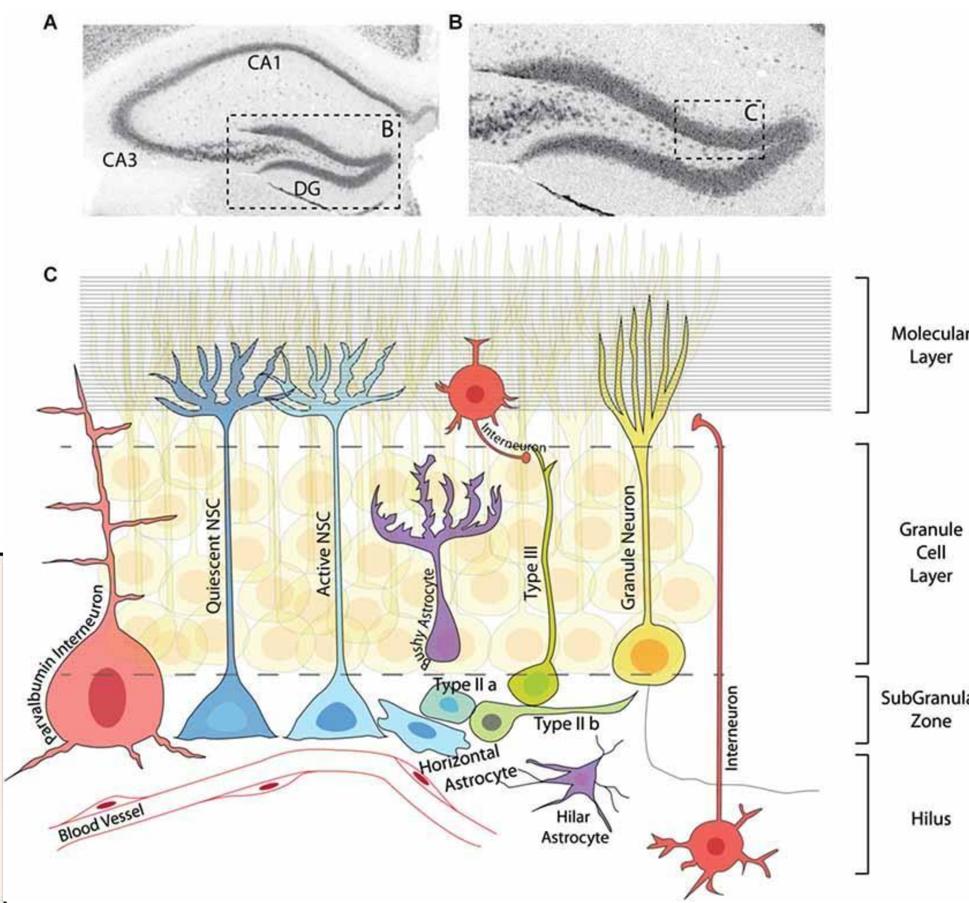
Опухолевые мышиные ткани, куриная кровь, экстракт эмбрионов и... чувствительные ганглии эмбриона = необходимые ингридиенты для открытия фактора роста нервов... и фактора роста эпителия.



Нобелевская премия по физиологии или медицине 1986 «в знак признания открытий, имеющих важнейшее значение для раскрытия механизмов регуляции роста клеток и органов».

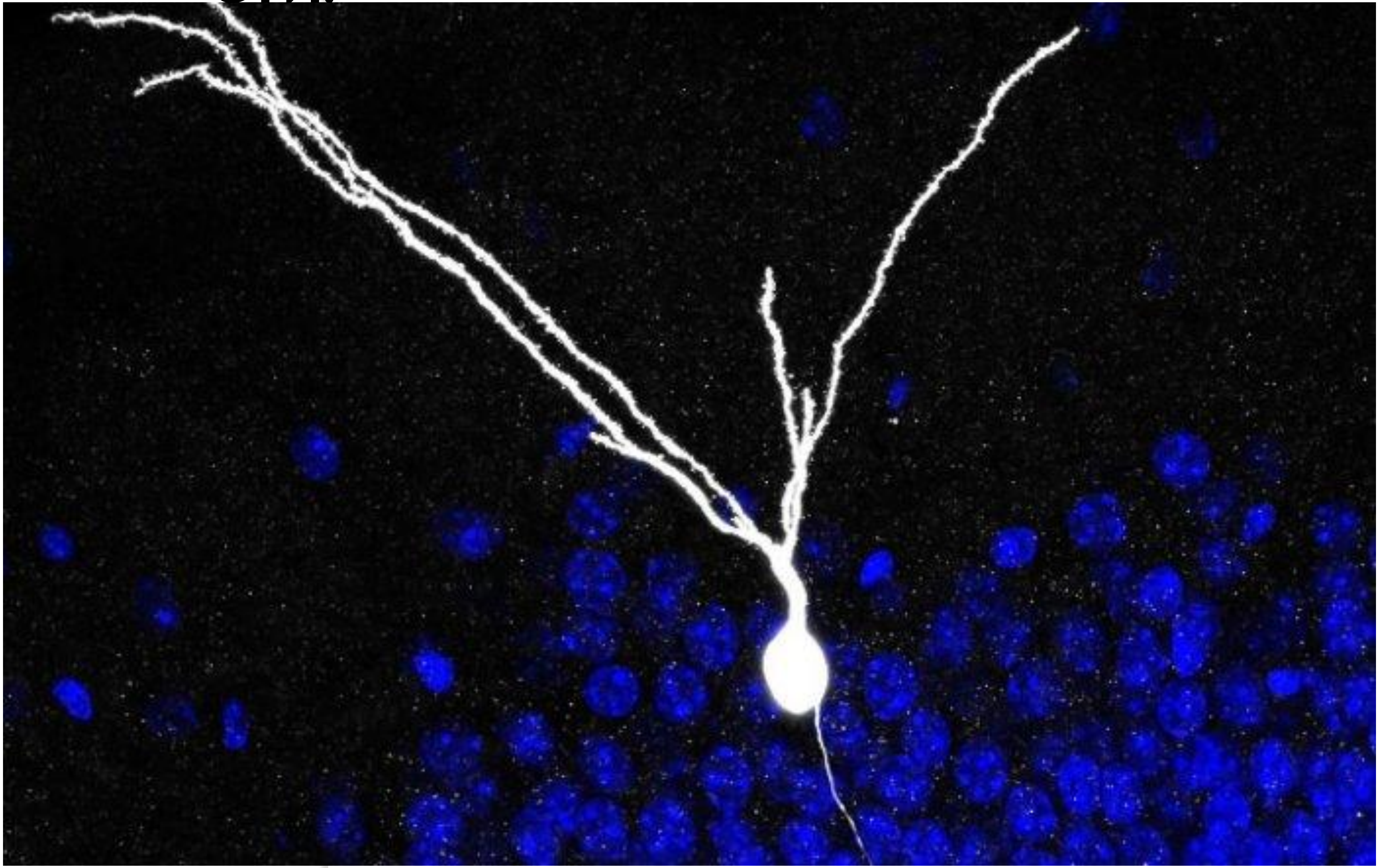
ОСНОВЫ НЕЙРОГЕНЕЗА

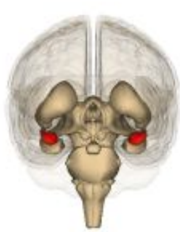




МЕХАНИЗМЫ НЕЙРОПЛАСТИЧНОСТИ:

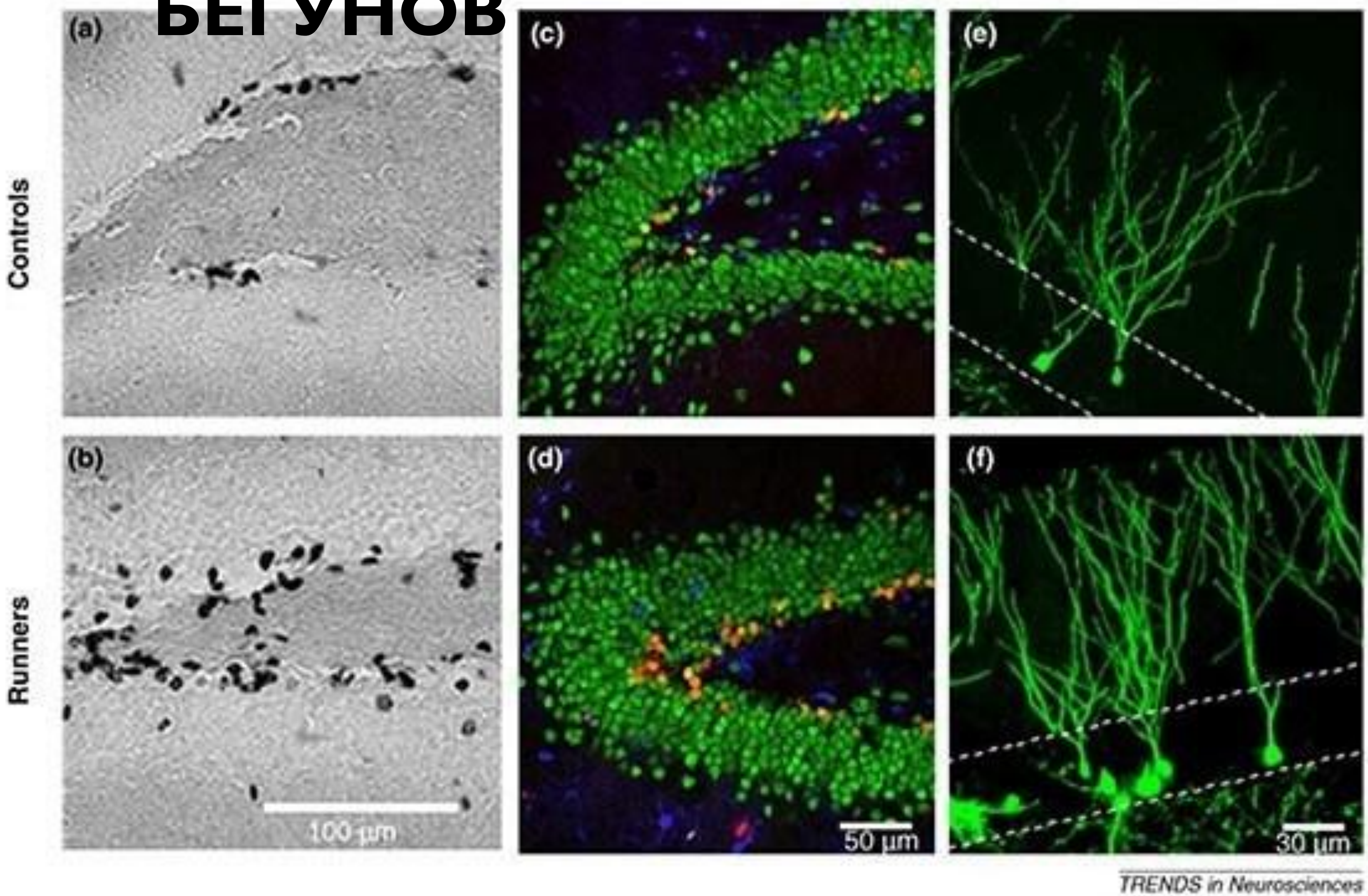
- спраутинг (рост отростков нейронов)
- арборизация (ветвление дендритов)
- изменение синаптической проводимости (резервы)
- нейрогенез (стволовые клетки)

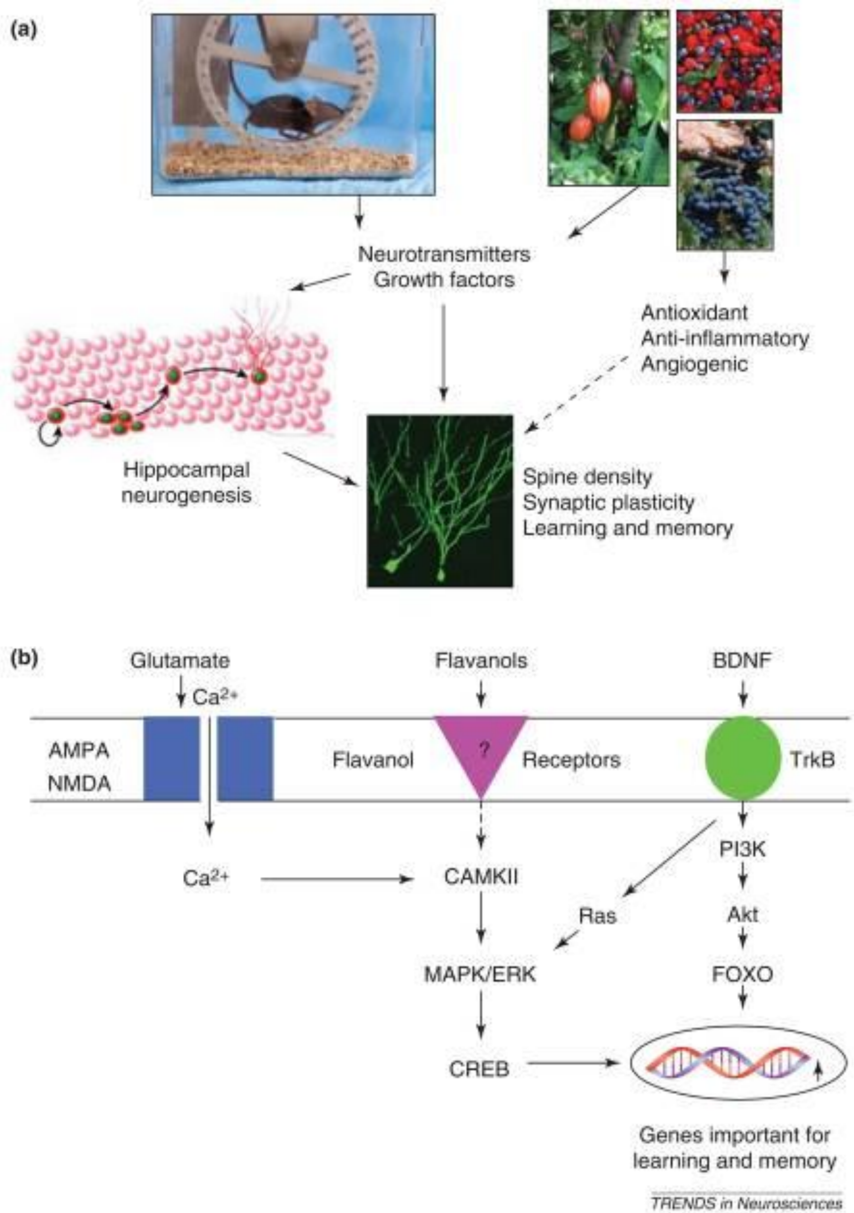




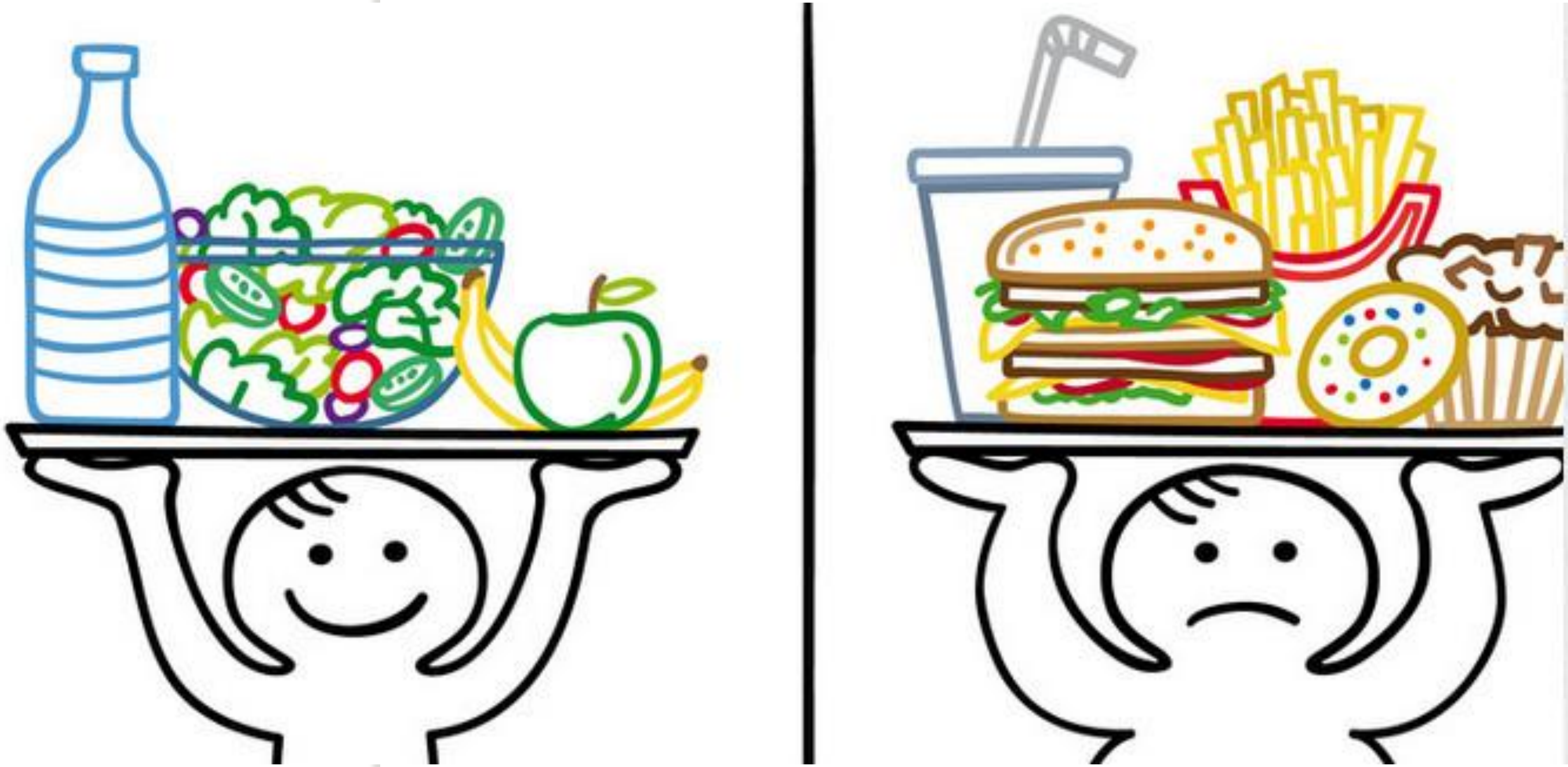
Saive A-L, Royet J-P, & Plailly J. A review on the neural bases of episodic odor memory: from laboratory-based to autobiographical approaches. Frontiers in Behavioral Neuroscience 8 (2014). doi: 10.3389/fnbeh.2014.00240

НЕЙРОГЕНЕЗ У КРЫС-БЕГУНОВ

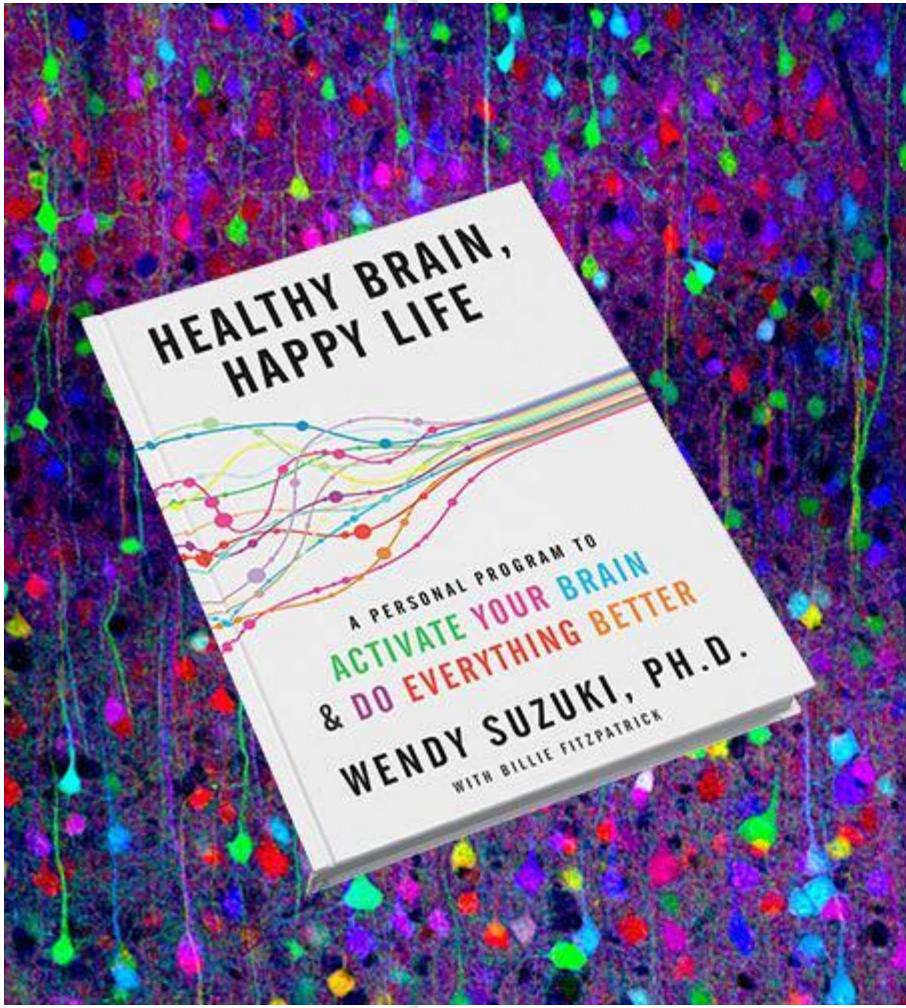




Henriette van Praag. Exercise and the brain: something to chew on. Trends Neurosci. 2009 May; 32(5): 283–290.



Molteni R, Barnard RJ, Ying Z, Roberts CK, Gómez-Pinilla F. A high-fat, refined sugar diet reduces hippocampal brain-derived neurotrophic factor, neuronal plasticity, and learning. Neuroscience. 2002;112(4):803-14.


HEALTHY BRAIN,
HAPPY LIFE
A PERSONAL PROGRAM TO
ACTIVATE YOUR BRAIN
& DO EVERYTHING BETTER
WENDY SUZUKI, PH.D.
WITH BILLIE FITZPATRICK


Brain and Behavioral Changes	Exercise Protocol	Time Course Post-Exercise Cessation (20 min, 40 min, 60 min, 80 min, 100 min, 120 min, ..., 24 hrs +)	Anatomical Sites
A. Behavioral Changes			
Prefrontal-Dependent Cognitive Function [27]	50 min cycling at 85% of age-predicted MHR, with additional 5 min warmup and cooldown	(120 min)	
Mood			
Enhanced positive mood states [28]	A range of exercise modes at varying intensities (low to very high) for a duration of 7 to over 75 min	(24 hrs)	
Decreased negative mood states [29]	30 min of aerobic exercise class at age-predicted 60-80% of MHR	(24 hrs)	
Stress Reduction [30]	60 or 120 min of cycling at 50-55% of VO_2 max, with additional 3 min warmup	(3 hrs)	
B. Neurophysiological Changes			
Extracellular Recording			
Increased theta [70]	5 min of treadmill running at speeds ranging from 1 to 22 cm/sec	(6 min)	Hippocampus
EEG			
Increased delta, theta, alpha and beta [66]	A range of exercise modes at various intensities for a duration of 2 to 60 min	(30 min)	Frontal, Temporal, Parietal and Occipital Cortices
Increased P300 amplitude [88]	20 min of treadmill walking at 60% of age-predicted MHR	(25 min)	
Decreased P300 latency [88]	20 min of treadmill walking at 60% of age-predicted MHR	(25 min)	
fNIRS			
Increased activation during task performance [100]	10 min of cycling at 50% of VO_2 max	(15 min)	Prefrontal Cortex
Increased HAROLD during task performance [103]	10 min of cycling at 50% of VO_2 max	(15 min)	
TMS			
Excitation [116]	20 min of cycling at 65-70% of age-predicted MHR, with additional 5 min warmup	(30 min)	Primary Motor Cortex
Inhibition [116]	20 min of cycling at 65-70% of age-predicted MHR, with additional 5 min warmup	(30 min)	
fMRI			
Increased hippocampal pattern similarity [113]	25 min of high-intensity interval cycling at 80% of age-predicted MHR, with additional 5 min warmup and cooldown	(48 hrs)	Hippocampus, Frontal and Temporal Cortices
Altered activation to an acute stressor [114]	30 min of treadmill walking/running at 60-70% of VO_2 max	(90 min)	
C. Neurochemical Changes			
Lactate [129]	Graded exercise test on a bicylce ergometer to 85% of age-predicted MHR	(40 min)	Cortex
Cortisol [141]		(120 min)	Hippocampus, Hypothalamus, Pituitary gland, Frontal Cortex
Neurotrophins			
BDNF [179]	30 min treadmill running at low- (15 m/min) or moderate-intensity (25 m/min)	(90 min)	Hippocampus, Prefrontal Cortex, Striatum
IGF-1		?	
VEGF		?	
Neurotransmitters (see 197 for review)			
Dopamine [201]	20 min treadmill running at 12 m/min	(120 min)	Hippocampus, Prefrontal Cortex, Striatum, Midbrain, Brainstem, Pons medulla, Hypothalamus, Cortex, Preoptic area
Norepinephrine [222]	120 min treadmill running at 25 m/min at a 3% slope	(70 min)	
Serotonin [214]	120 min treadmill running at 25 m/min	(120 min)	
Acetylcholine		?	
GABA [233]	Graded exercise test on a bicycle ergomenter to ≥80% age-predicted MHR.	(20 min)	
Glutamate [201]	20 min treadmill running at 12 m/min	(40 min)	
Endogenous Opioids [240]	2 hrs of endurance running (21.5±4.7 km)	(30 min)	Frontal, Temporal, and Parietal Cortices, Cerebellum, Basal Ganglia
Endocannabinoids		?	

Basso JC, Suzuki WA. The Effects of Acute Exercise on Mood, Cognition, Neurophysiology, and Neurochemical Pathways: A Review. *Brain Plast.* 2017;2(2):127-152. Published 2017 Mar 28. doi:10.3233/BPL-160040

Moon HY, Becke A et al. Running-Induced Systemic Cathepsin B Secretion Is Associated with Memory Function. Cell Metab. 2016 Aug 9; 24(2):332-40.

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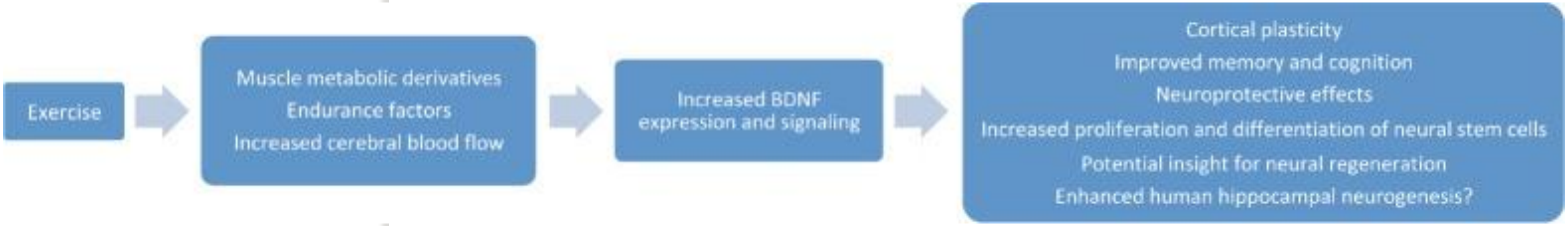
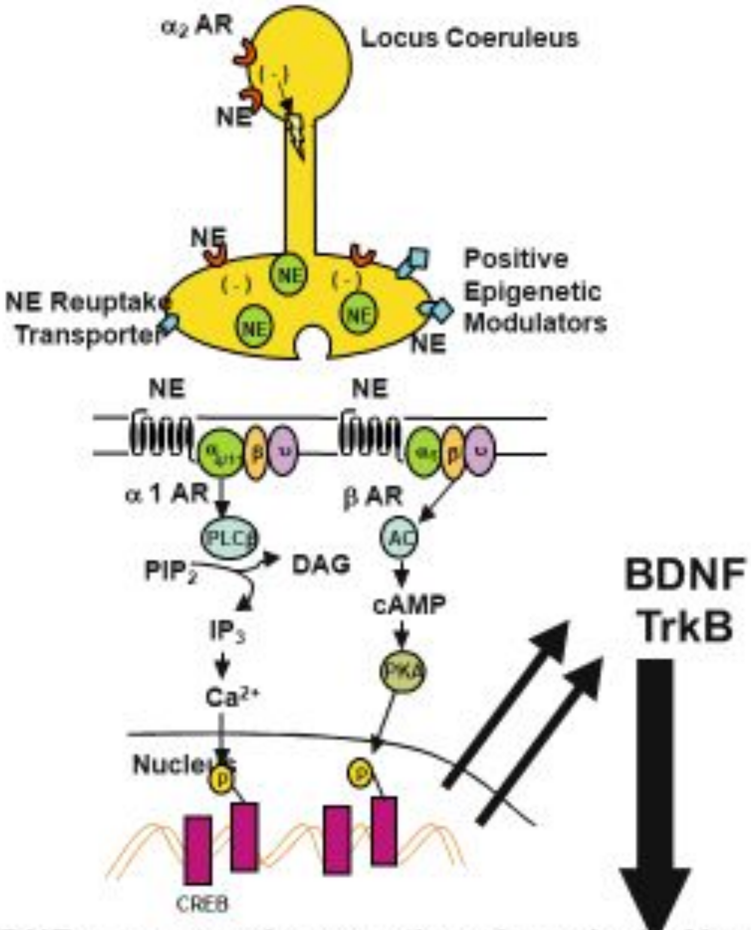
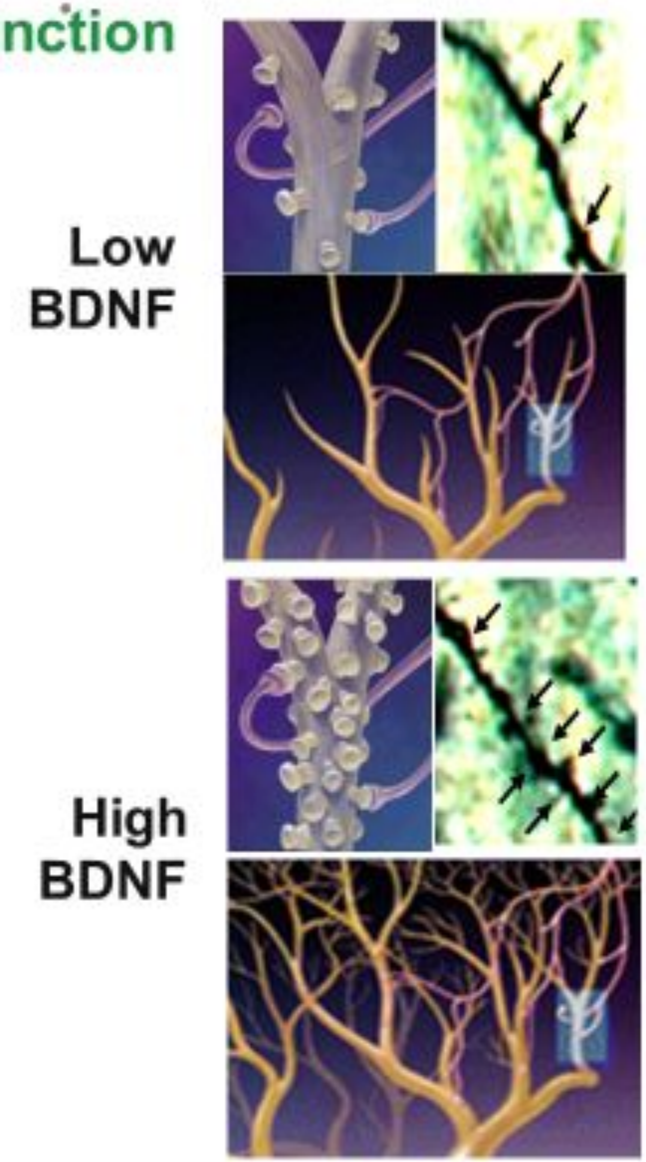


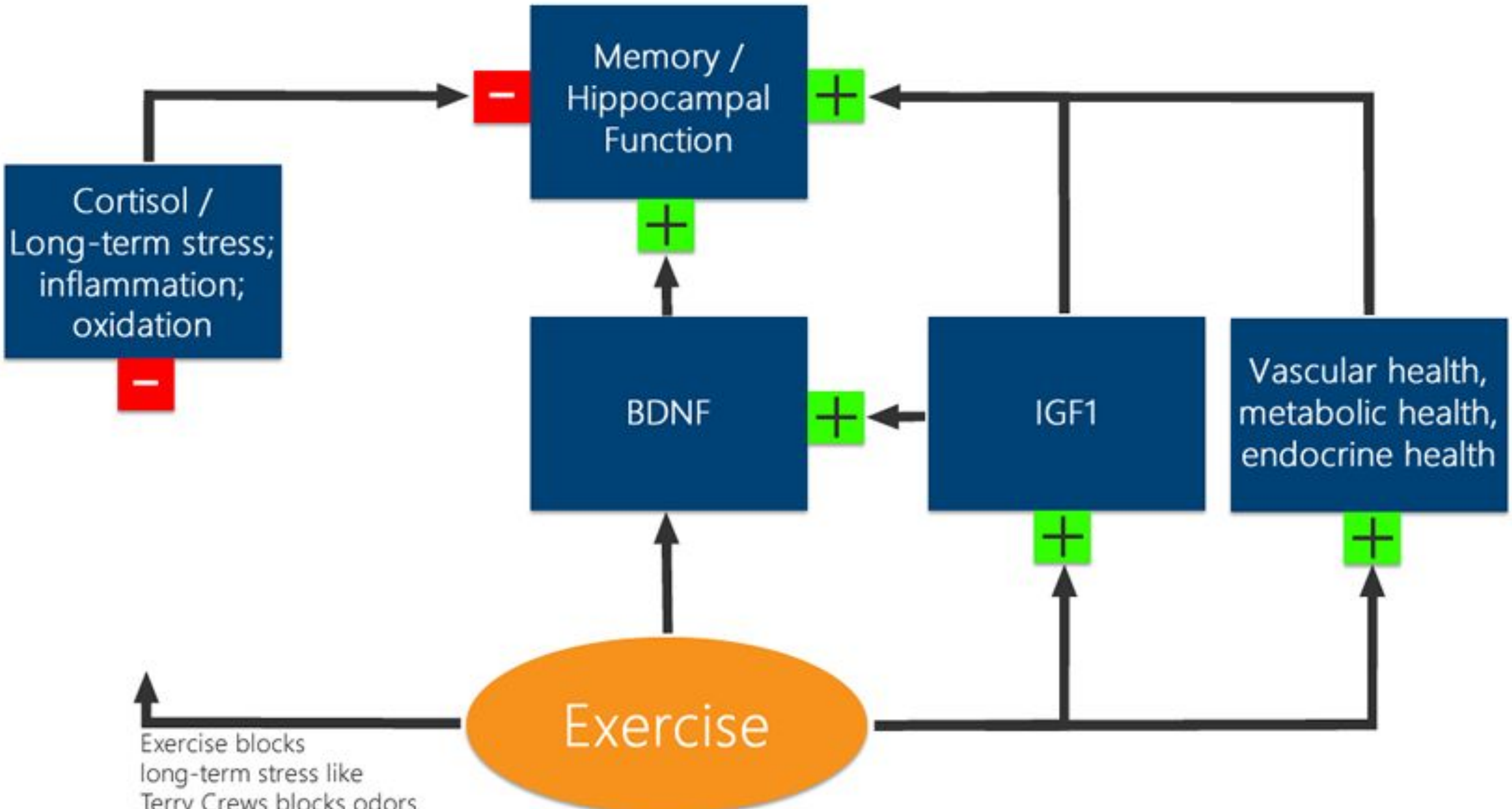
Genomics 101: BDNF and Brain Function





BDNF promotes the growth and survival of brain cells:

- Restores/enhances neural connectivity
- Promotes healthy cognitive functioning.
- Produces critical neurotransmitters
- Improves executive functioning and memory



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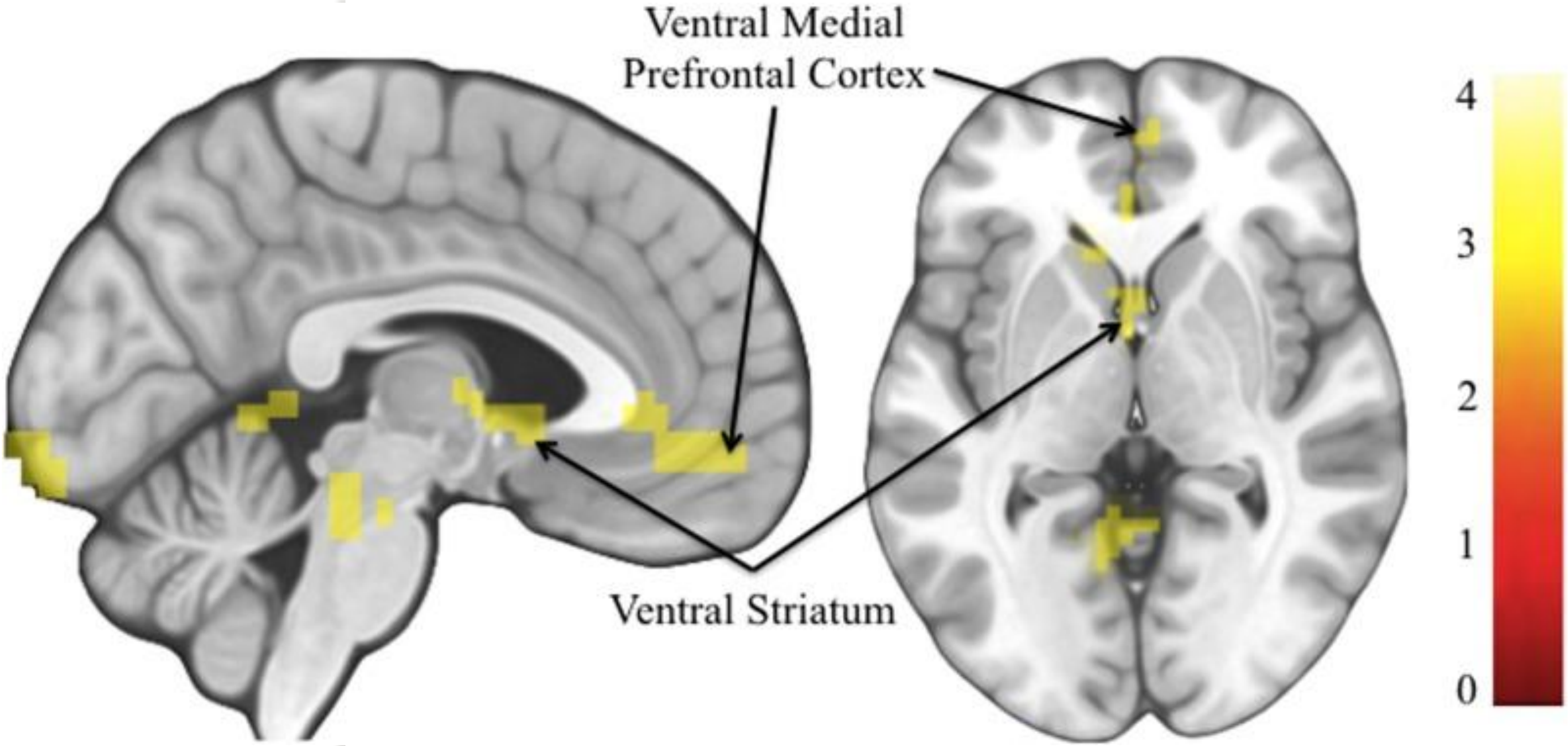

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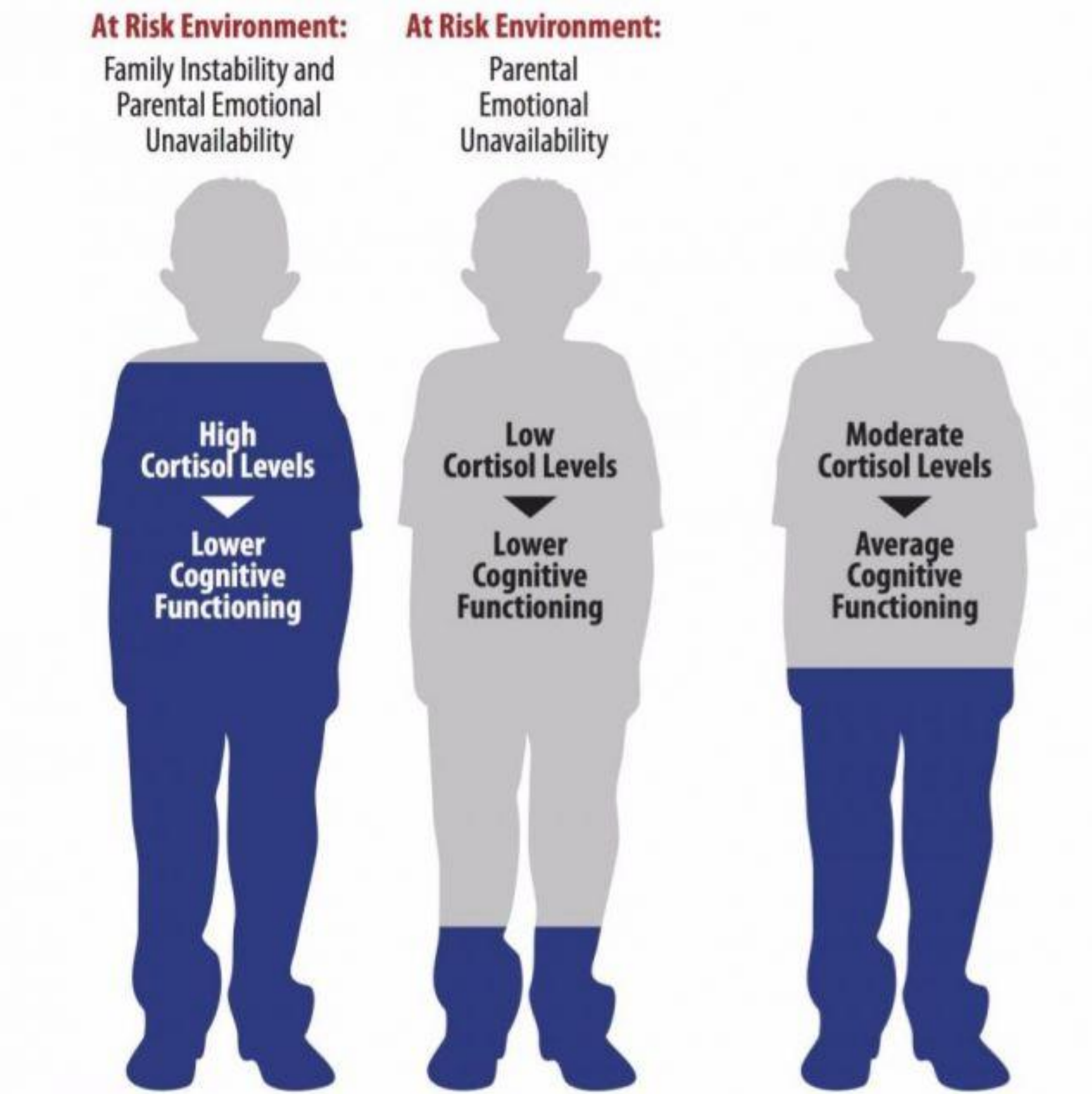
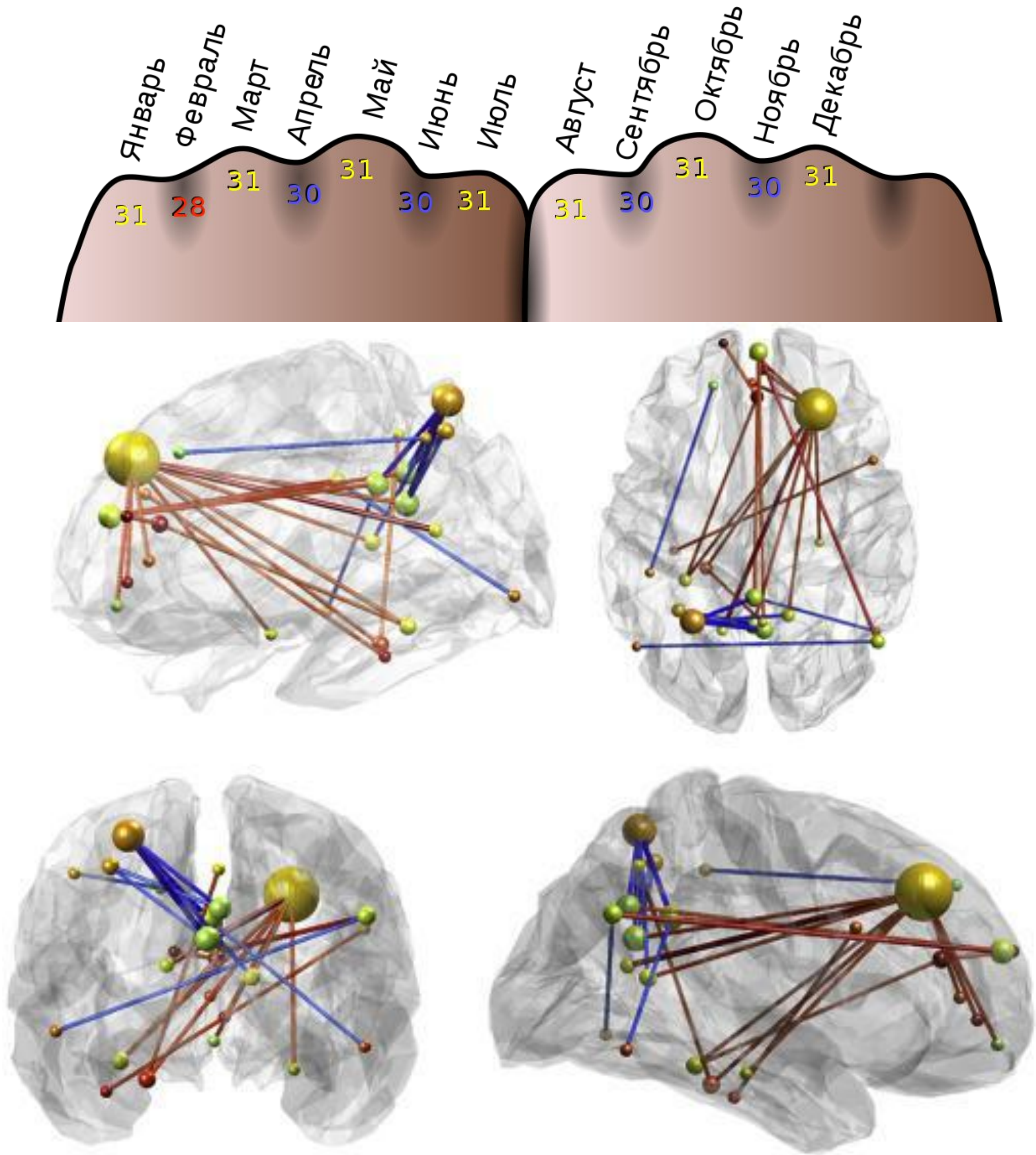

At Risk Environment:
Family Instability and Parental Emotional Unavailability
At Risk Environment:
Parental Emotional Unavailability
High Cortisol Levels
Lower Cognitive Functioning
Low Cortisol Levels
Lower Cognitive Functioning
Moderate Cortisol Levels
Average Cognitive Functioning

ЛОКУСНАЯ ТРЕНИРОВКА ПАМЯТИ


Январь
Февраль
Март
Апрель
Май
Июнь
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Август
Сентябрь
Октябрь
Ноябрь
Декабрь
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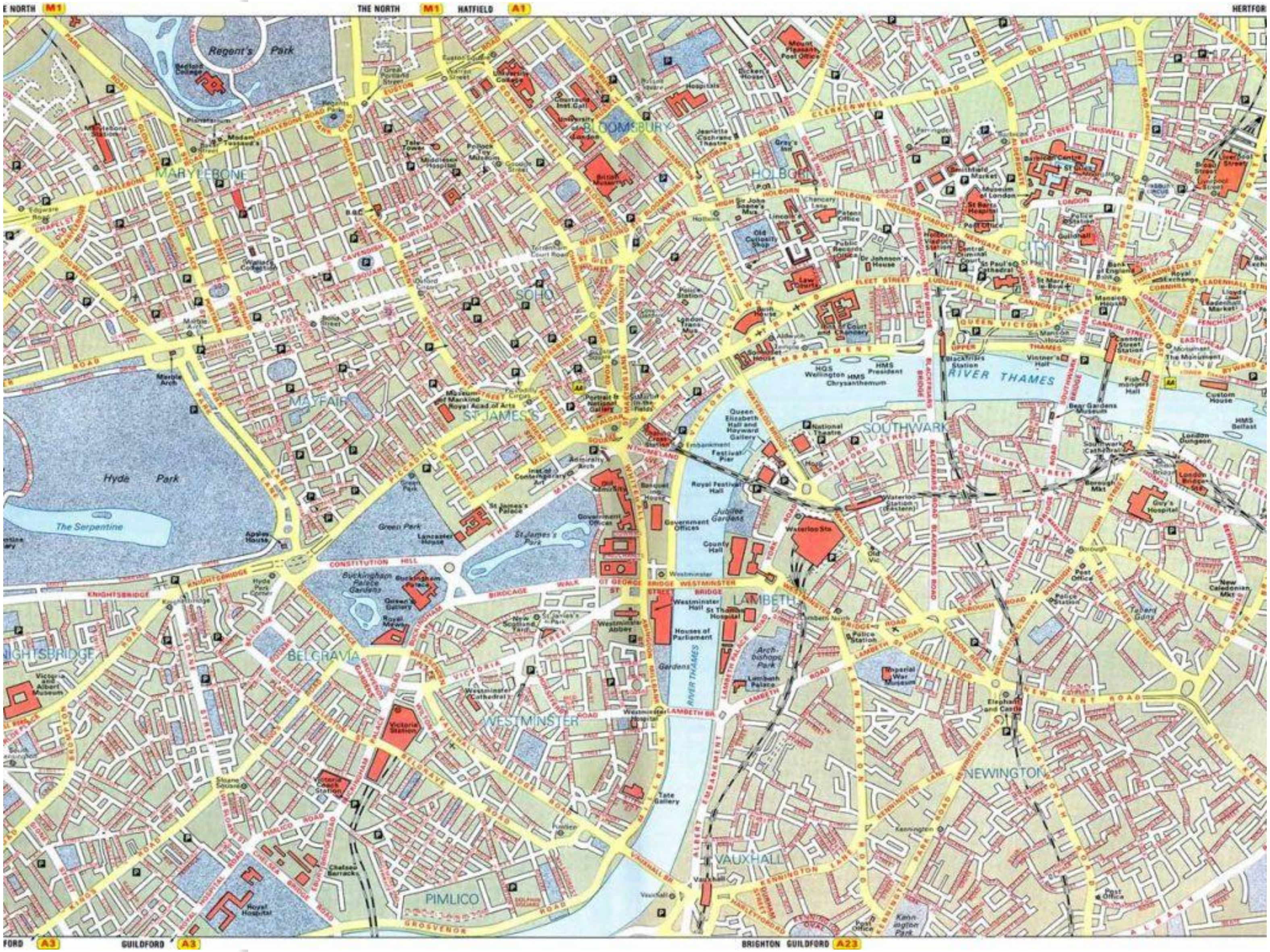
https://memocamp.com/en

	mnemonic training	active control	passive control
pre-training 20 min	26.5 ±16.2	31.3 ±14.8	29.5 ±16.1
post-training 20 min	62.5 ±11.1	42.7 ±17.1	36.6 ±19.5
training change 20 min	+35.9 ±17.0	+11.4 ±11.8	+7.1 ±13.3
pre-training 24 h	16.5 ±14.0	19.6 ±12.7	18.7 ±15.7
post-training 24 h	55.7 ±16.9	31.1 ±18.6	21.8 ±19.1
training change 24 h	+39.2 ±17.8	+11.4 ±12.7	+3.1 ±10.7
4 month follow-up 15 min	50.3 ±16.5	30.4 ±9.5	27.4 ±9.8
4 month change 20/15 min	+22.4 ±18.9	+0.5 ±11.8	-2.2 ±11.4

Martin Dresler, William R. Shirer. Mnemonic Training Reshapes Brain Networks to Support Superior Memory. Neuron. Volume 93, Issue 5, P1227-1235.E6, March 08, 2017



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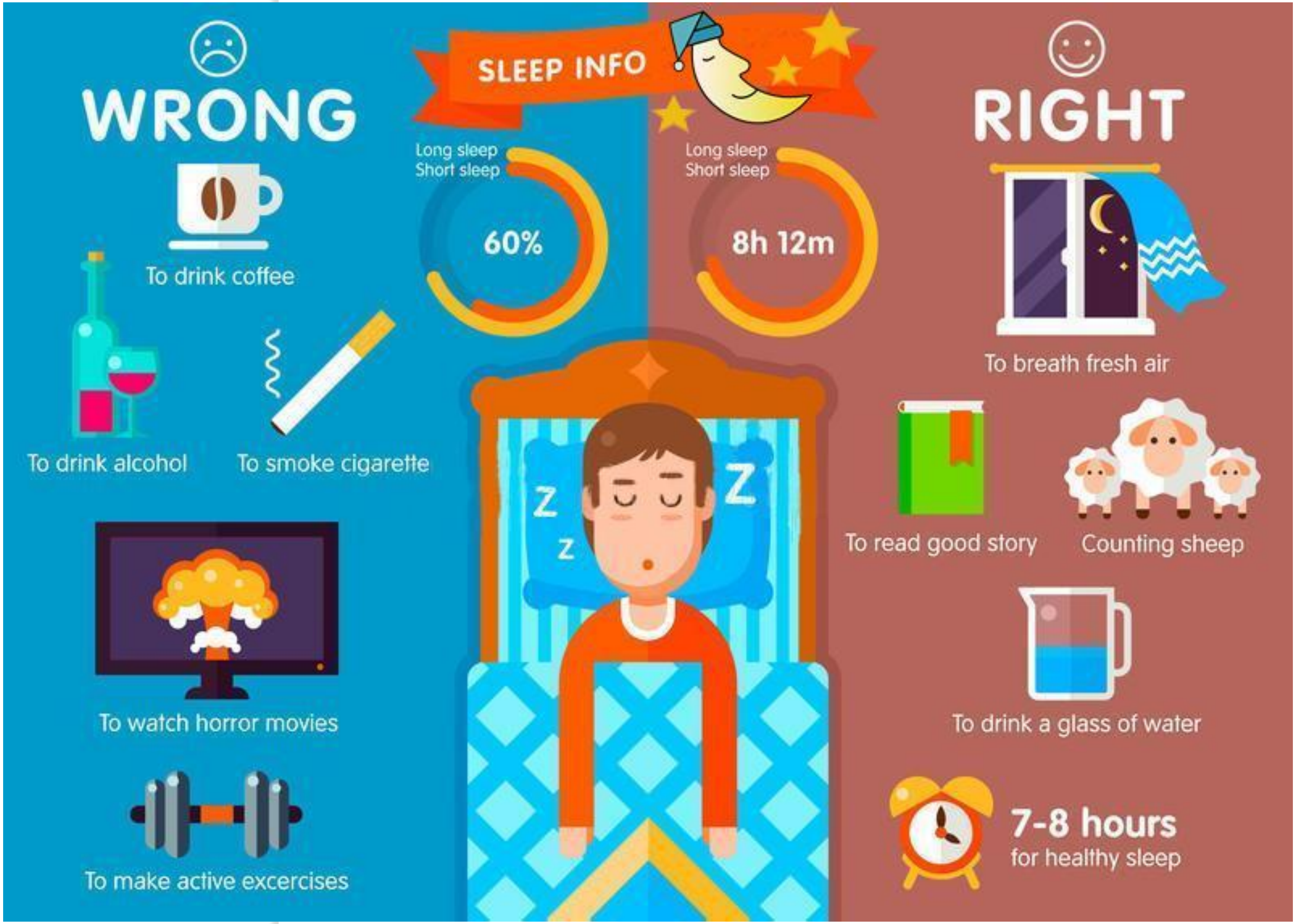

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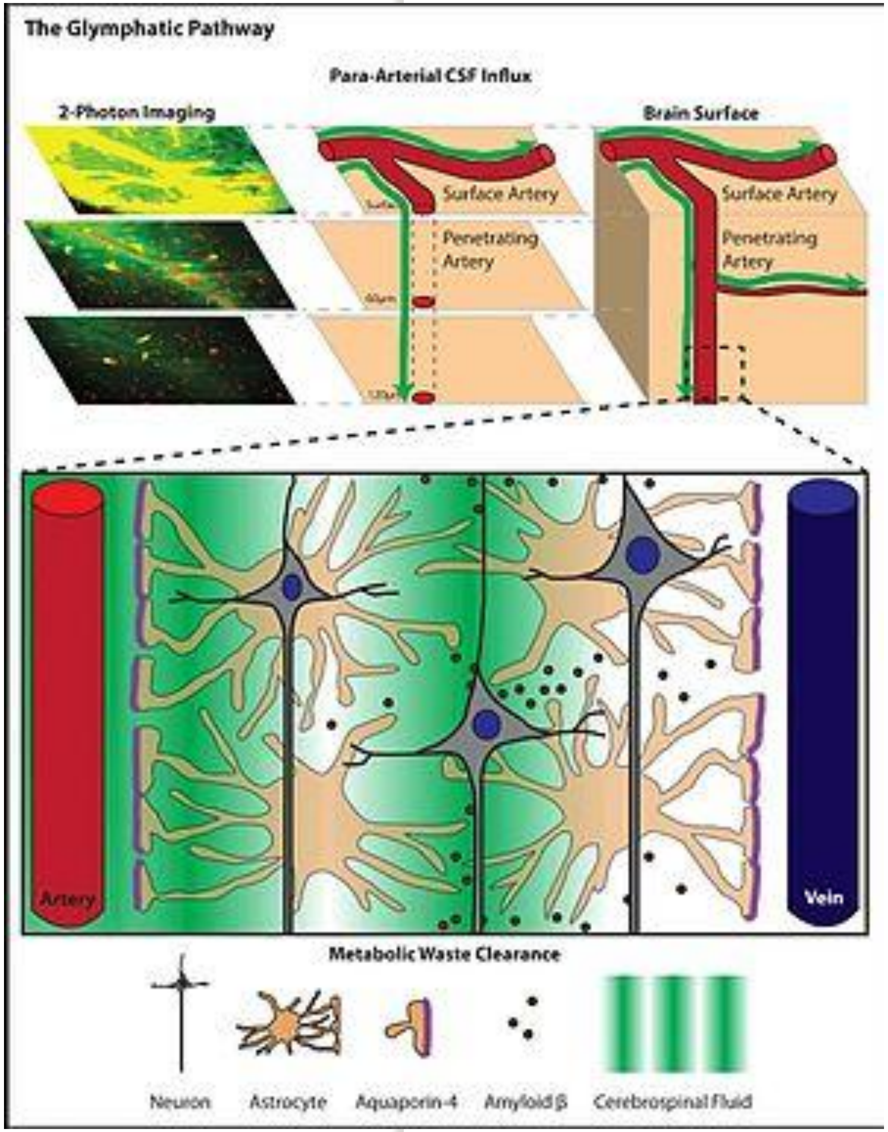

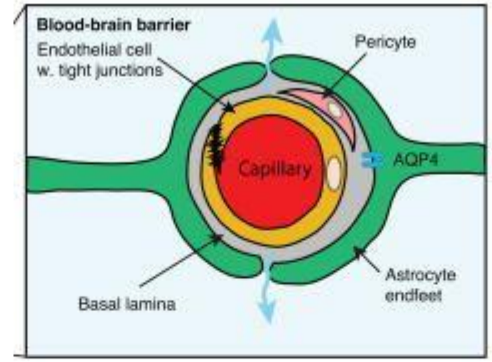

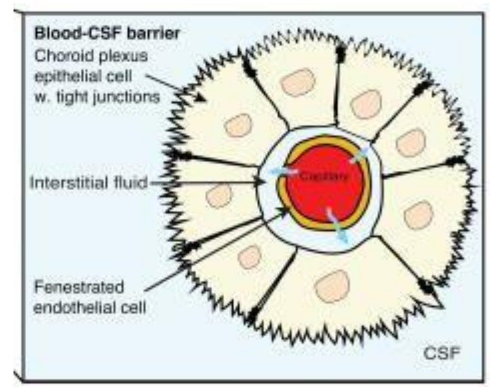

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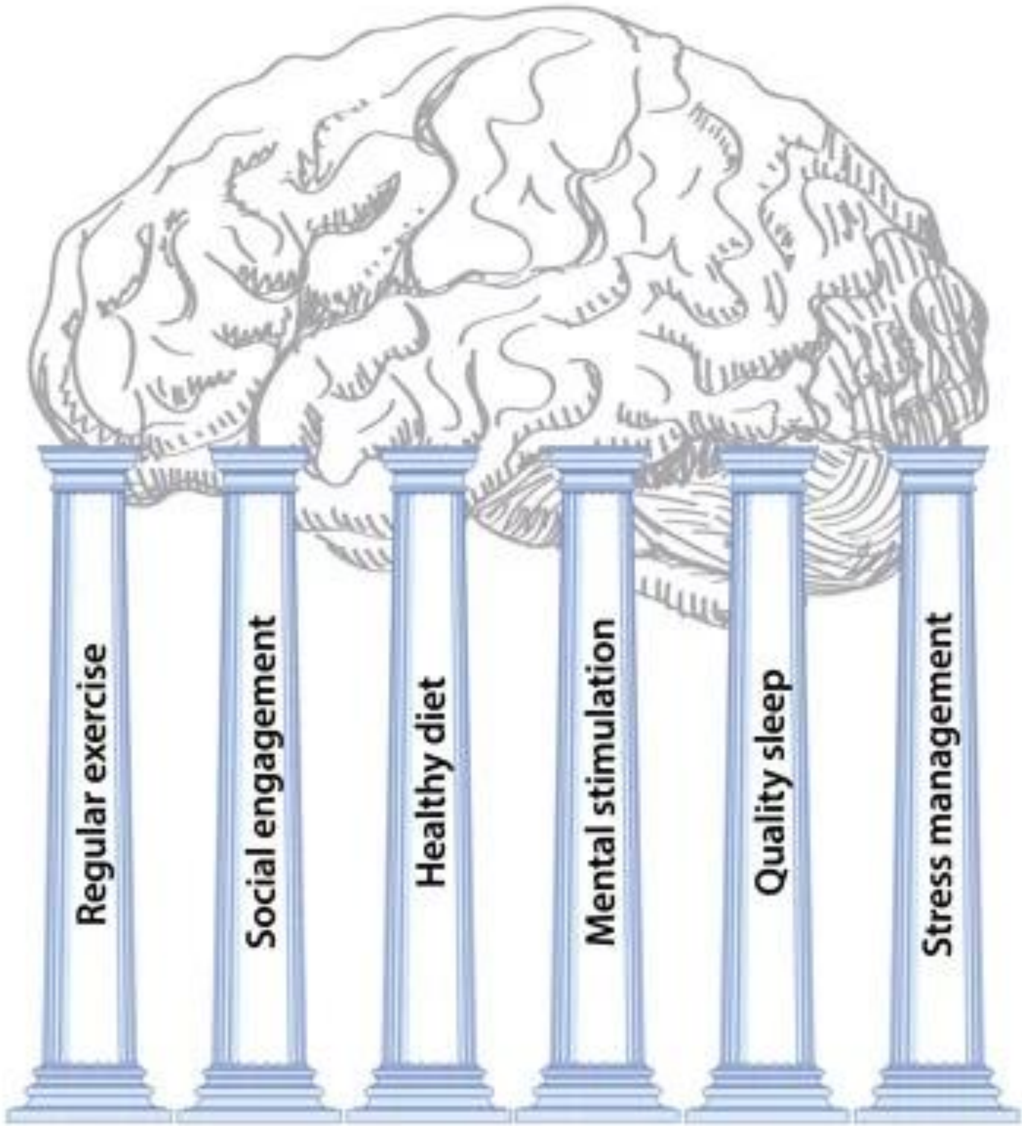
The 6 Pillars of Alzheimer's Prevention



СПАСИБО ЗА ВНИМАНИЕ!