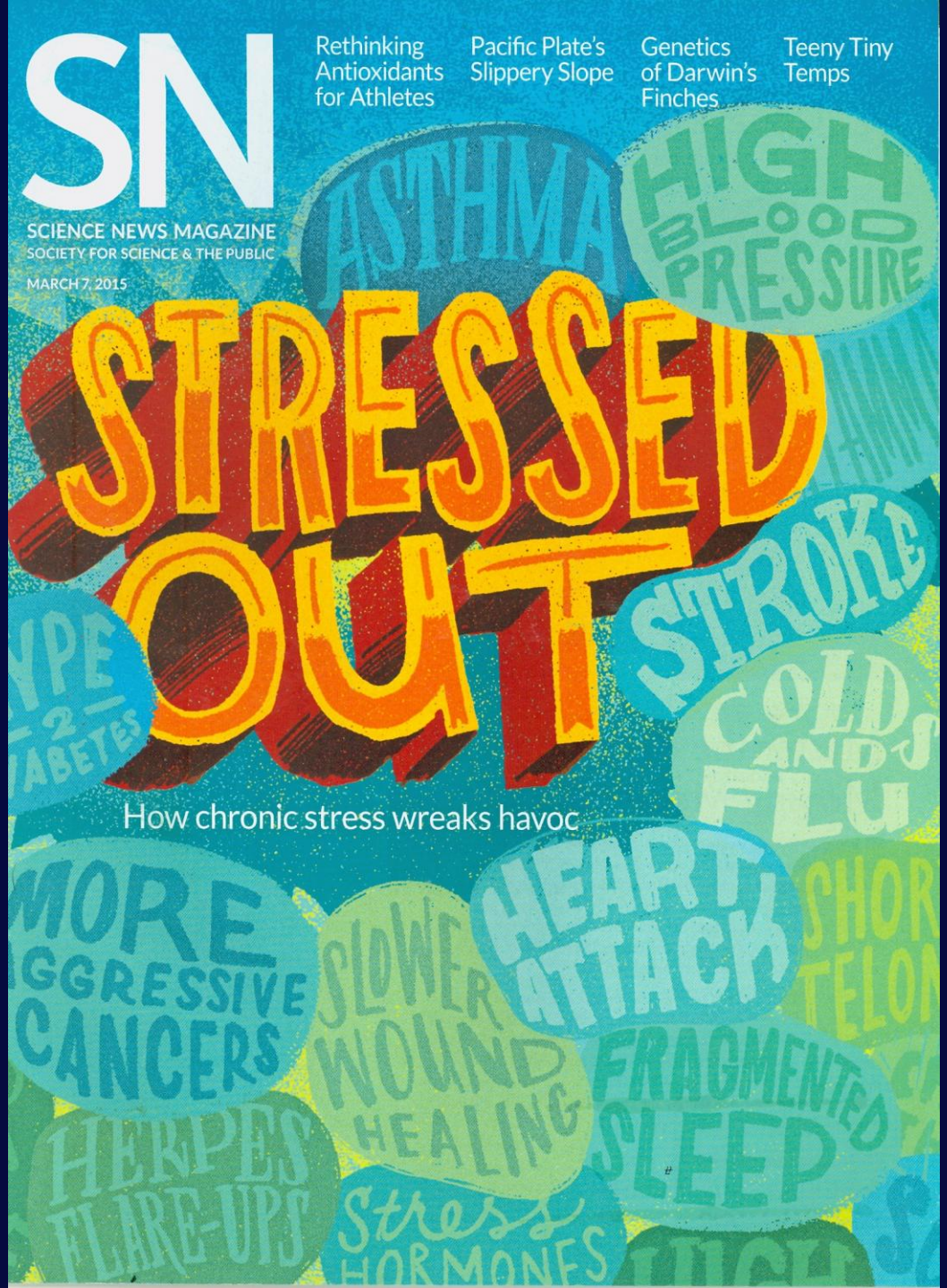
Stress and Examinations in Secondary and Tertiary Education

George P. Chrousos, MD, MACP, MACE
Professor of Pediatrics and Endocrinology Emeritus,
National and Kapodistrian University of Athens,
Athens, Greece
Distinguished Investigator Emeritus, NICHD, NIH
Bethesda MD, USA
(No disclosures)

EXAMINATION STRESS *vs.* EXAMINATION SUFFERING

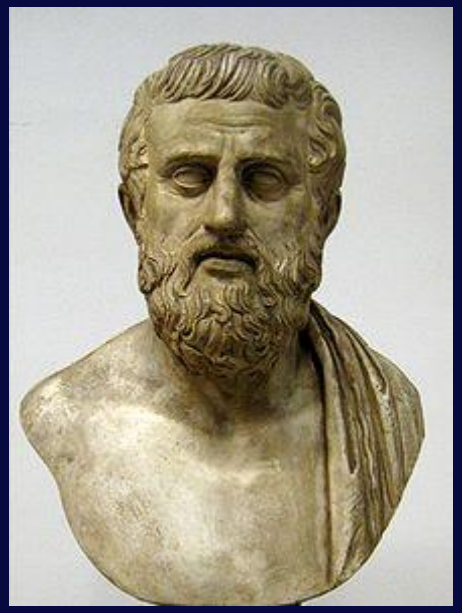

SN
SCIENCE NEWS MAGAZINE
SOCIETY FOR SCIENCE & THE PUBLIC
MARCH 7, 2015
Rethinking Antioxidants for Athletes
Pacific Plate's Slippery Slope
Genetics of Darwin's Finches
Teeny Tiny Temps
ASTHMA
HIGH BLOOD PRESSURE
STRESSED OUT
How chronic stress wreaks havoc
STROKE
COLDS AND FLU
HEART ATTACK
MORE AGGRESSIVE CANCERS
SLOWER WOUND HEALING
FRAGMENTED SLEEP
HERPES FLARE-UPS
Stress HORMONES

Physical and Emotional Stress

- **Complexity- Human Uniqueness**
- **Concepts of Homeostasis and Stress**
- **Stress Mechanisms**
- **Effects of Stress in Secondary and Tertiary Education**

“Πολλά τα δεινά κ’ουδέν ανθρώπου δεινότερον πέλλει….”

'There are many wonderful things and nothing is more wonderful than the human ...”



Σοφοκλής

Sophocles

496-406 BCE

HUMAN COMPLEXITY: POST(EPI)GENOMIC ERA

Human genome:

About 3+3 billion bases ("Non-junk" DNA 98 *vs.* 2 %
of retroviral origin 60%, 15-25K retrotransposons)
About 20 thousand protein-coding genes
About 22 thousand ncRNA-coding genes
About 200 thousand transcripts
(mRNA, ncRNA)
About 200-260 thousand proteins
Single nucleotide polymorphisms (snp's or snv's),
microsatellites or copy number variants : (0.9% difference)
About >25 million snp's (snv's), 1.5 million indels
About 20 million microsatellites
>5000 cnv's (many million bases)
> 100 k disease-related mutations
>60% of promoters have CpG islands, **>1 million reg sequences**
EPIGENETICS/EPIMUTATIONS

THE HUMAN BRAIN

~100 billion neurons ($100x10^{12}$) x >10.000 synapses per neuron = $>10^{18}$ synapses)

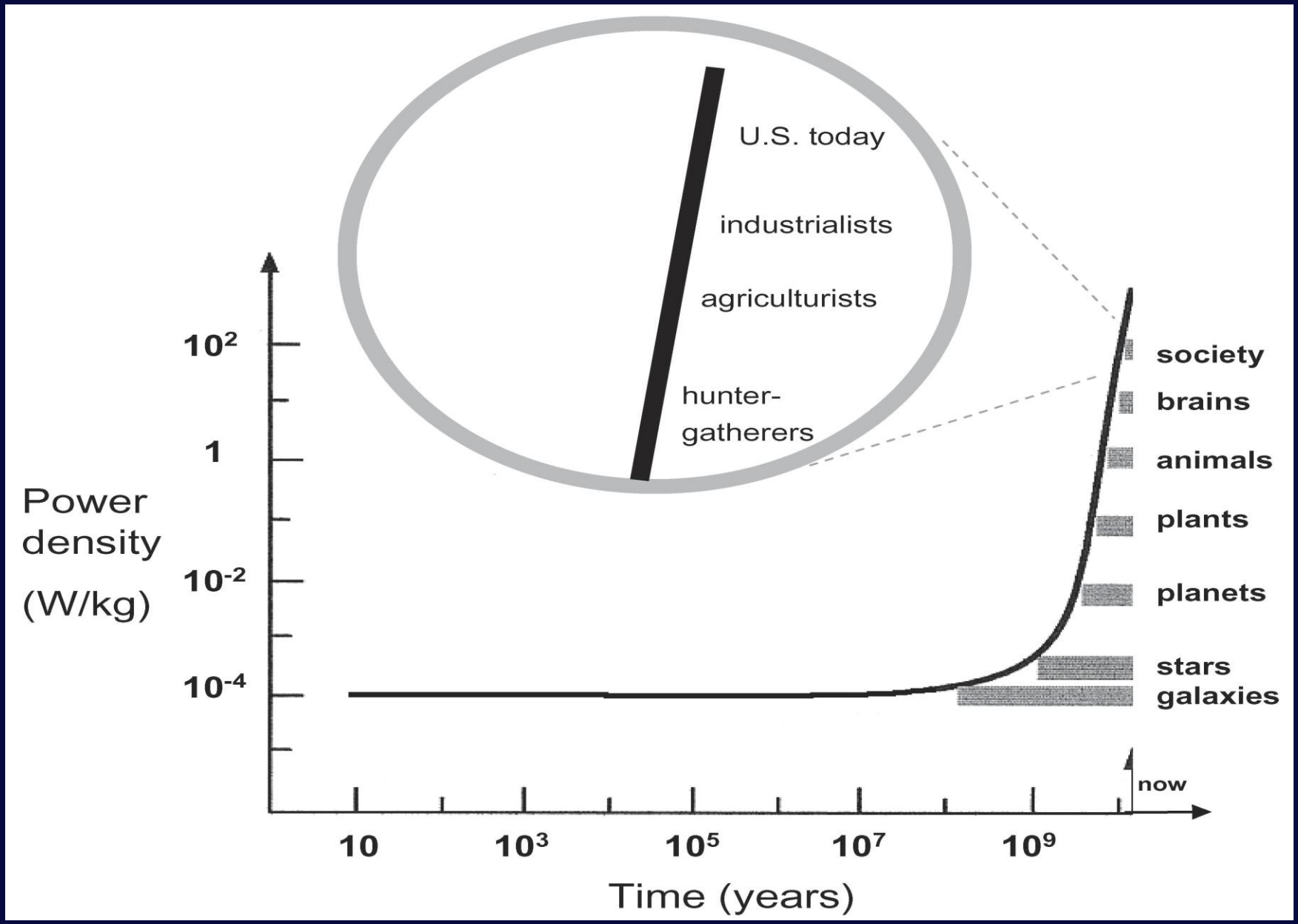
~ 100.000 km of fibers

~ 1 trillion or more glial cells

~ 1.25 terabytes

~ 15 Watt lamp (2% of BW uses 20% energy)

Plasticity



Chaisson E, New Scientist 2009

Man and his/her civilization are of unique complexity in the known universe.

Complex systems are in a dynamic disequilibrium that requires energy to be sustained.

Complex systems have organizing principles and follow mathematic rules.

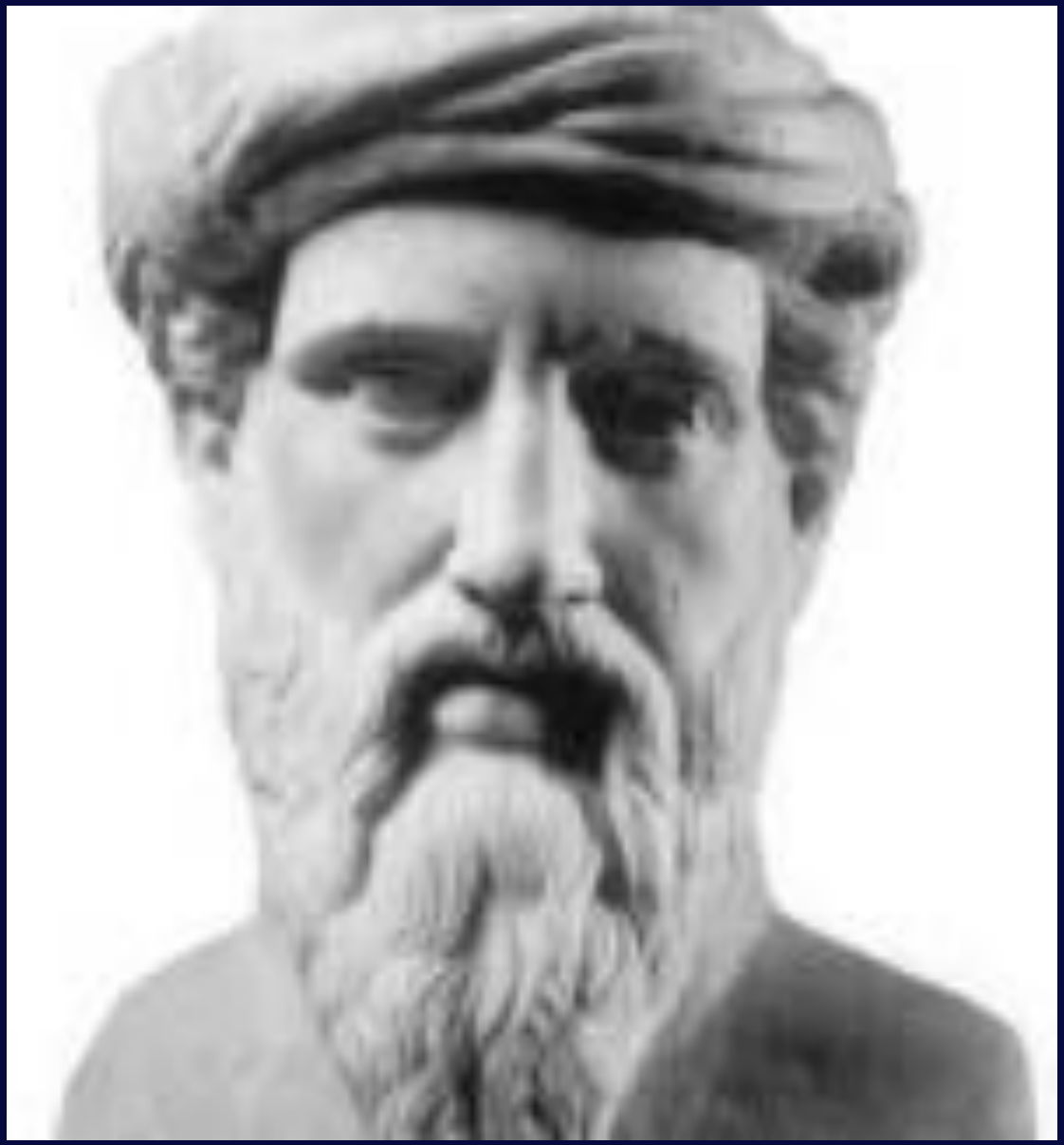
SYSTEMS BIOLOGY, SYSTEMS MEDICINE
NARRATIVE AND PRECISION MEDICINE
P4 MEDICINE (predictive, personalized, preventive, participatory)

Physical and Emotional Stress

- Complexity- Human Uniqueness
- Concepts of Homeostasis and Stress
- Stress Mechanisms

Effects of Stress in Secondary and Tertiary Education

G.P. Chrousos



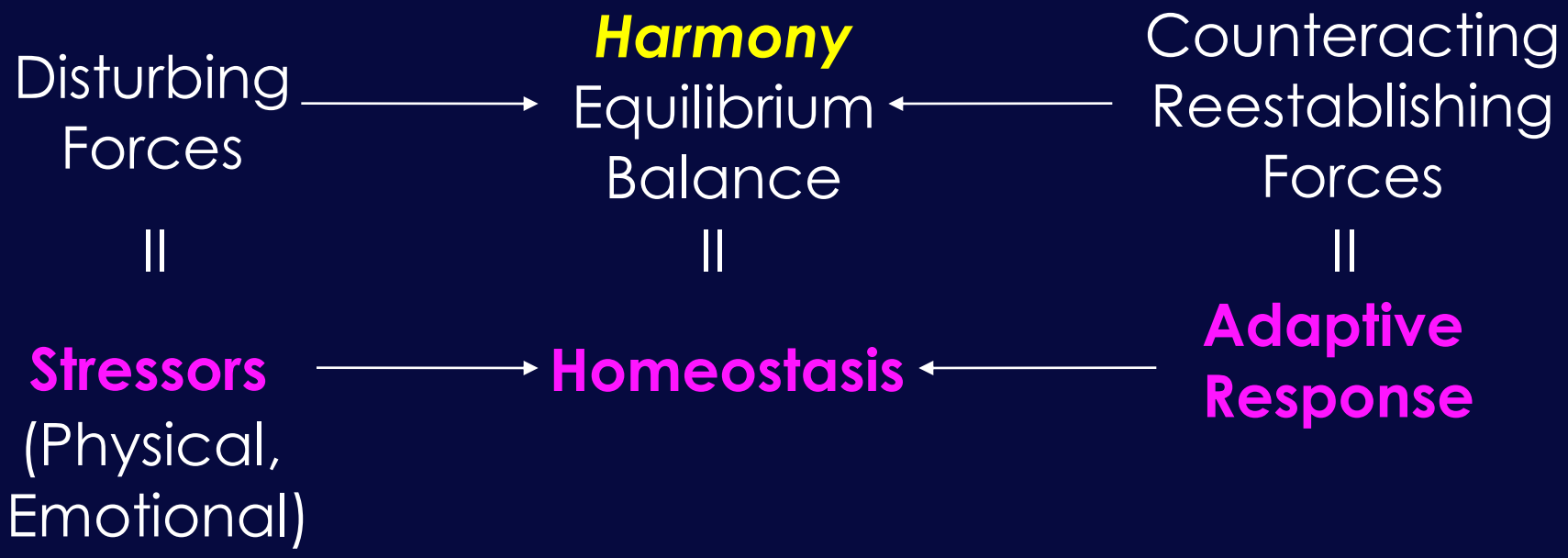
Pythagoras. 6th cent BCE

“Αρμονία δ’εστί πολυμιγέων ένωσις και δίχα φρονεόντων συμφρόνησις”

“Harmony is the union of multiple mixed components and the agreement of the opposites”

Αλκμαίων Κροτωνιάτης
Almaeon of Croton

Complex Systems Theory



Pythagoras= *Harmony*
Alcmaeon=*Iso-nomia*
Epicurus= Eustatheia
Walter Cannon= Homeostasis

Επικούρεια Ευστάθεια
Epicurean "Eustatheia"

"ευστάθεια" : "σαρκός και ψυχής ευσταθές κατάστημα"

eustatheia: "the balanced state of the flesh and the soul"

Stress is the State of Threatened (or Perceived as Threatened) Homeostasis

«Αρχή επιστήμης η των ονομάτων επίσκεψις»

Αντισθένης

“The beginning of science is the visit of names ”

Antisthenes

STRESS ETYMOLOGY

Indoeuropean root:

Gk: *Strangaleuin* = to strangle, also *Catastrophe,* and *Strabismus*

Lt: *Stringere* = to draw tight, to press

STRESS CONCEPTS

Pythagoras	**The *Harmony* of the *Cosmos***
(580-489 BC)	
Alkmaion	**The intellect is based in the brain**
(c. 500 BC)	**Health is the equipose of opposing forces: *«Isonomia»***
Empedocles	Matter consists of essential elements and qualities in
(500-430 BC)	opposition or alliance to one another
Hippocrates	A harmonious balance of the elements and qualities of life
(460-375 BC)	is health-Dysharmony is disease
	«***Nouson physeis iatroi =Vis medicatrix naturae»***
Aristotle	Unity of body and mind, "***Eudaimonia"*** tranquil, non sensual pleasure)
Stoics/Sceptics	***Ataraxia*** (imperturbability of mind, equanimity), mind controls affect
Epicurus	***Ataraxia*** but also ***Aponia*** (no pain) and "***Hedone"***
(341-270 BC)	(=***Eudaimonia), «Eustatheia» = Good balance, Carpe diem= seize the day***
Thomas Sydenham	Symptoms and signs of a disease arise also from the reaction of the
(AD 1624-1689	patient's system
Claude Bernard	The "***milieu interieur"***
(1813-1878)	
Walter Cannon	***Homeostasis/Stress***
(1871-1945)	Bodily responses to emotions
	Fight or flight (and freeze) reactions
Hans Selye	The **general adaptation syndrome** (**the stress syndrome**)
(1907-1982)	***Diseases of adaptation***, ***Distress*** *vs*. ***Eustress***

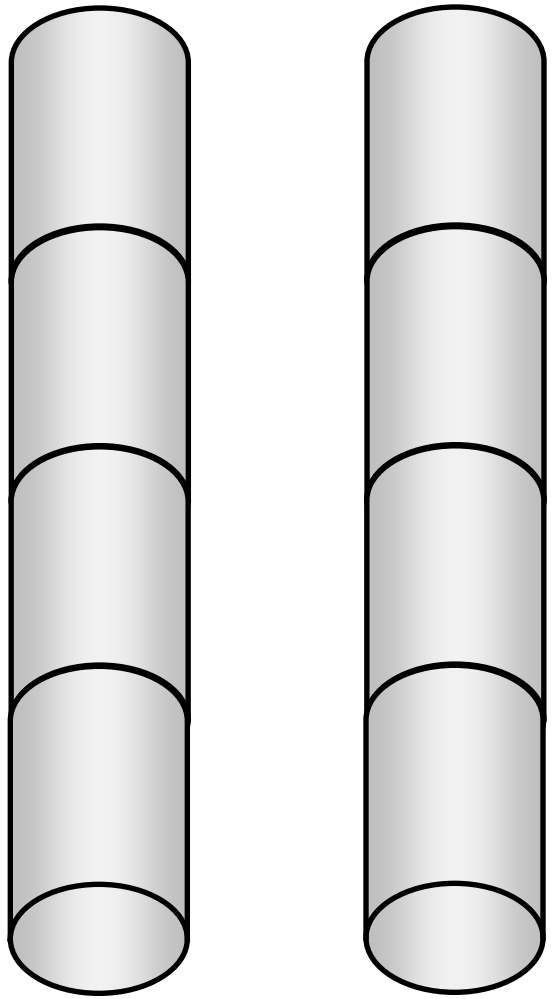
Behavioral Adaptive Responses

Fight	o	o	Anger
Flight	o	o	Fear
Freezing	o	o	Depression
Predation	o	o	No emotion

PAG

Active Coping
(hypertension and tachycardia)

Passive Coping
(quiescence, hypotension and bradycardia)



Fight
Anger

Flight
Fear

Freeze
Shutdown

No Emotion

Predation

Evolutionary and Developmental Stressors

- Starvation
- Dehydration/hemorrhage (gastroenteritis, trauma)
- Injurious agents (infections, toxic substances)
- Adversaries (anticipation, minimization of exposure)
- Tissue injury
- Social disruption

Humans as Complex Biological Systems

- **Organism**
- **Society**

Con(Re)sonance (*"mirror" and "spindle"* or von Economo neurons)
"Empathy/Emotional Epidemiology"

- Oxytocin,
- Prolactin,
- Opioid peptides
- Endocanna-binoids
- Serotonin
- Dopamine

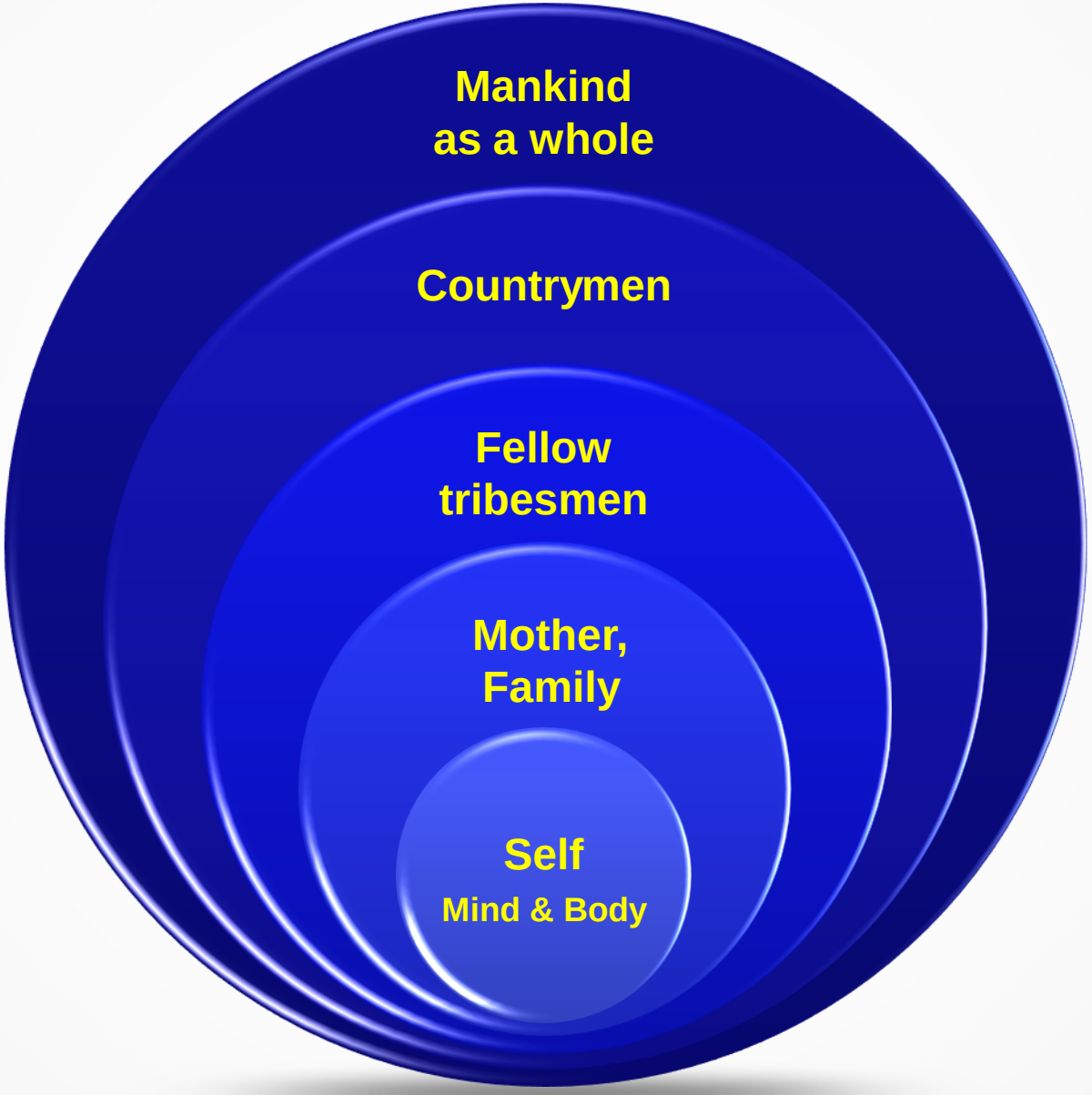
- Empathy,
- Pro-sociality,
- Moral law
- Justice

Ethical engagement

“Aid to others in need would never be internalized as a duty without the fellow-feeling that drives people to take an interest in one another. **Moral sentiments came first; moral principles second.**”

-- Frans de Waal, 1996, p. 87. Cf. Mengzi (Mencius), Hume, Adam Smith, and HH the Dalai Lama.

The cycles of Hierocles



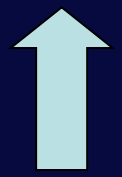
«Εκ του εισοράν γίγνετ' ανθρώποις το εράν»

"Through empathy is love generated in Man "

Ευριπίδης, Euripides

"CRITICAL" PERIODS OF LIFE

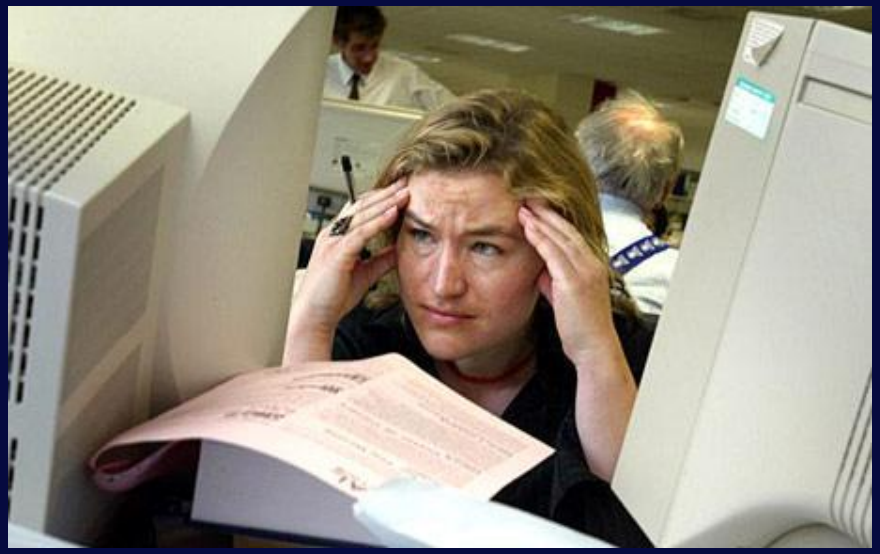
Prenatal, Early Childhood, Puberty, Youth
(Human brain ontogeny complete at 25-27 y)



"Organizational" Effects of Hormones, Epigenetics, "Predictive programming"

(CRH, glucocorticoids, sex steroids, cytokines)

Acute *vs*. Chronic Stress



Human Stressors

Daily hassles

Life transitions: Natural and unnatural catastrophies

Starvation, Excessive nutrition, Deficient exercise, Excessive exercise, Obesity

Socioeconomic status, Minority status, Loneliness (Dignity)

School Stress, Secondary and Tertiary Education Examinations (Dignity)

Work stress (Effort Reward Imbalance, ERI), Unemployment (Dignity)

Job loss, Downsizing, Loss of control (Dignity)

Social Inequality (Dignity)

Bereavement

Caretaking/ Pathologic empathy *vs.* principled compassion

Addictions/ Toxic substances

Chronic diseases, Treatments

Inflammations (Traumatic, Infectious, Autoimmune, Allergic, Parainflammation)

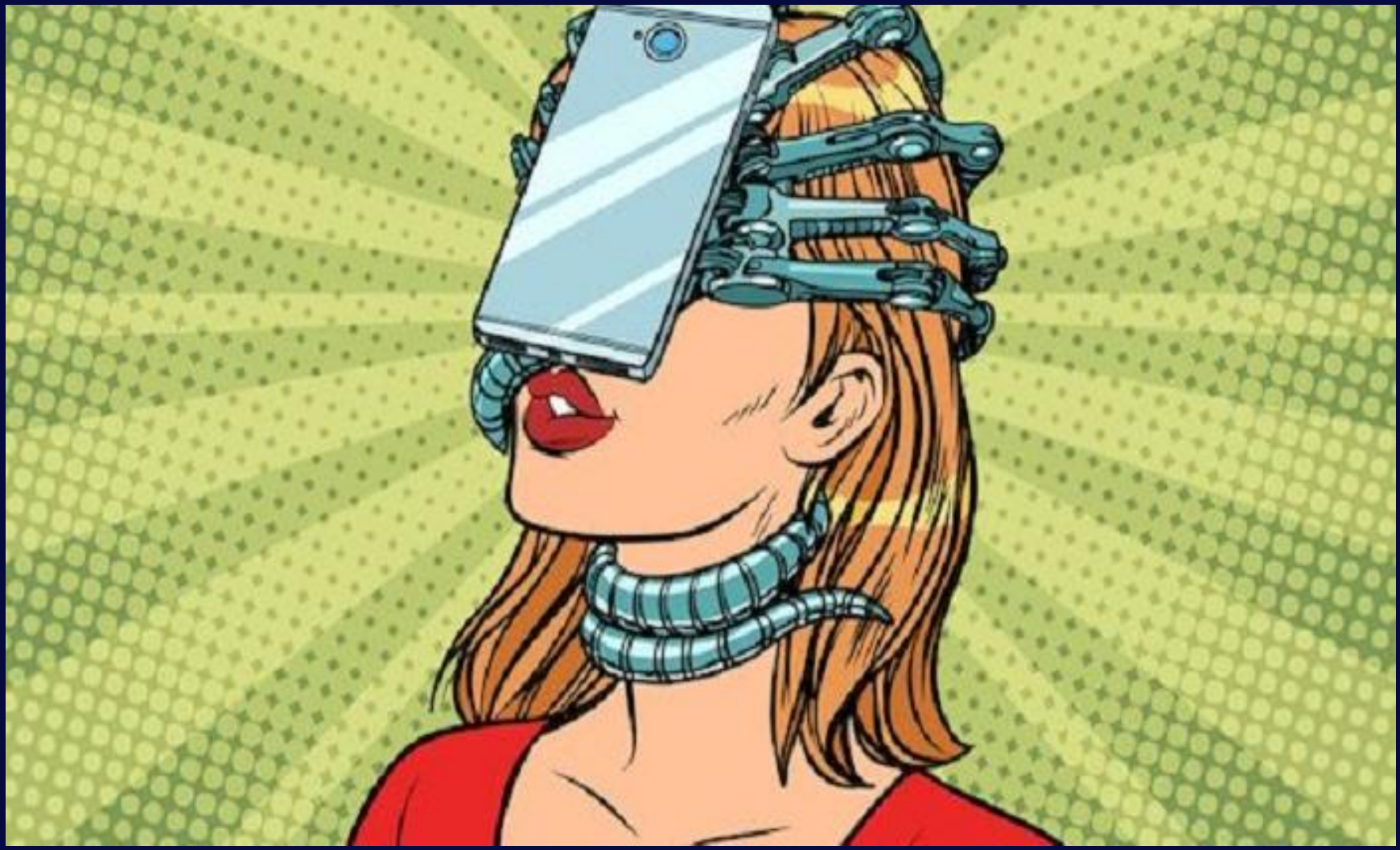
Anxiety, Depression, Personality disorder, **Neurodevelopmental disorders**

Sleep deficiency, Sleep excess

Uncoupling of the Clock: Jet-lag, **"Social-jetlag"**

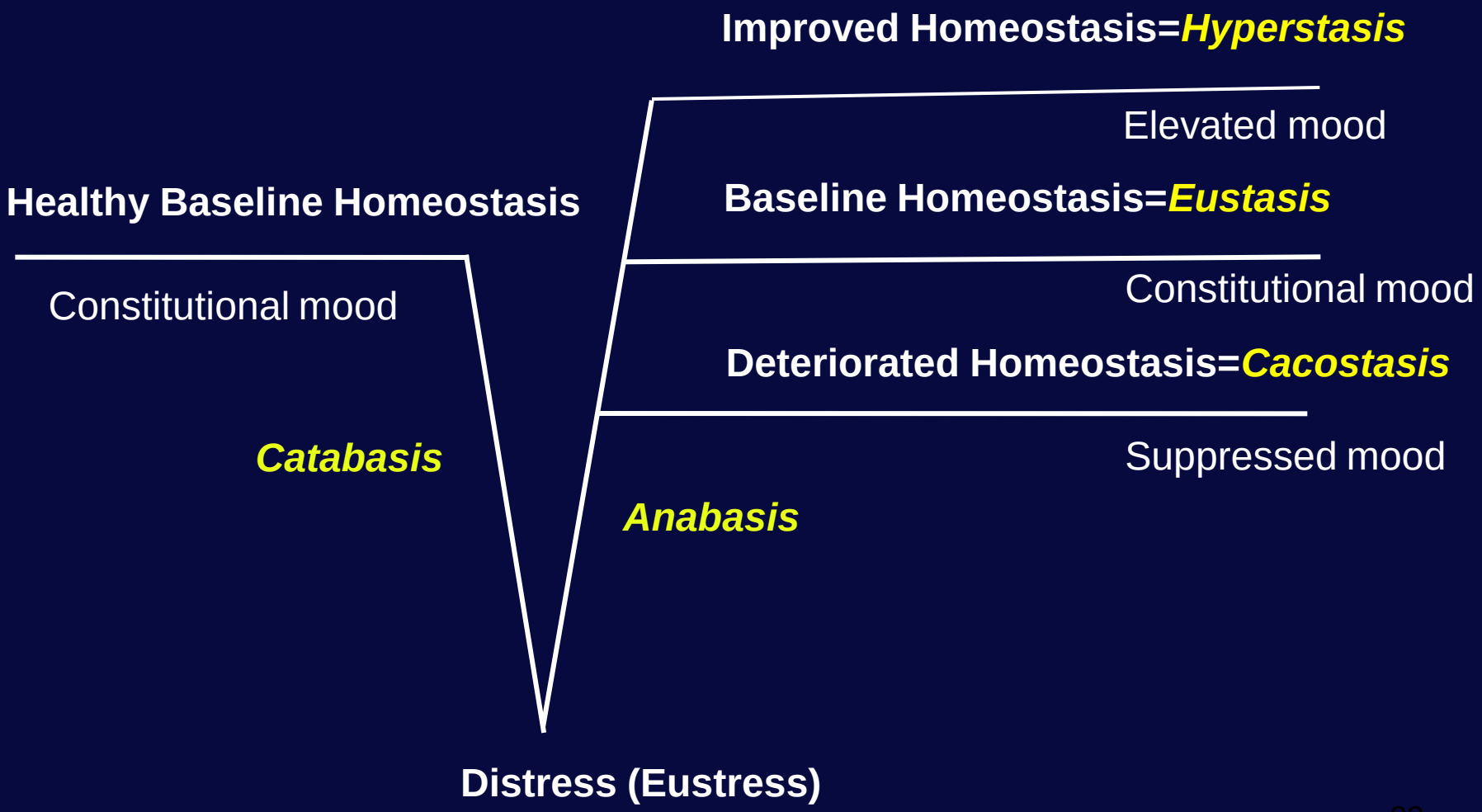
Behavioral addictions: "Meta-modern stress" , "Cyborg stress"

“Cyborg Stress”



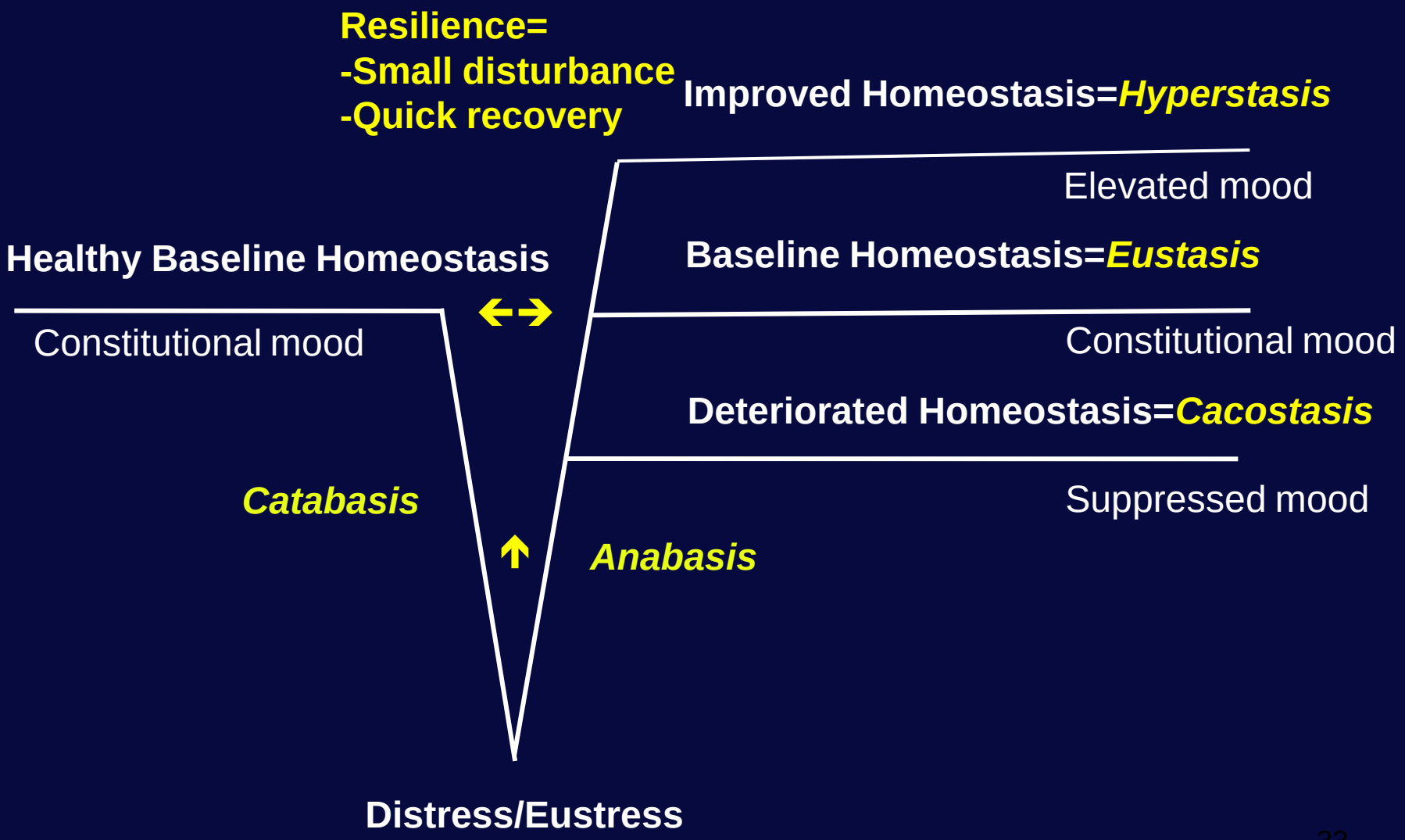
FRESH
FOODS

Homeostasis over Time



G.P. Chrousos

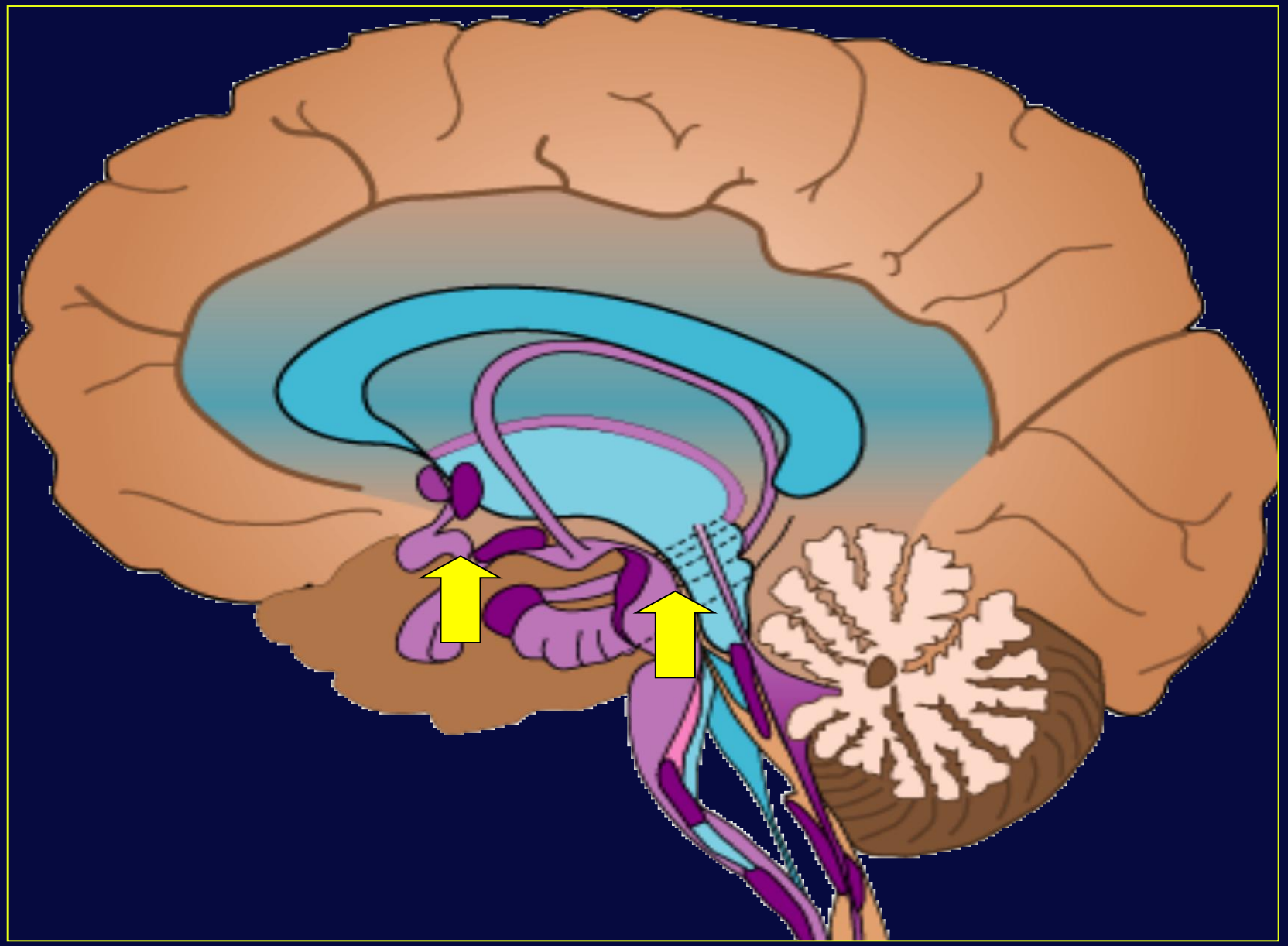
Homeostasis over Time



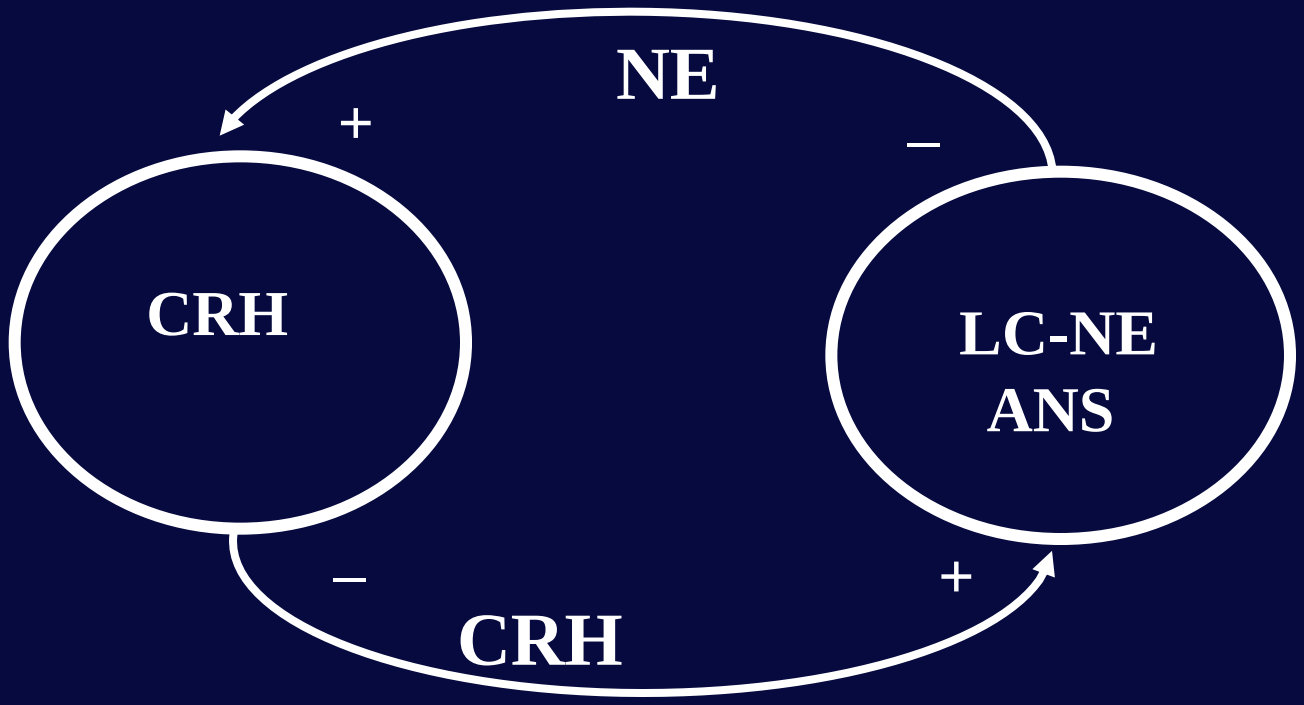
G.P. Chrousos

Physical and Emotional Stress

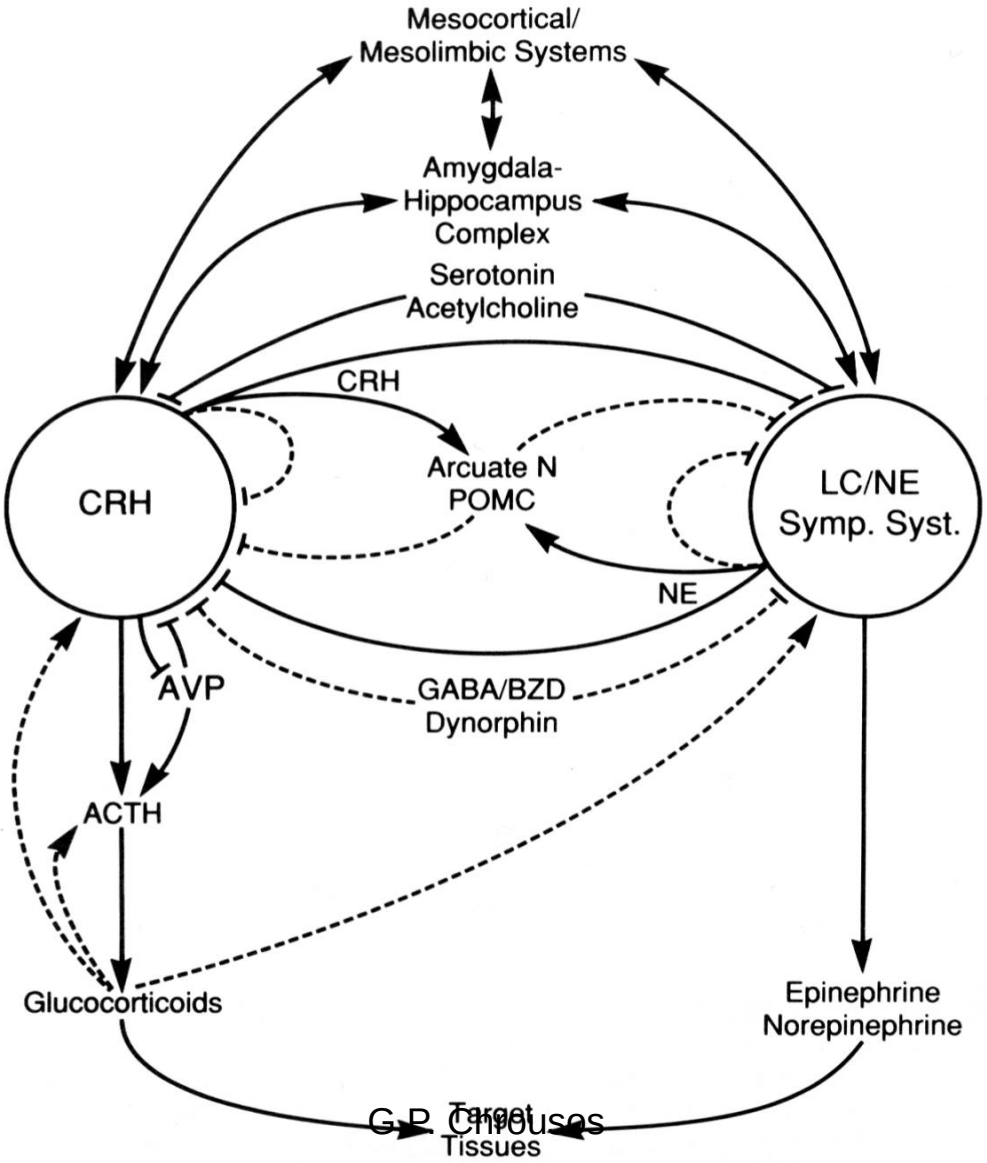
- Complexity- Human Uniqueness
- Concepts of Homeostasis and Stress
- Stress Mechanisms
- Effects of Stress in Secondary and Tertiary Education



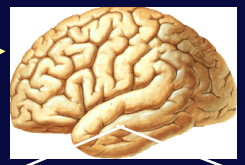
Stress System



Stress System



Chrousos
JAMA 1992



STRESS SYSTEM
Amygdala CRH

HIPPOCAMPUS

CRH/AVP

LC/NE

ACTH

F

NE/E
iCRH
+

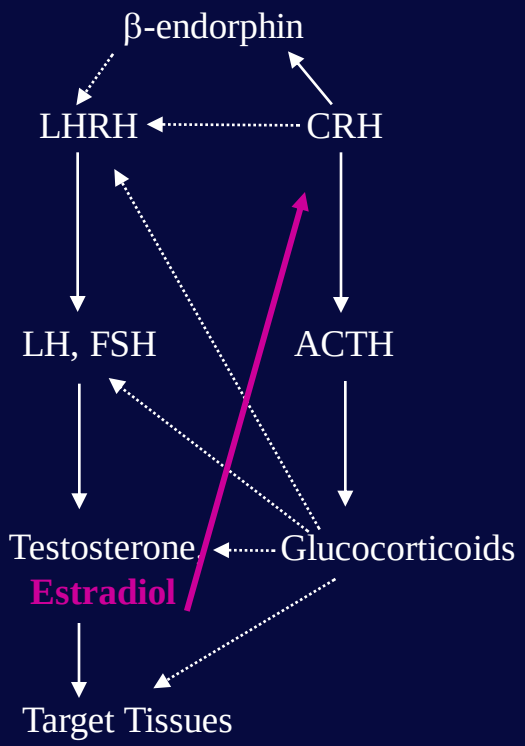
IL-6

GH/IGF-1
LH/T
TSH/T_3

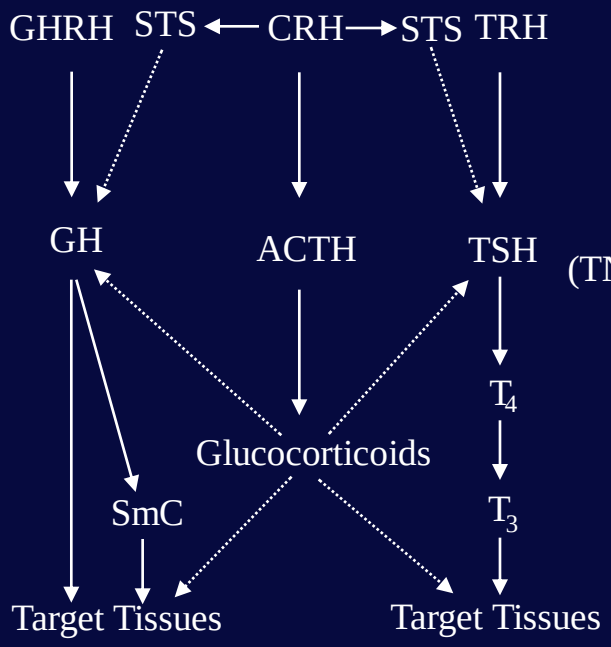
Inflammation

G.P. Chrousos

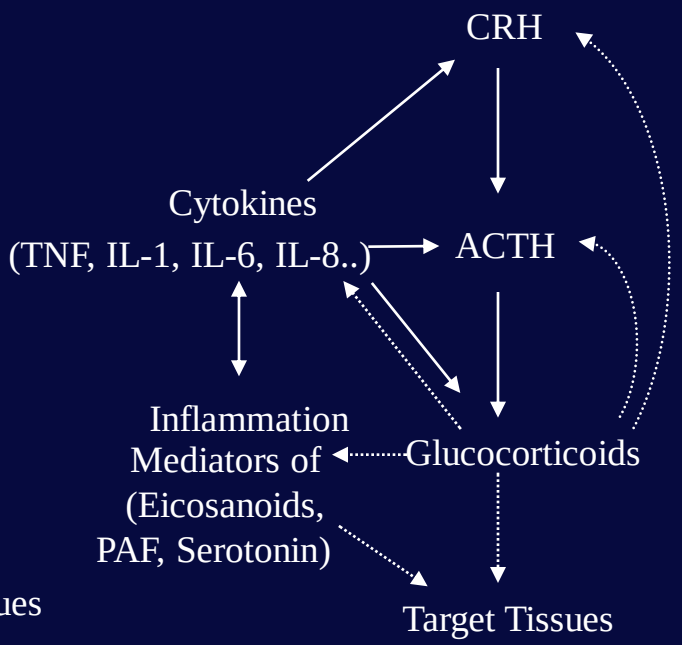
Reproduction



Growth and Thyroid Function



Immune Function



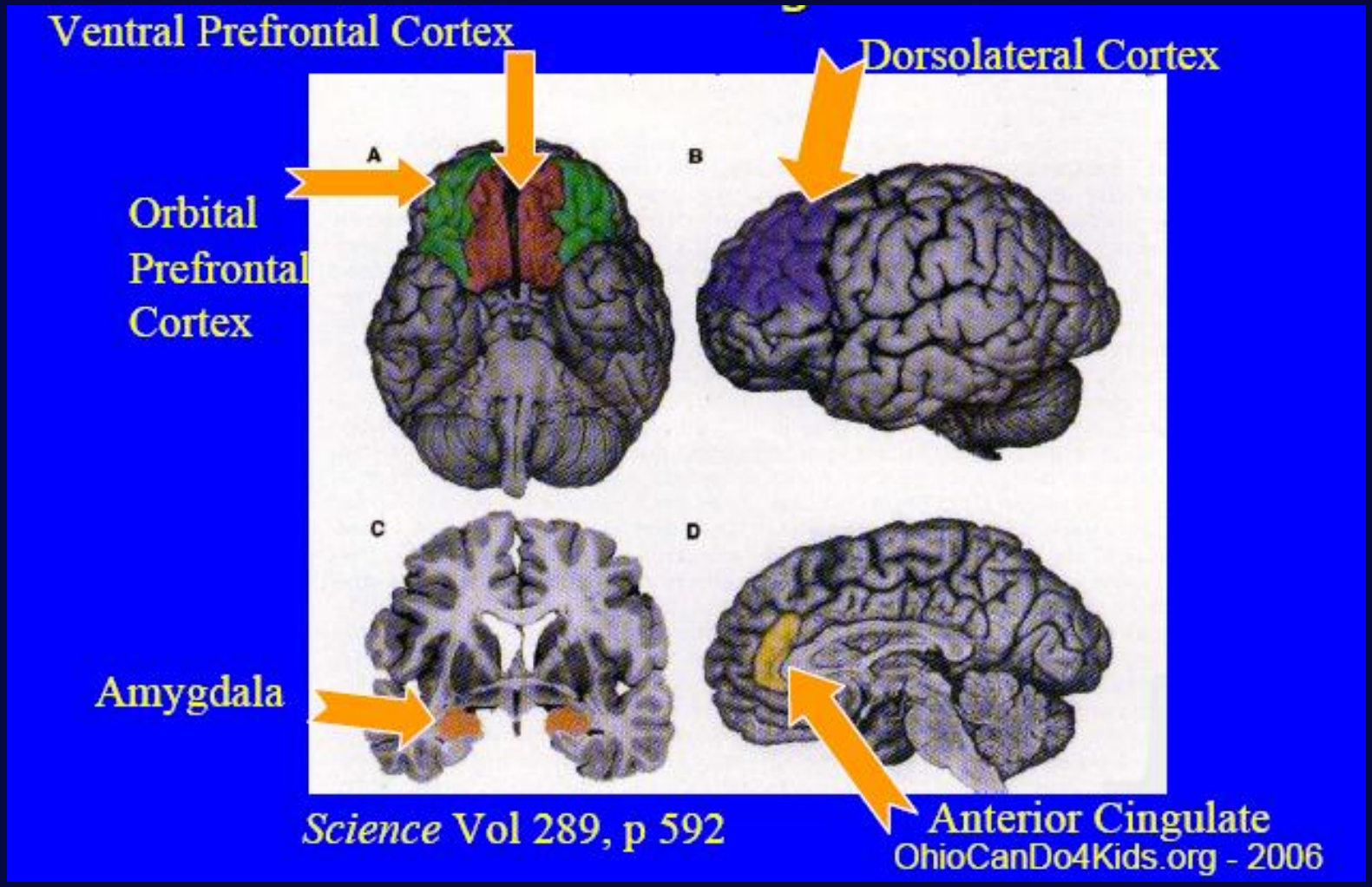
HYPOGONADISM

POOR GROWTH

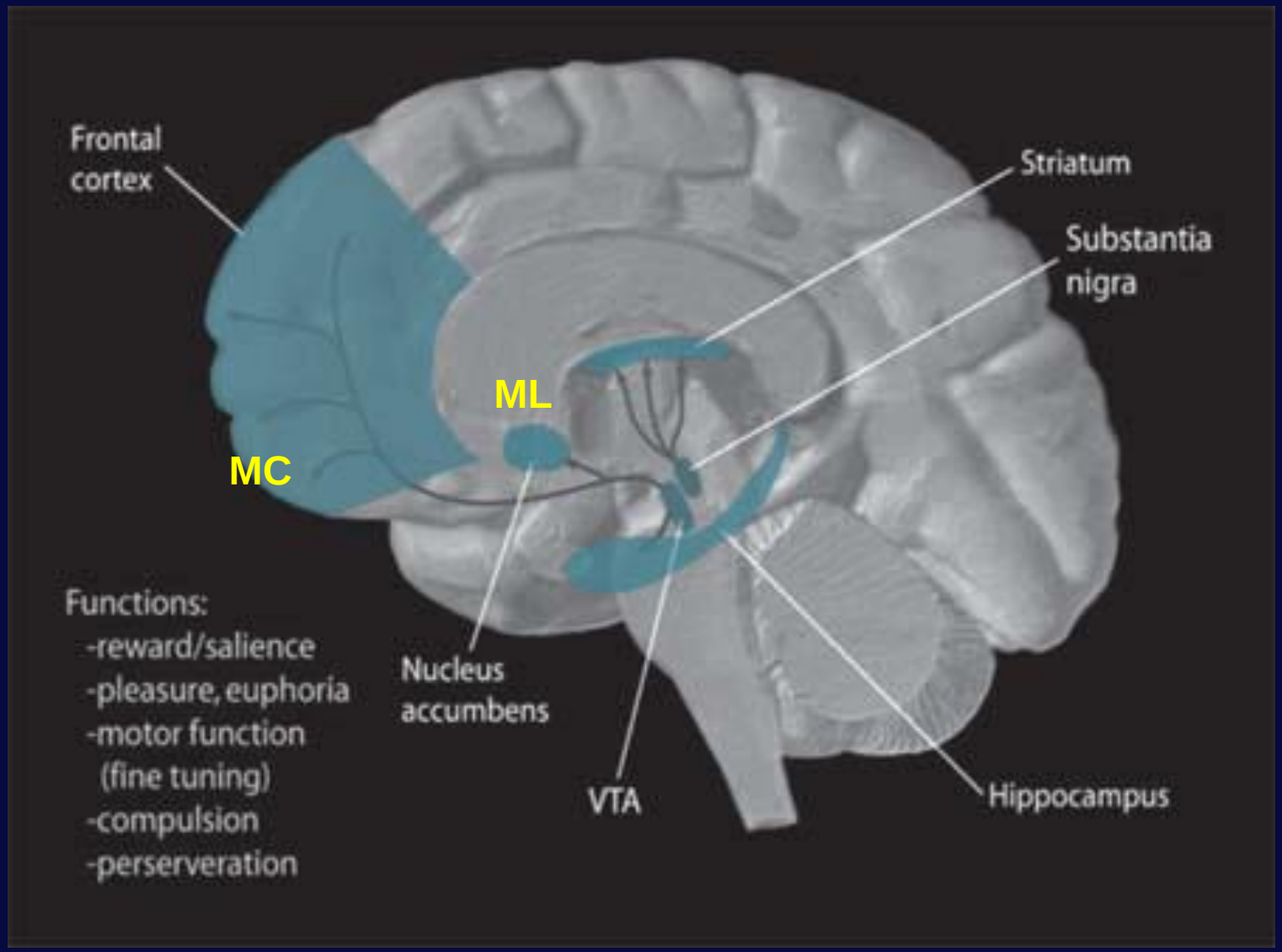
“EUTHYROID SICK”

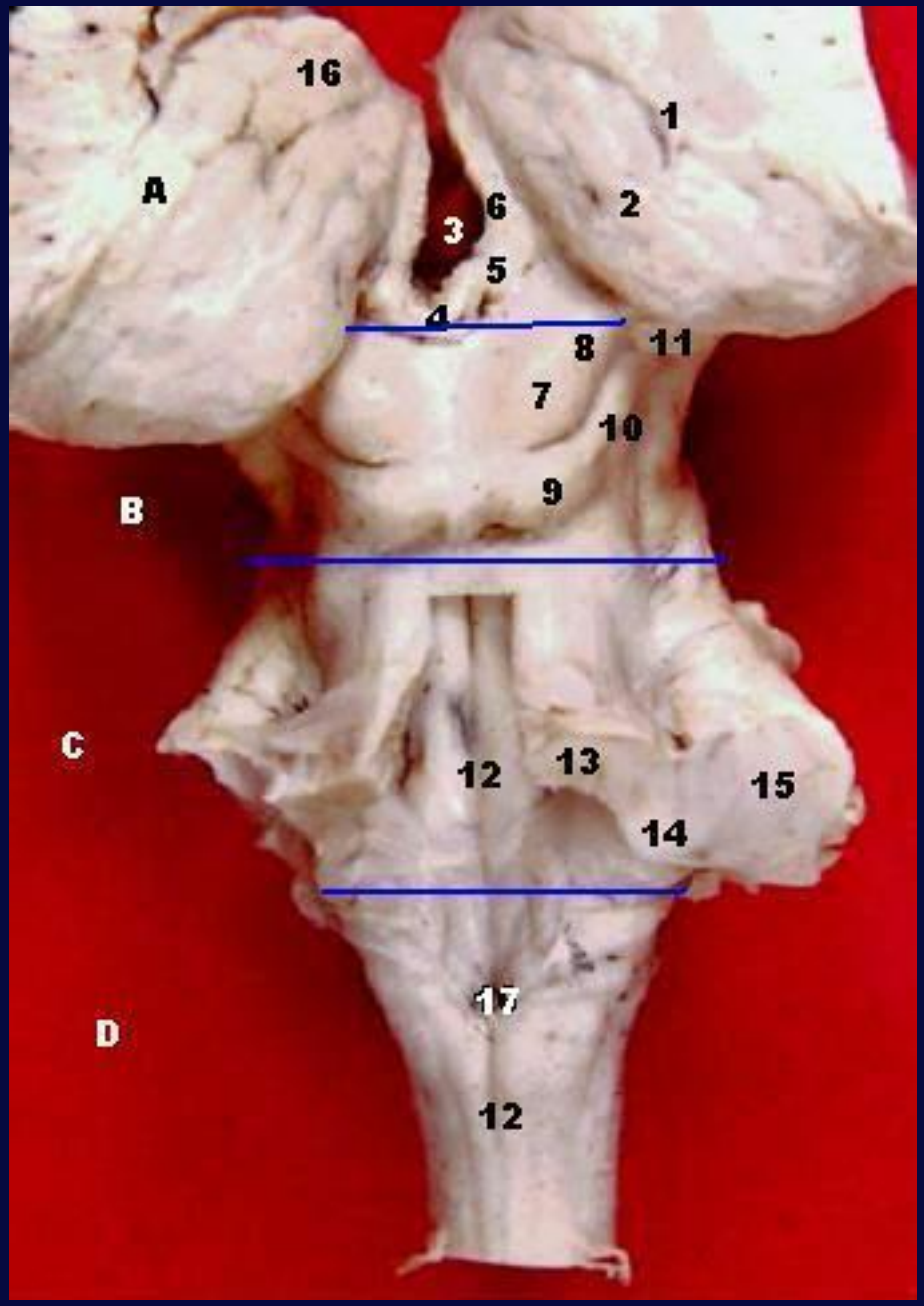
ANTI-INFLAMMATION,
Th1 to TH2 SHIFT
“PARAINFLAMATION”

Structures related to emotional regulation

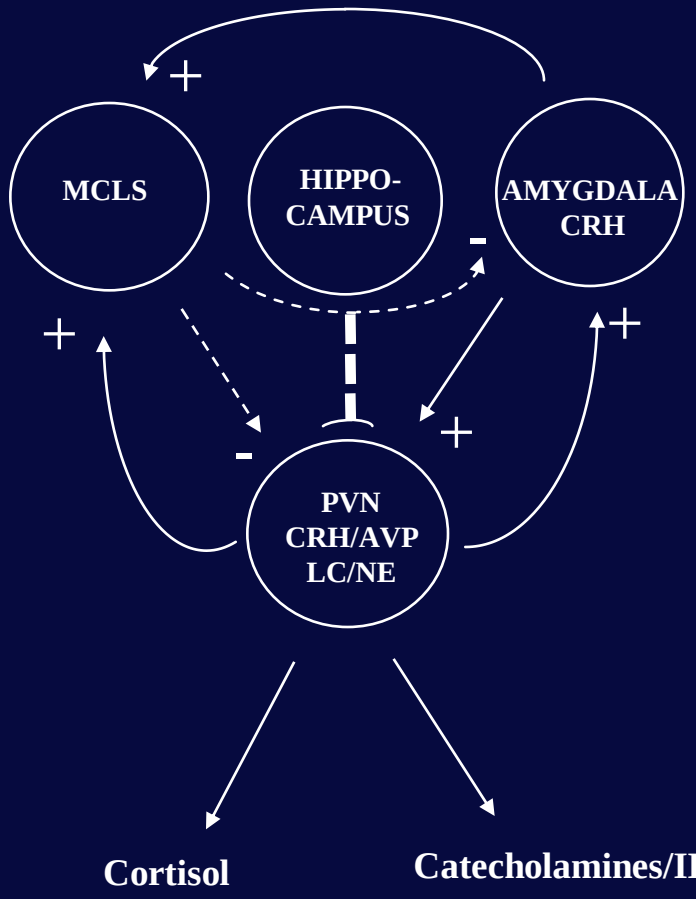


The Reward System




16
1
A
6
2
3
5
4
8
11
7
10
9
B
C
12
13
15
14
17
D
12

Acute Stress

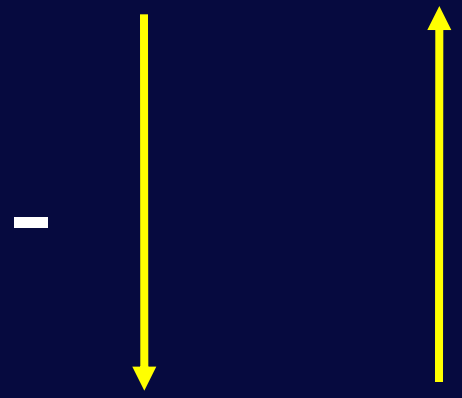


Behavioral adaptation

Physical adaptation

G.P. Chrousos

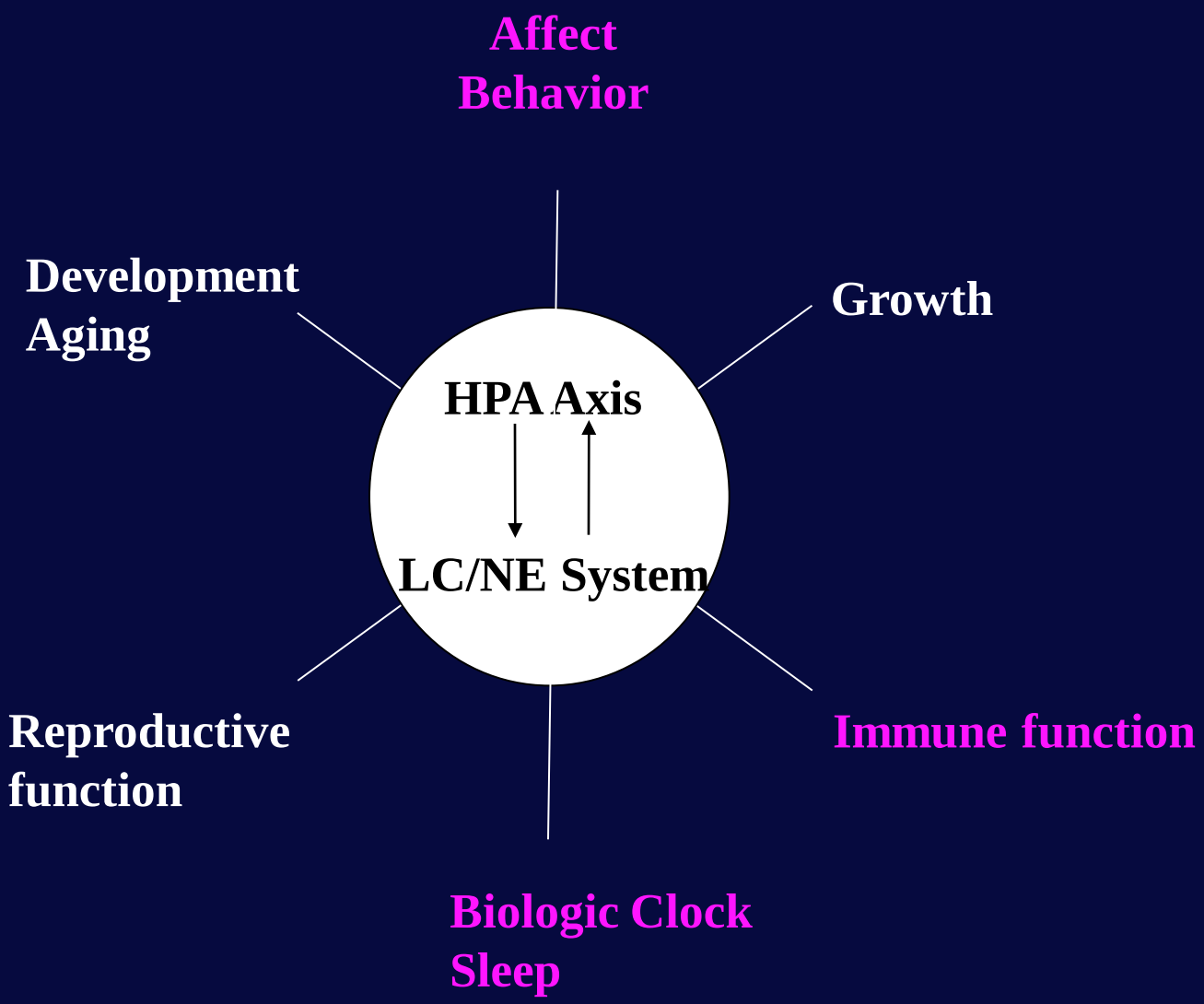
MC/ML System Tone



+ acute

- chronic

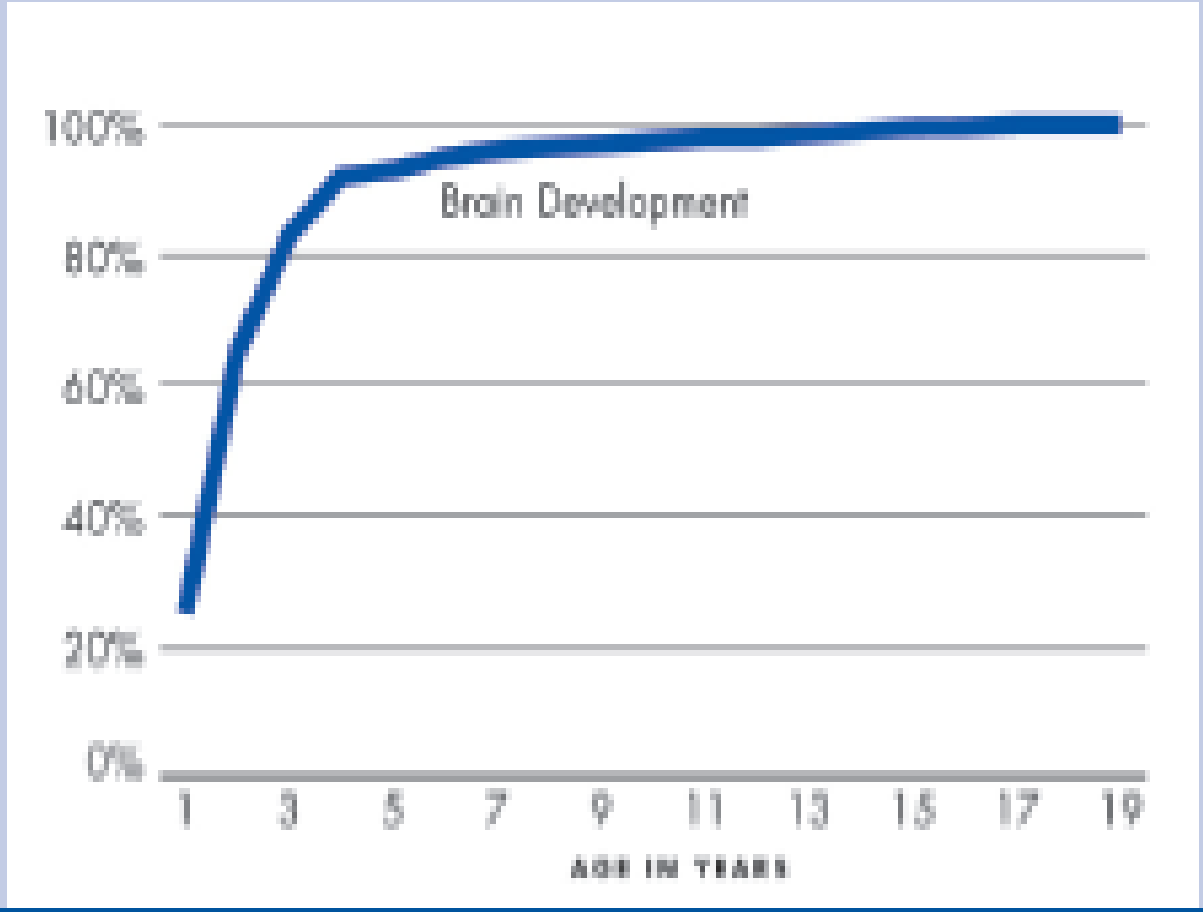
Stress System Tone


Affect
Behavior
Development
Aging
Growth
HPA Axis
LC/NE System
Reproductive
function
Immune function
Biologic Clock
Sleep

Physical and Emotional Stress

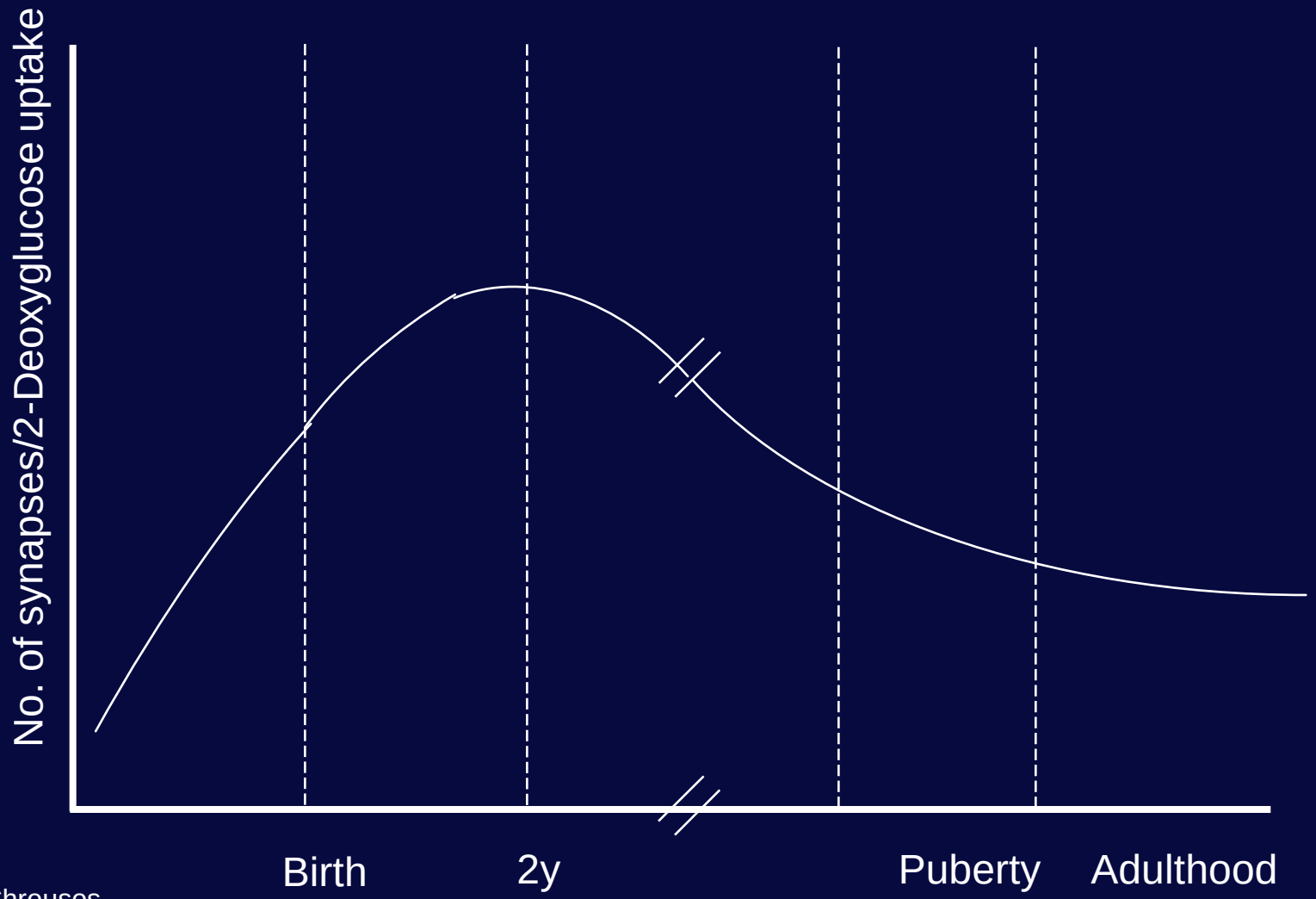
- **Timing** (Critical periods=prenatal, first 5 y and adolescence)
- **Acuity**
- **Chronicity**

Brain Growth and Child Age



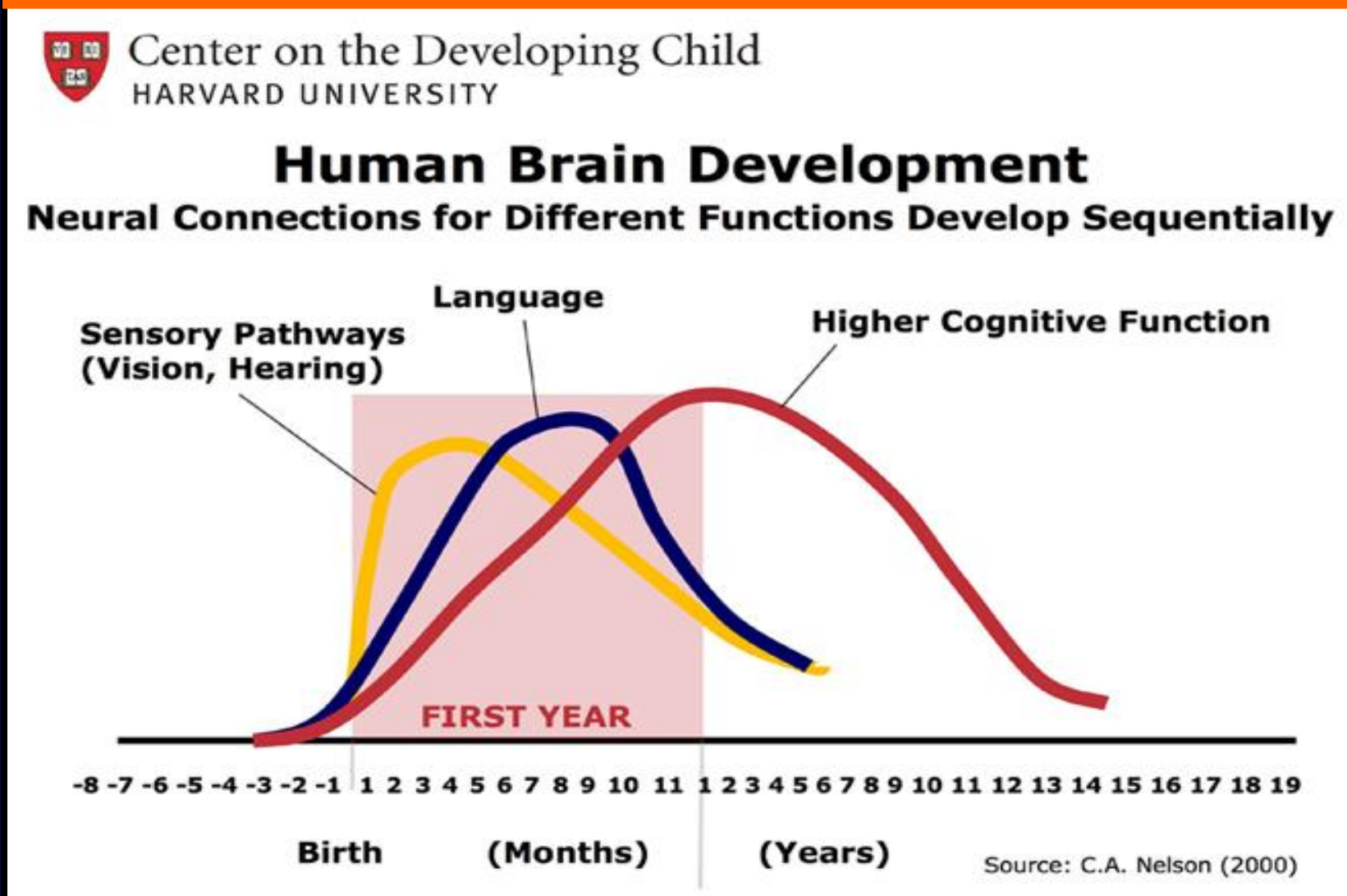
Source: RAND Corporation

THE DEVELOPING BRAIN



G.P. Chrousos

Cognitive and Language Development



Prefrontal/Frontal Lobe "Higher Functions"

- Interpretation of the environment, social cues
- Problem solving
- Planning for the future
- Proper control of impulses (emotional auto-regulation)

IMMUNE STRESS: INFLAMMATORY (SICKNESS) SYNDROME

ANOREXIA/NAUSEA

FATIGUE AND/OR DEPRESSED AFFECT

SOMNOLENCE

HYPERALGESIA ± HEADACHE

ELEVATED TEMPERATURE/ FEVER

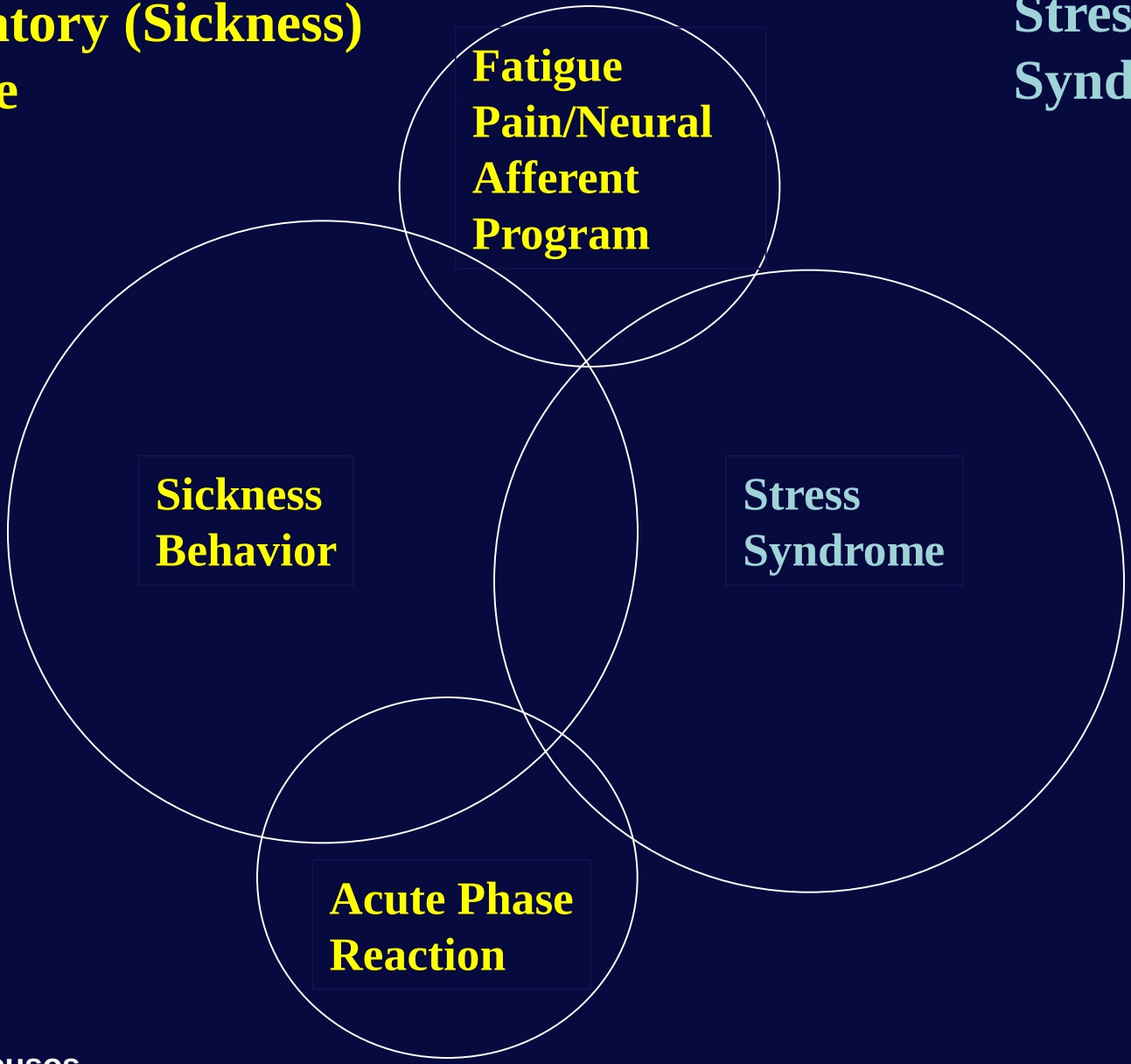
INCREASED METABOLIC RATE

MOLECULAR EFFECTORS

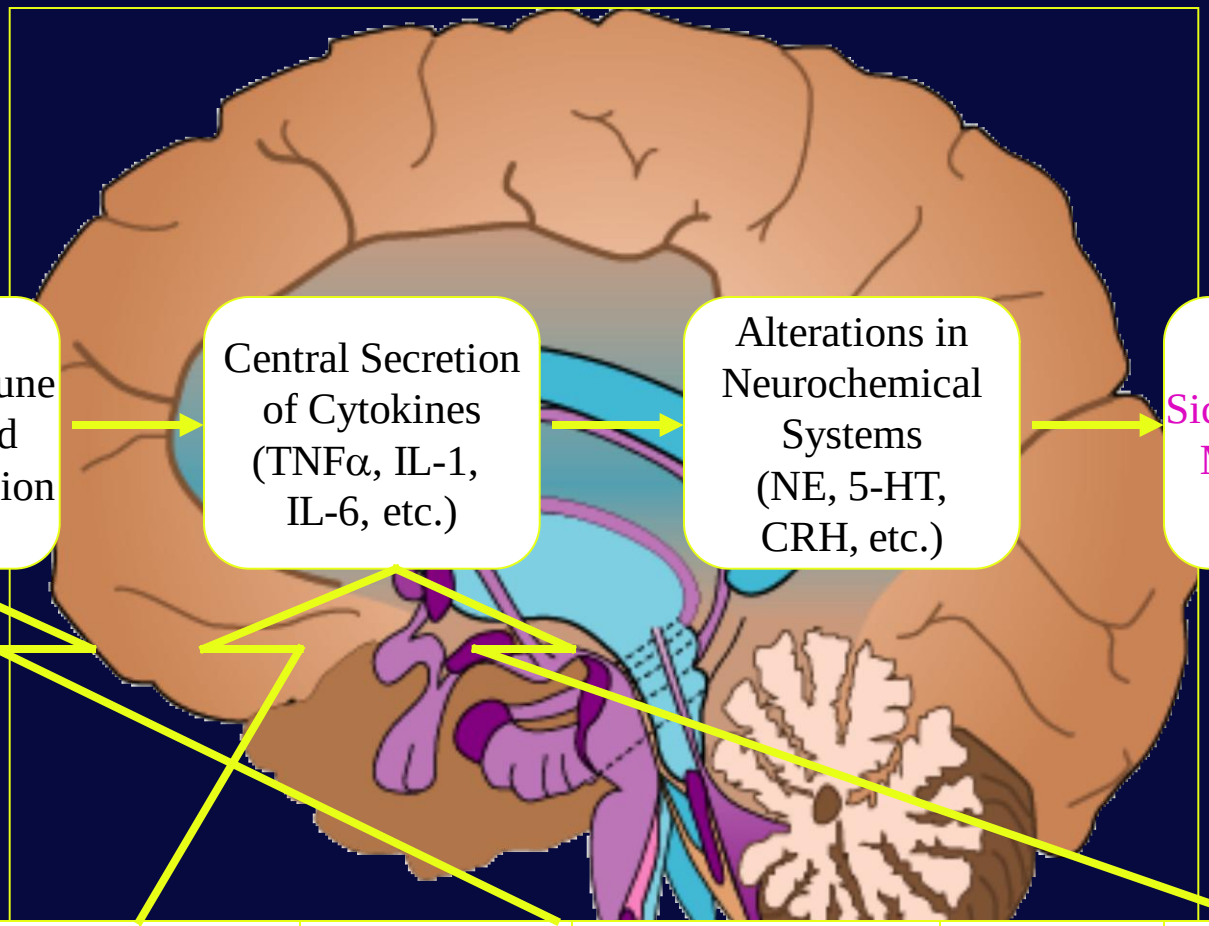
INFLAMMATORY CYTOKINES/MEDIATORS

Inflammatory (Sickness) Syndrome

Stress Syndrome



G.P. Chrousos



Peripheral Immune Activation and Cytokine Secretion

Central Secretion of Cytokines (TNFα, IL-1, IL-6, etc.)

Alterations in Neurochemical Systems (NE, 5-HT, CRH, etc.)

Stress +/-
Sickness Syndrome Manifestations

Peripheral Infections

Post Partum Period

Stress

Autoimmune Disease

Neurodegenerative Disease

Stroke, Trauma

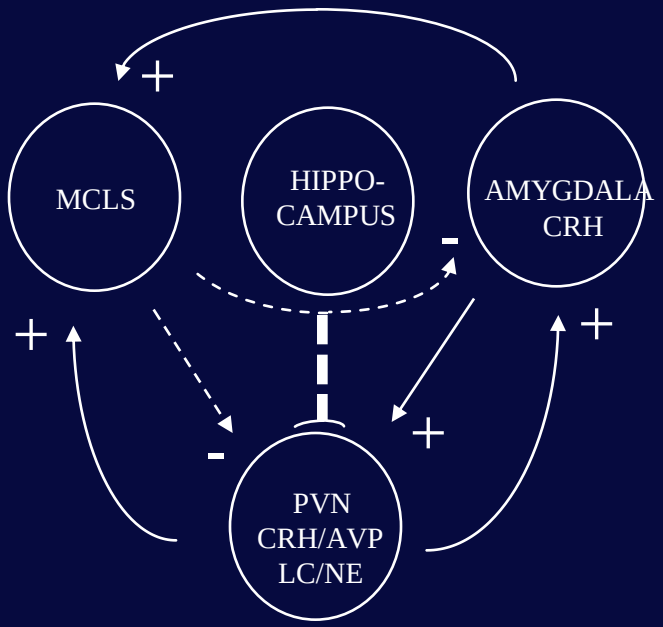
Intracerebral Infections

Physical and Emotional Stress

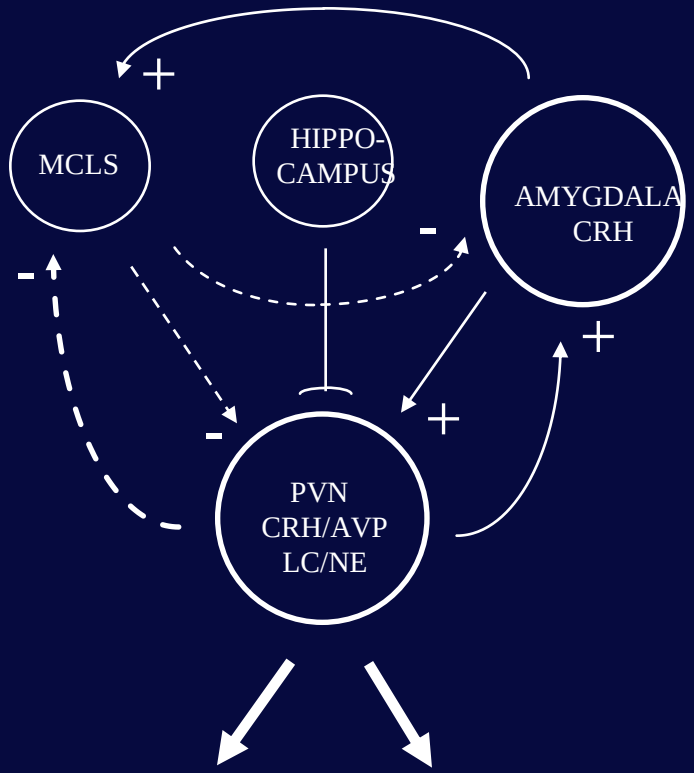
- Complexity- Human Uniqueness
- Concepts of Homeostasis and Stress
- Stress Mechanisms
- Effects of Stress in Secondary and Tertiary Education

G.P. Chrousos

Acute Stress



Stress Hyper-responsive Child/Adult



Cortisol + Catecholamines/IL-6

Adjusment *vs.* Maladjustment

Behavioral consequences	+	Somatic consequences
Maladjustment disorders		Growth retardation
Anxiety, Depression		Metabolic syndrome X
Personality disorders		Cardiovascular disease
Addiction, Psychosomatics		Osteoporosis

Sickness s.

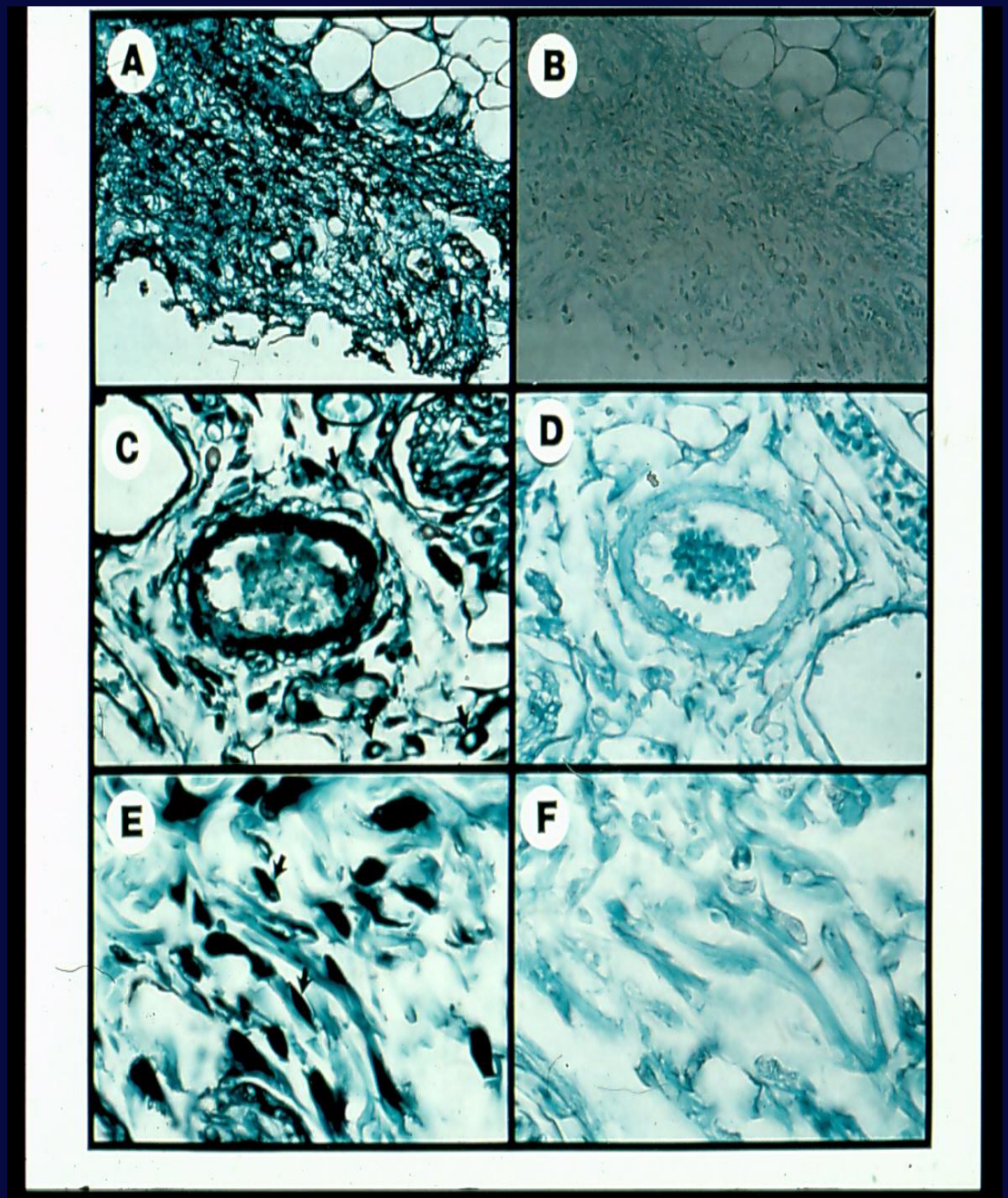
G.P. Chrousos

THE STRESS SYSTEM
Pathophysiology

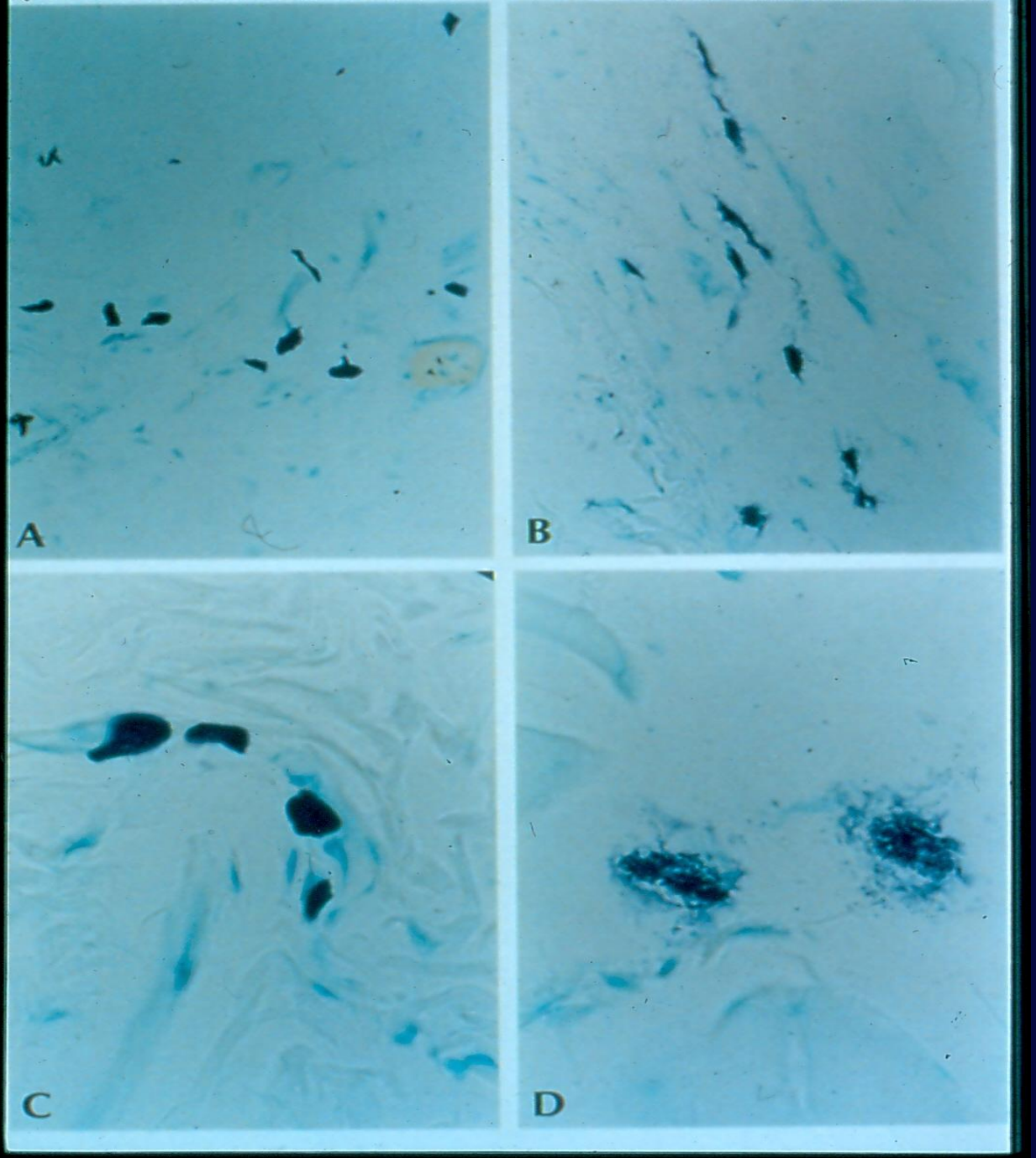
Acute effects of stress system activation

- Asthma, eczema, urticaria
- Migraine and tension headache
- Gastrointestinal pain
- Hypertensive episode, CVA, Death (compromised host)
- Cardiac ischemia, MI, Arrhythmia, Death (compromised host), Heart failure *(Takotsubo disease)*
- Psychotic episode

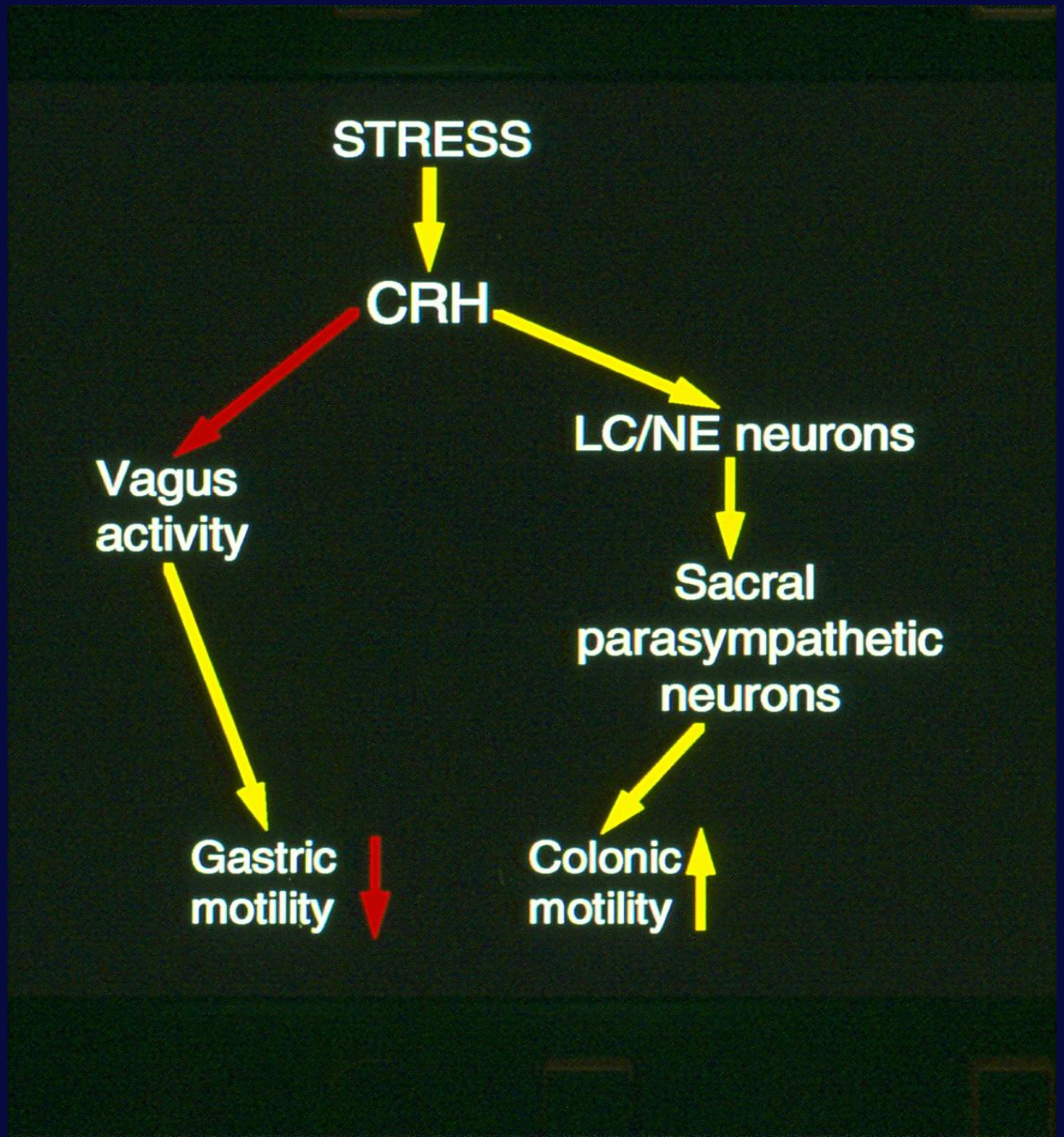
Takotsubo Disease



Karalis *et al*. Science 1999



Theoharidis *et al*. Endo 1995


STRESS
CRH
Vagus activity
LC/NE neurons
Sacral parasympathetic neurons
Gastric motility
Colonic motility

THE STRESS SYSTEM
Pathophysiology

Chronic effects of stress system activation:

- Anxiety, depression, addiction, anti-social behavior, psychosomatic disorders, fatigue, pain

- Loss of weight, poor growth, obesity, metabolic syndrome, smoldering inflammation, ("parainflammation"), immune dysfunction, autoimmunity, atherosclerosis, CVD

- Osteopenia/Osteoporosis

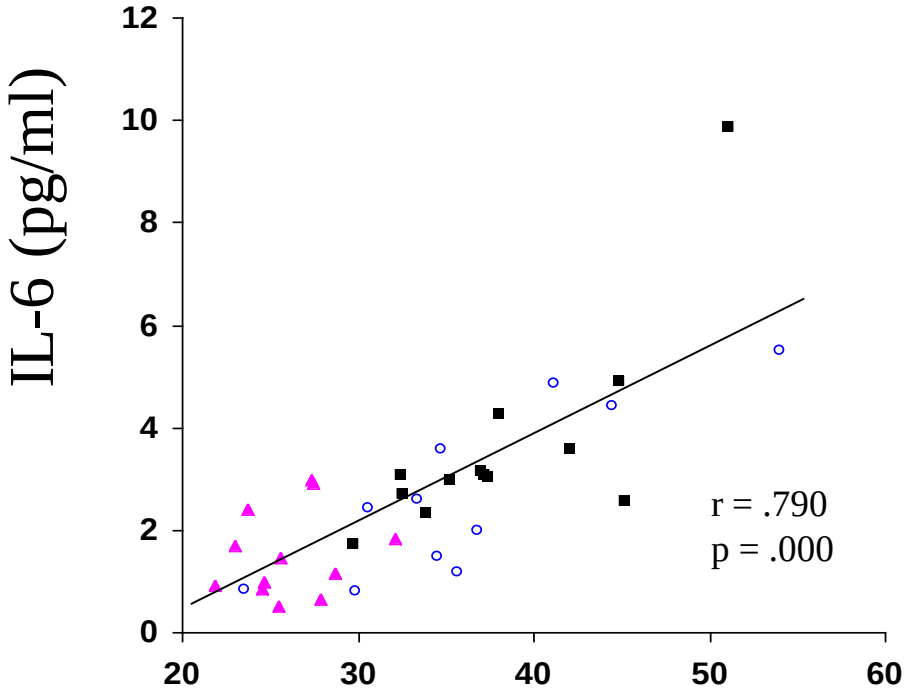
- Premature aging of all vulnerable organs, including the brain (neurodegeneration) and the skin

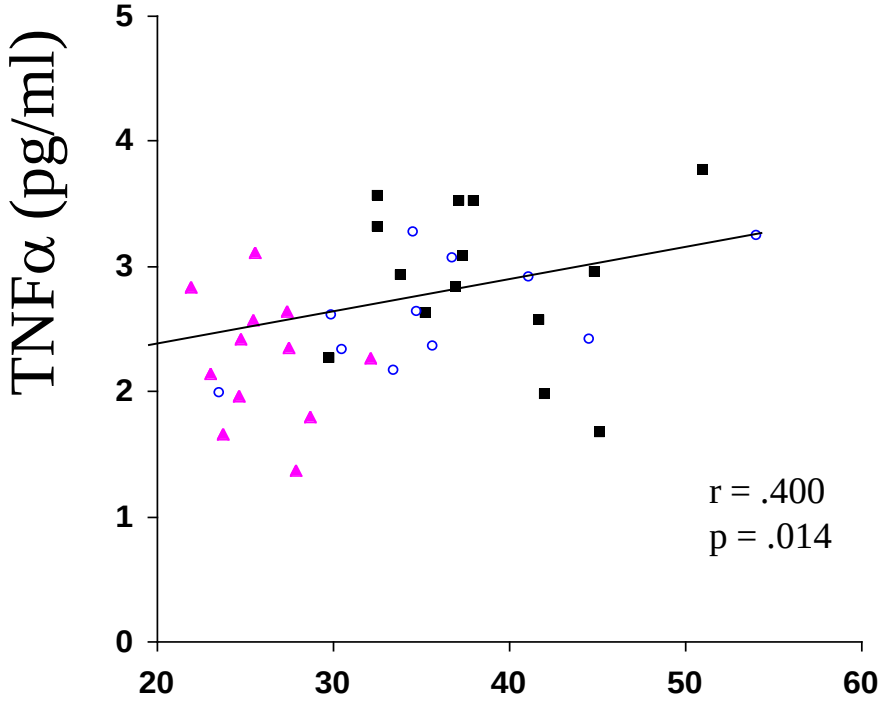
- Vulnerability to certain infections and cancers

↑

CHRONIC NONCOMMUNICABLE DISEASES

Both IL-6 and TNFα correlate with BMI





BMI

Vgontzas *et al.* JCEM 1997

HYPERCYTOKINEMIA

TRAUMA/ BURNS

INFECTIOUS ILLNESSES

AUTOIMMUNE INFLAMMATORY DISEASES

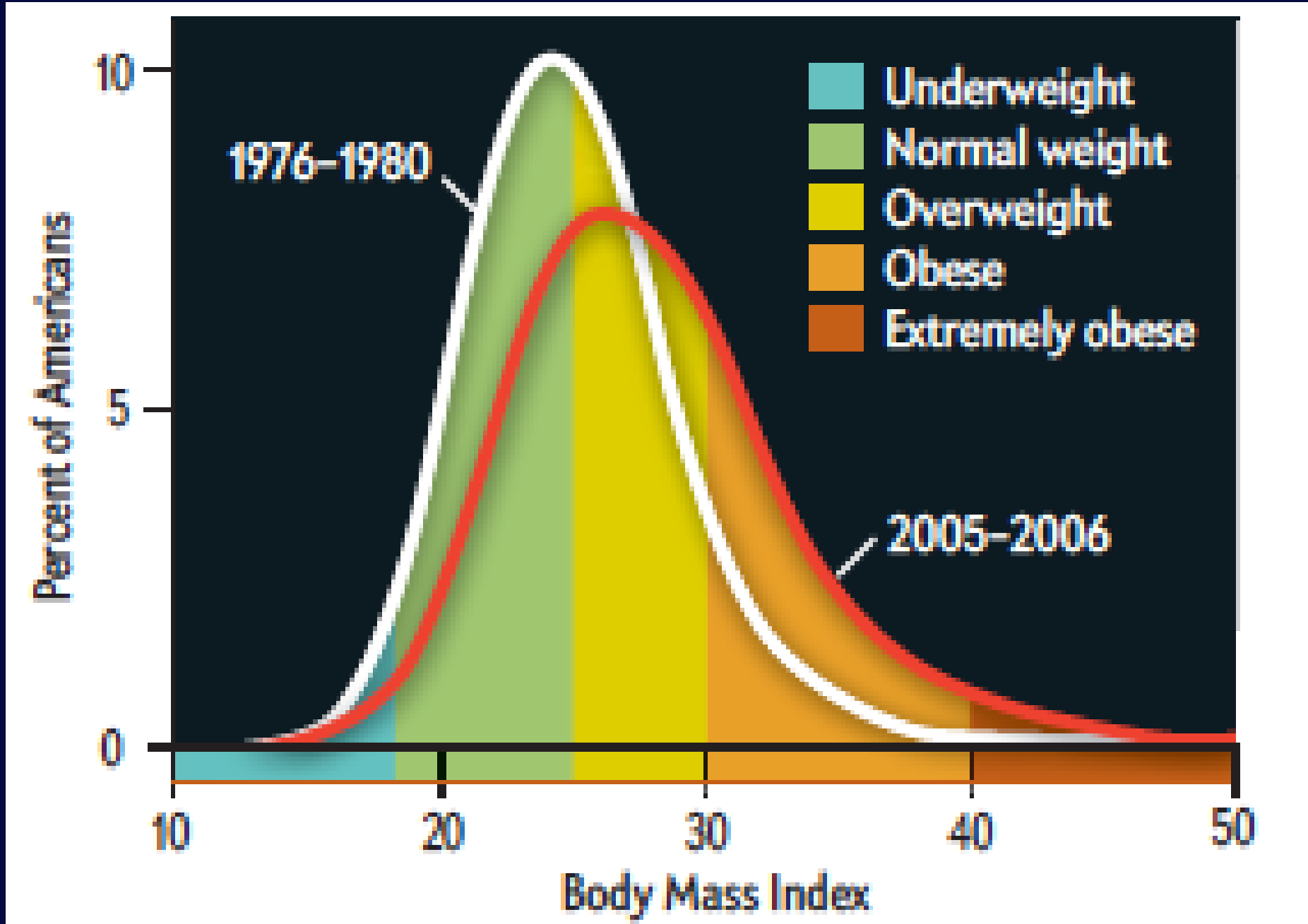
ALLERGIC INFLAMMATIONS

CNS INFLAMMATIONS

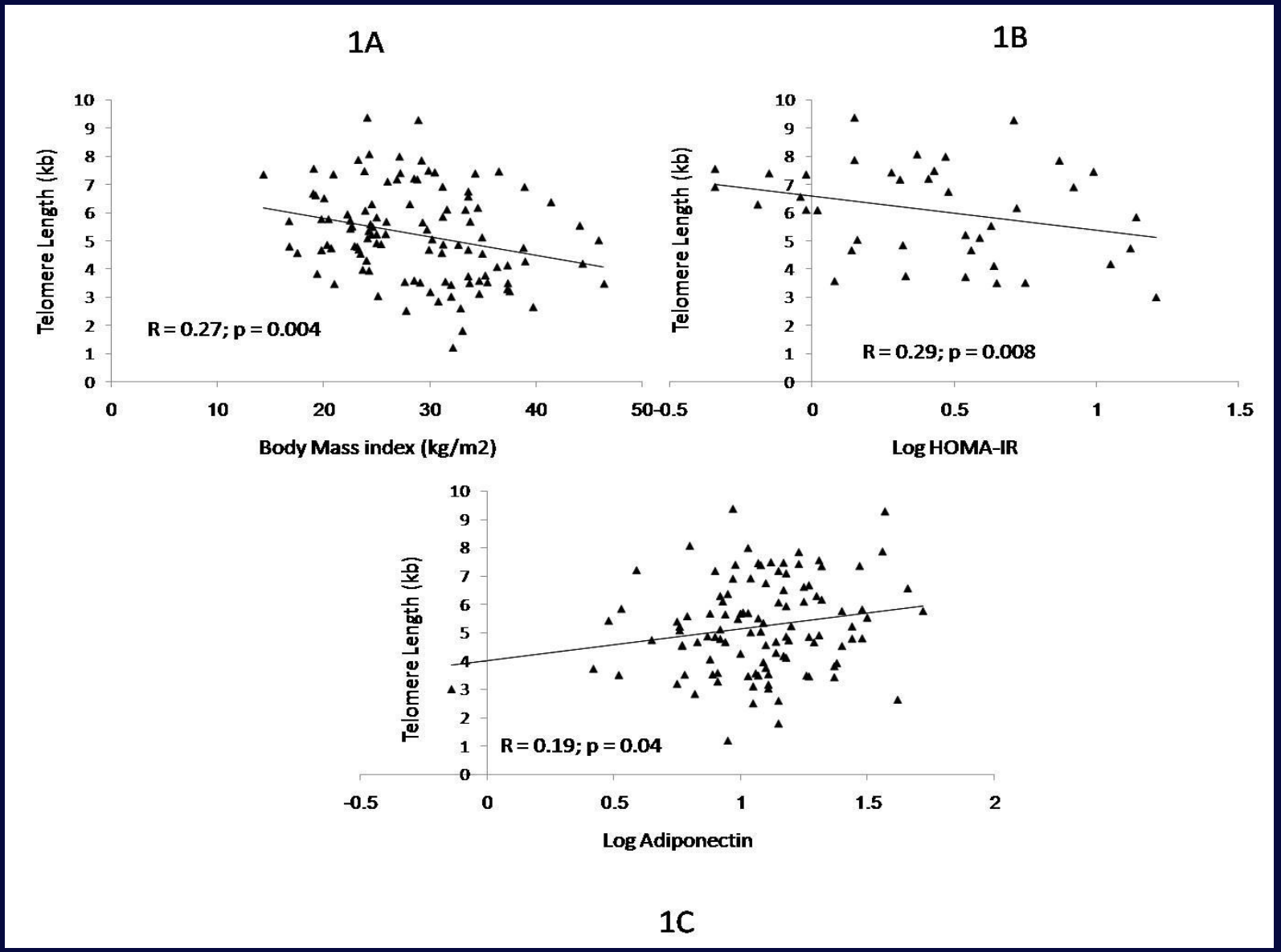
NONINFLAMMATORY STRESS

OBESITY/VISCERAL OBESITY

AGING

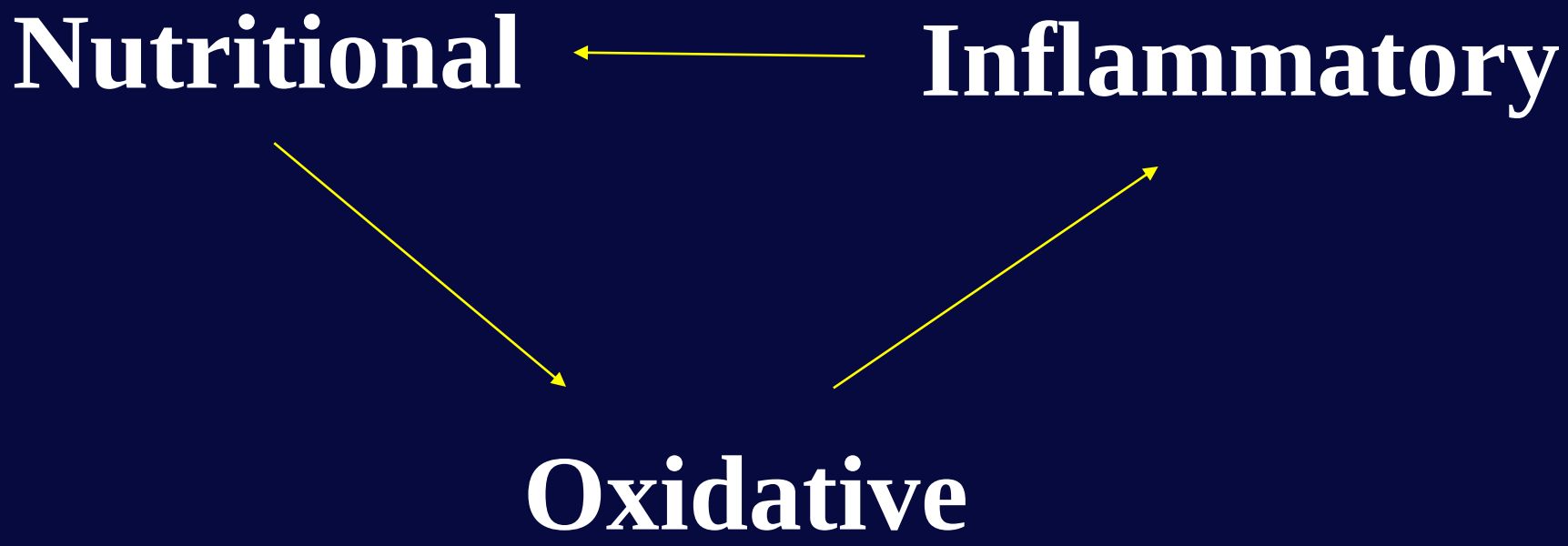

10
5
0
Percent of Americans
1976–1980
2005–2006
Underweight
Normal weight
Overweight
Obese
Extremely obese
10
20
30
40
50
Body Mass Index

SPL



Al-Attas et al. 2010

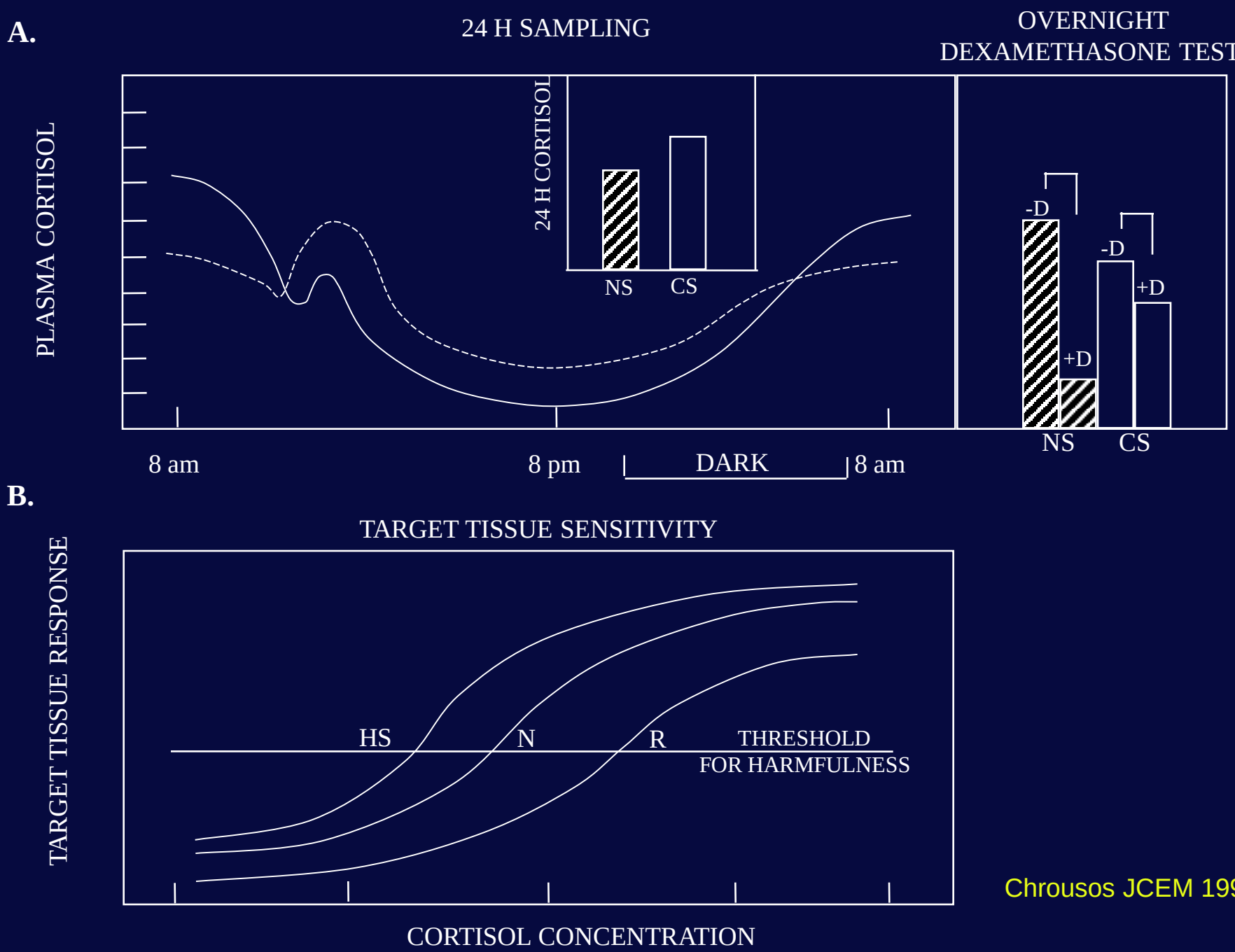
Cellular Stress



Cellular Stress

Mitochondria

Keap1 (SH sensor)-Nrf2-ARE



Chrousos JCEM 1998

THE STRESS SYSTEM AND THE METABOLIC SYNDROME

Post Long Periods of Stress

Neoplasia Rx
Anorexia Nervosa
Malnutrition
Addiction
Extreme Athleticism

MUSCLE MASS

Best predictor of morbidity and life expectancy

DEFINITIONS

- **Osteosarcopenia *vs.* "Paradoxic"-non-Obesity *vs.* Overweight/Obesity**

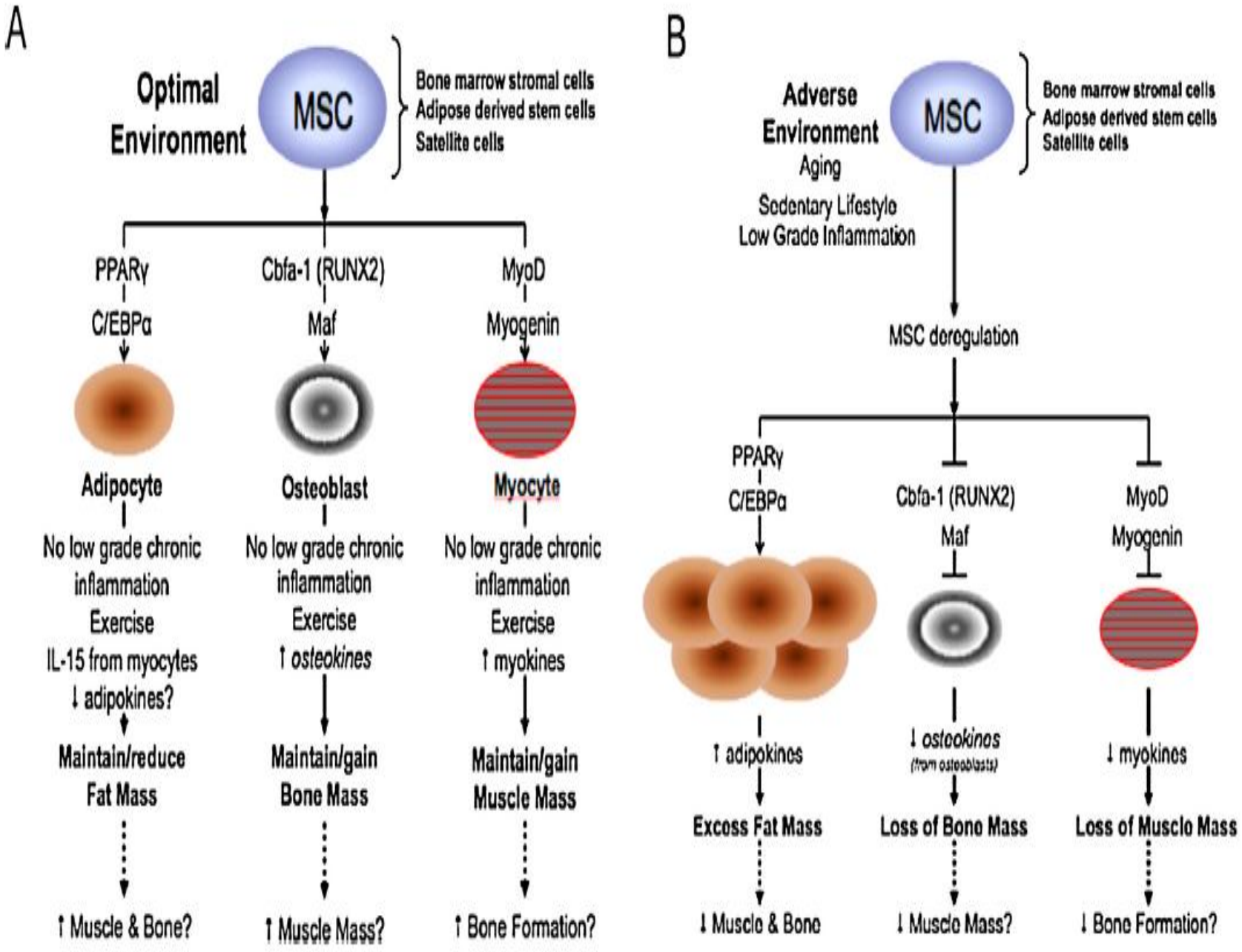
Decreased bone mass:

Osteopenia *vs.* Osteoporosis

T-scores from -1 to -2.5 *vs*. <2.5

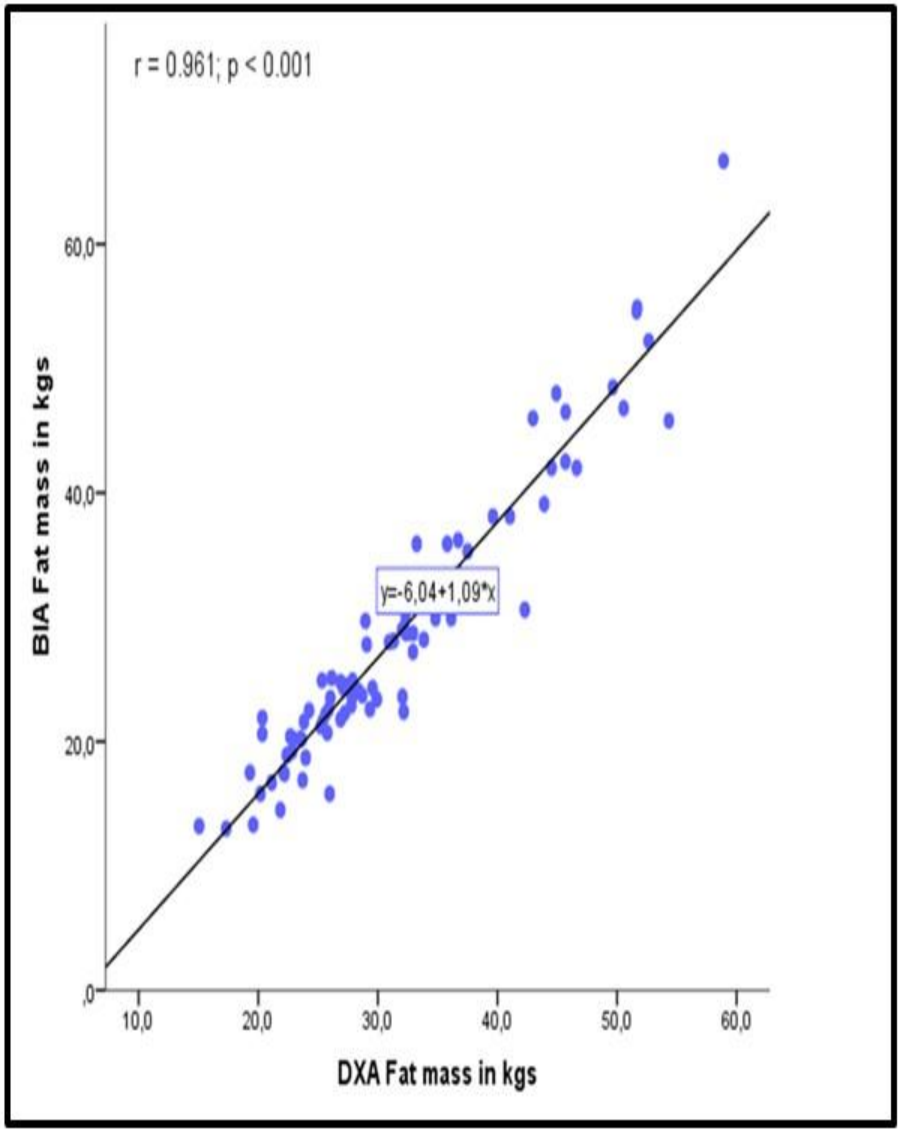
Decreased muscle mass:

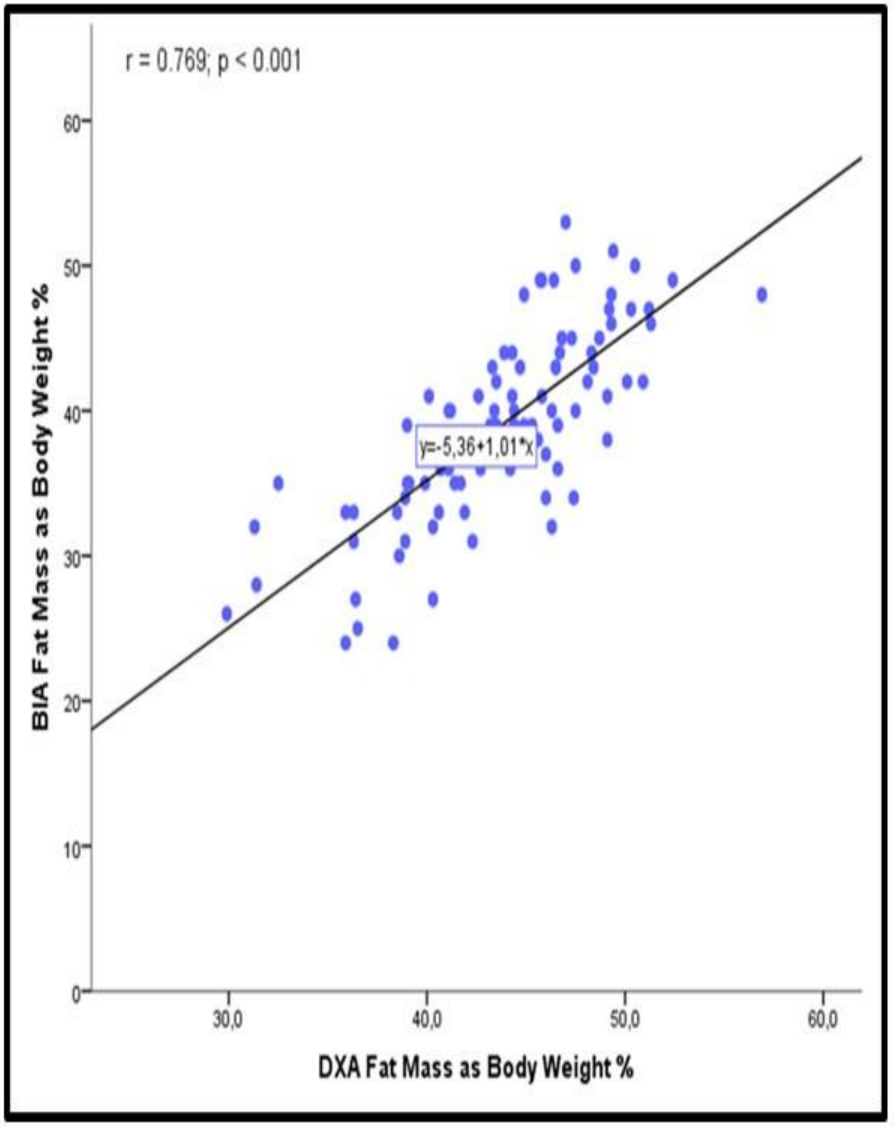
Sarcopenia *vs.* Sarcasthenia +/- lipoatrophy (cachexia, frailty)



Interrelationship among muscle, fat, and bone: connecting the dots on cellular, hormonal, and whole body levels. Ageing Res Rev. 2014 May;15:51-60.

Pearson's correlation co-efficient for BIA and DXA Fat Mass in kg & as Body Weight %





DOI: 10.1111/eci.12388

ORIGINAL ARTICLE

Stress and inflammatory biomarkers and symptoms are associated with bioimpedance measures

Constantine Tsigos[*], Charikleia Stefanaki[†], George I. Lambrou[‡], Dario Boschiero[§] and George P. Chrousos[†,‡,¶]

[*]School of Health Sciences and Education, Harokopio University of Athens, [†]Division of Endocrinology, Metabolism and Diabetes, University of Athens Medical School, "Eugenideion" Hospital, [‡]First Department of Pediatrics, Choremeio Research Laboratory, University of Athens, [§]BIOTEKNA Co., Venice, Italy, [¶]Biomedical Research Foundation, Academy of Athens, Athens, Greece

EJCI 2015

Participants were 99571 adult Caucasians (29624 males and 60047 females), ages 18-90 y, grouped by:

- **BMI: Lean, Overweight, Obese**

- **Presence of Medically Unexplained Symptoms = MUS**

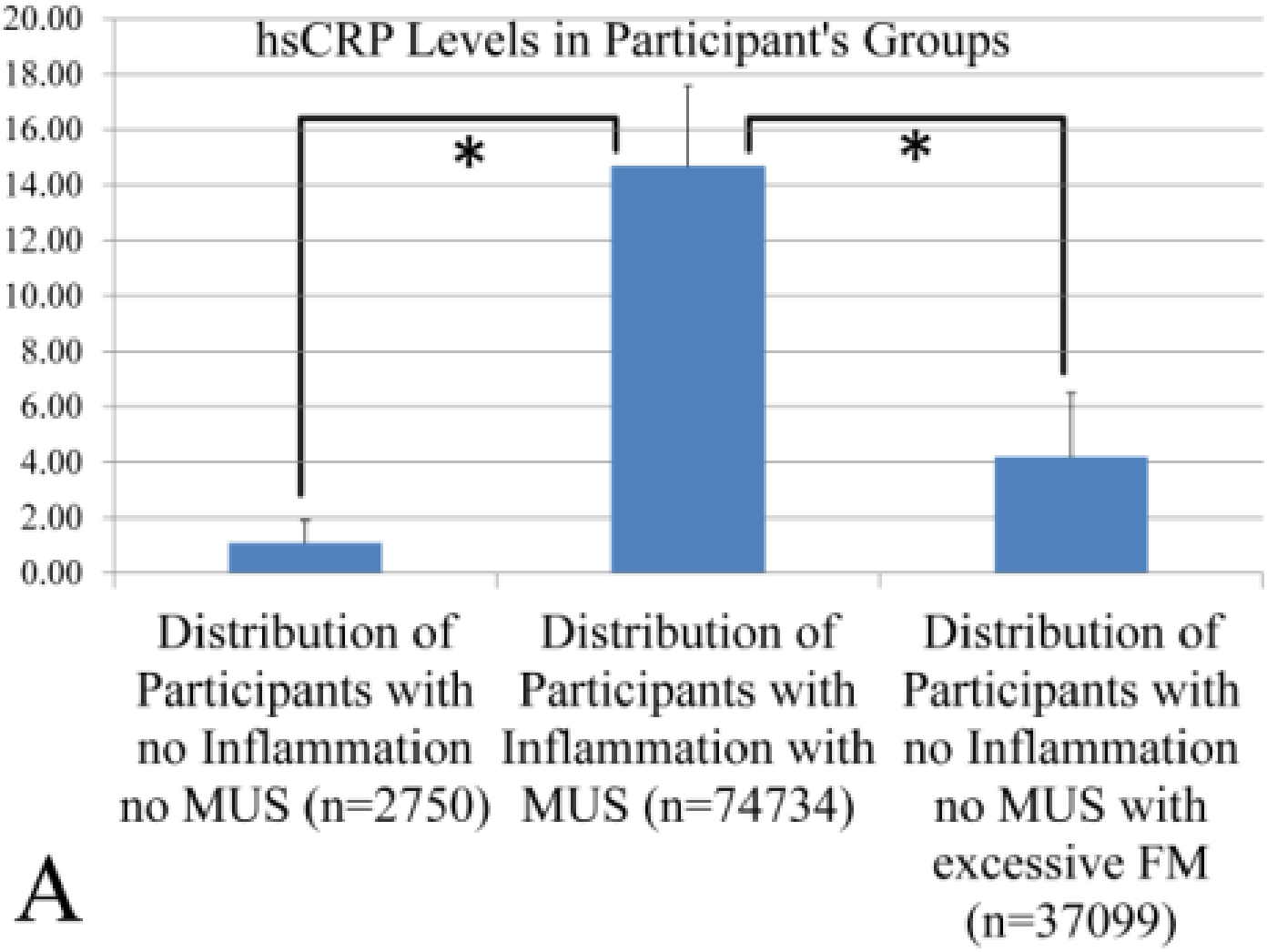
Evaluation included:

- **Advanced Body Composition Analysis by BIA-ACC**
- **Indices of Inflammation: am hsCRP, Interleukin-6**
- **Indices of Stress: am and pm Salivary Cortisol, Delta-Cortisol (am-pm) or am/pm cortisol ratio**

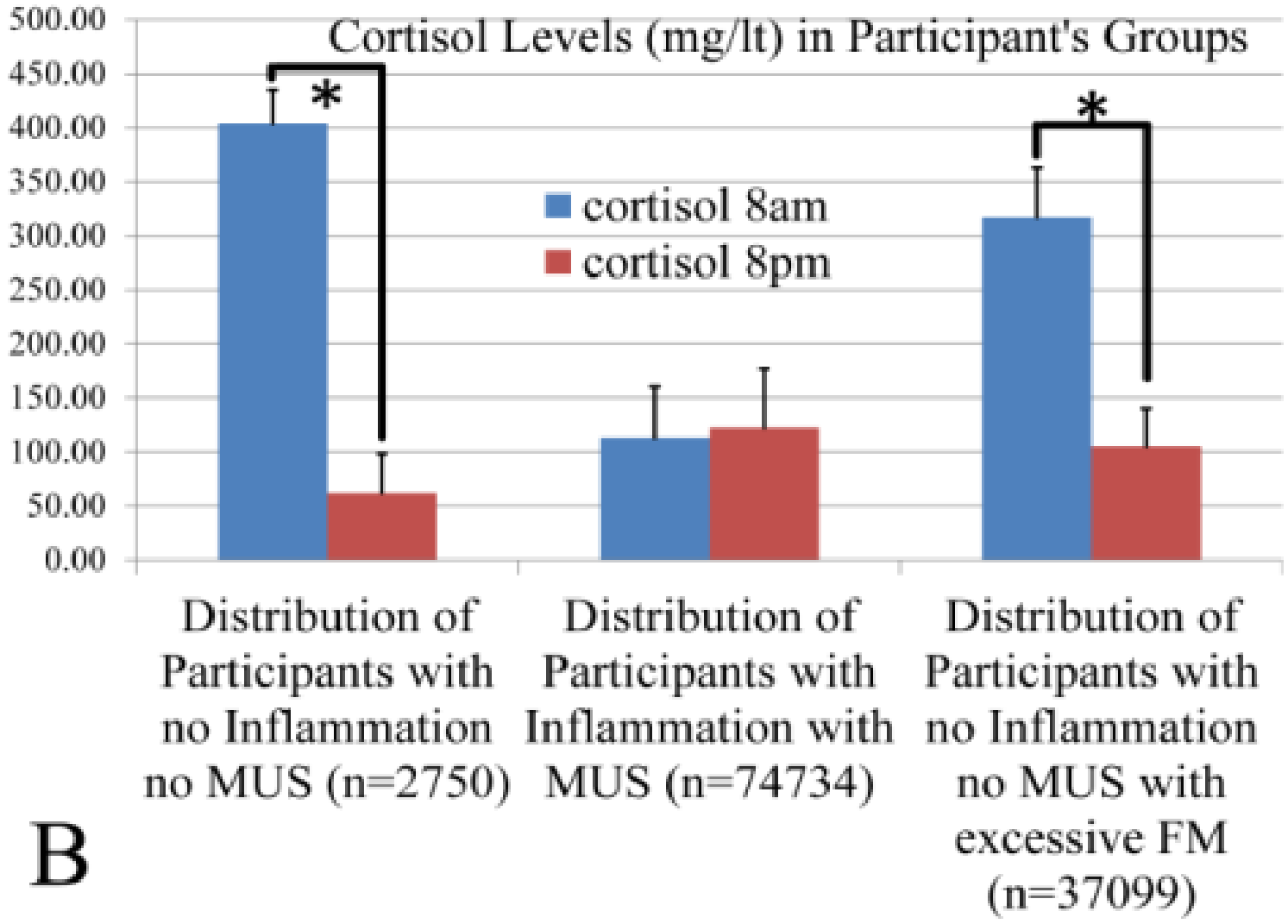
The MUS Examined*:

(i) persistent tiredness or fatigue,
(ii) depressive symptomatology,
(iii) persistent insomnia or night awakenings,
(iv) persistent drowsiness during the day,
(v) anxiety,
(vi) apathy,
(vii) panic attacks,
(viii) changes in heart rate (arrhythmias/tachycardia) at rest,
(ix) changes in appetite (appetite loss or excessive hunger),
(x) night binge eating,
(xi) stomach cramps, bloating or gastro-esophageal reflux disease (GORD),
(xii) presence of irritable bowel syndrome (IBS) symptoms,
(xiii) cold hands and feet,
(xiv) sweating during sleep.

***Presence of MUS was defined as a positive answer to more than 3 of the above 14 questions.**


hsCRP Levels in Participant's Groups
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
*
*
Distribution of Participants with no Inflammation no MUS (n=2750)
Distribution of Participants with Inflammation with MUS (n=74734)
Distribution of Participants with no Inflammation no MUS with excessive FM (n=37099)

A

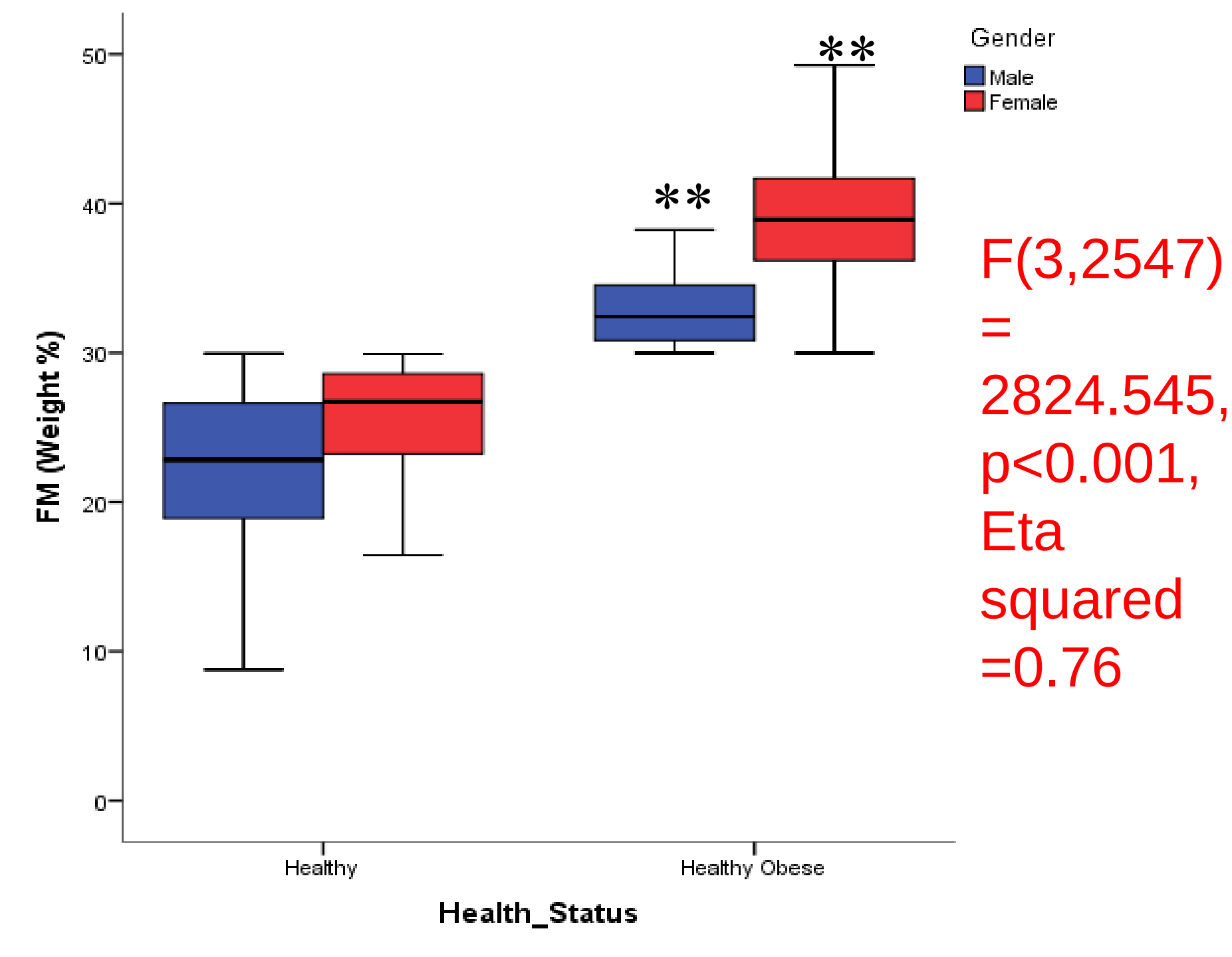

Cortisol Levels (mg/lt) in Participant's Groups
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
cortisol 8am
cortisol 8pm
*
*
Distribution of Participants with no Inflammation no MUS (n=2750)
Distribution of Participants with Inflammation with MUS (n=74734)
Distribution of Participants with no Inflammation no MUS with excessive FM (n=37099)

B

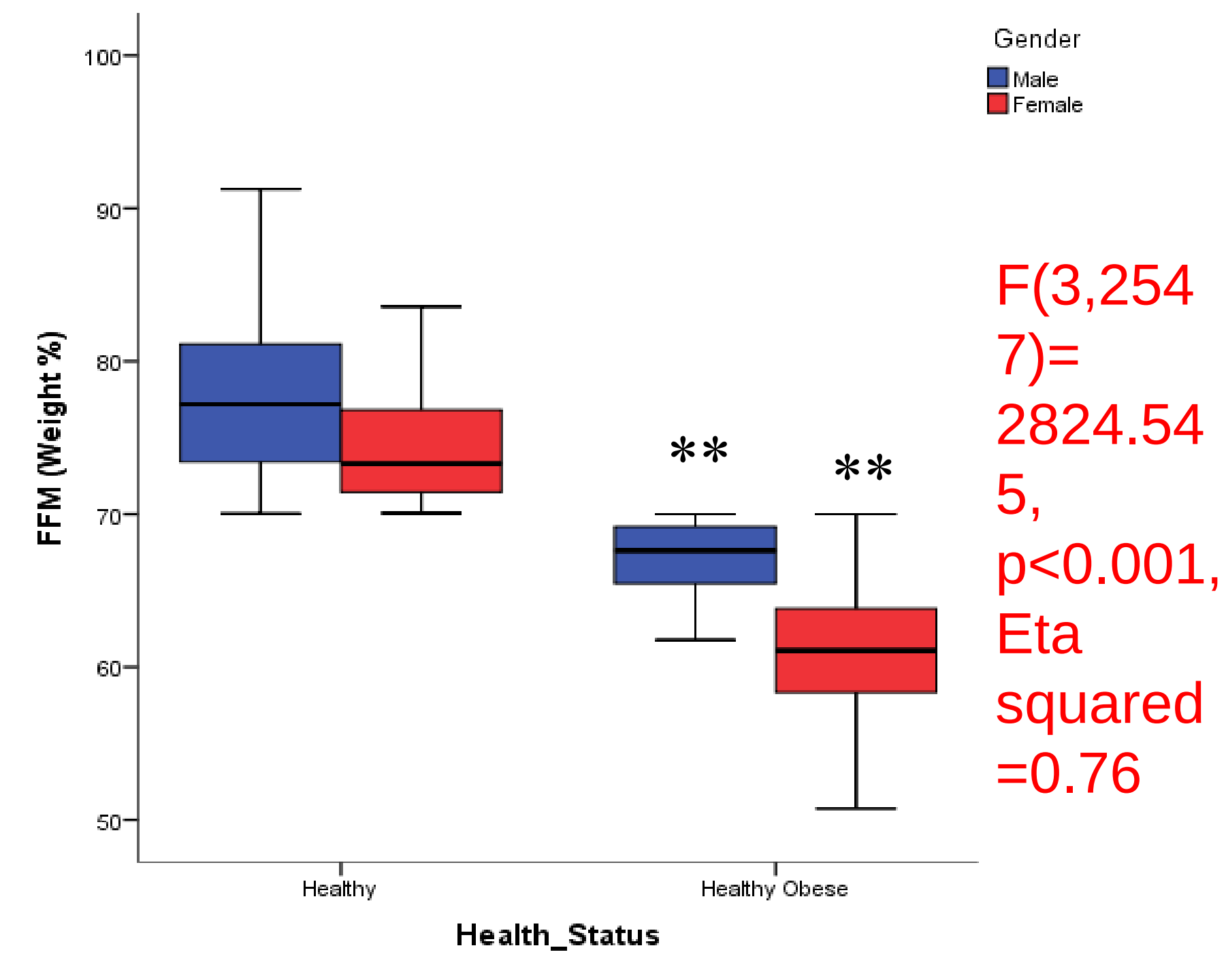
Healthy Overweight/Obese Youth: Early Osteosarcopenic Obesity Features.

Stefanaki C, Peppa M, Boschiero D, Chrousos GP.

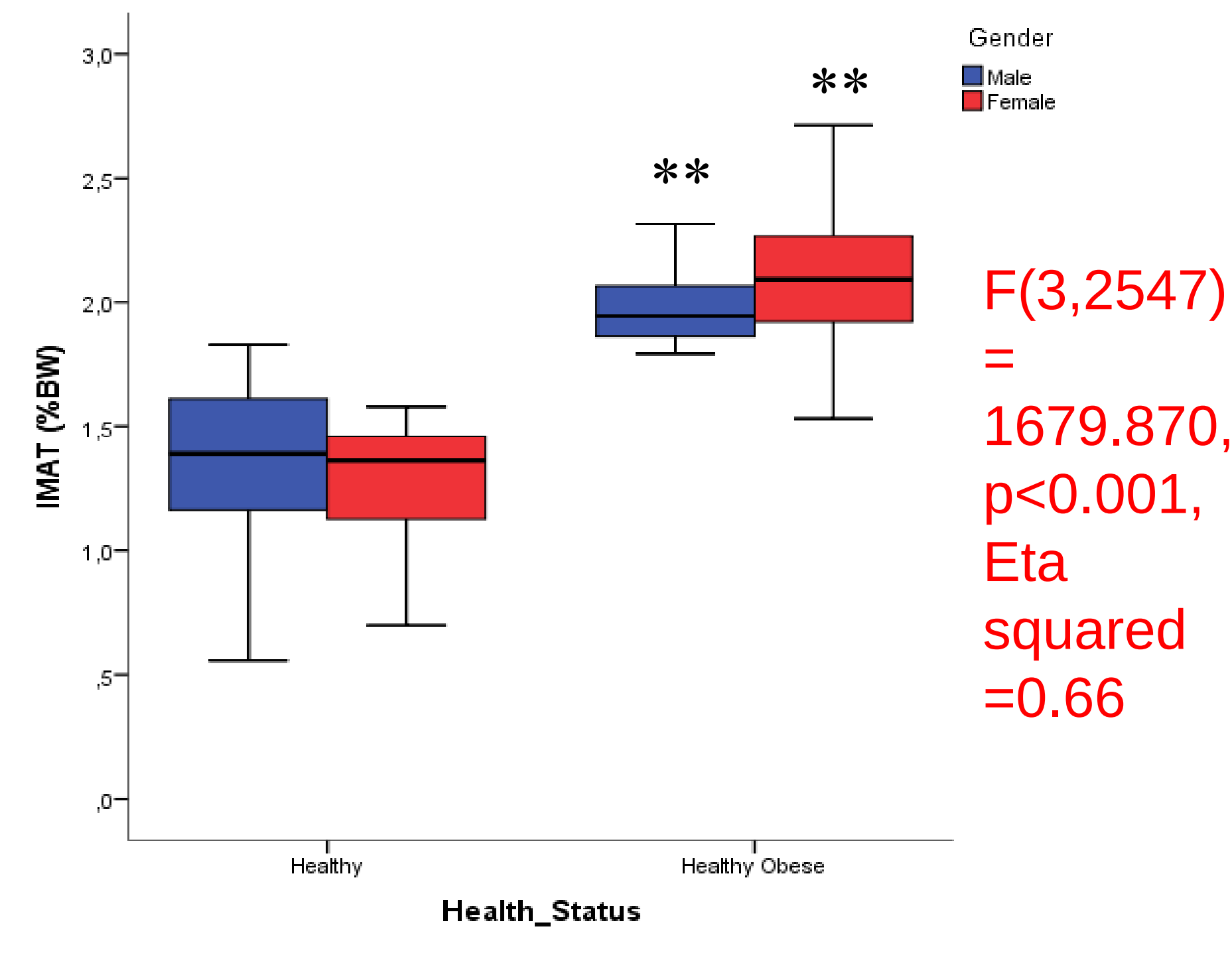
Eur J Clin Invest. 2016 Jul 19. doi: 10.1111/eci.12659. [Epub ahead of print]



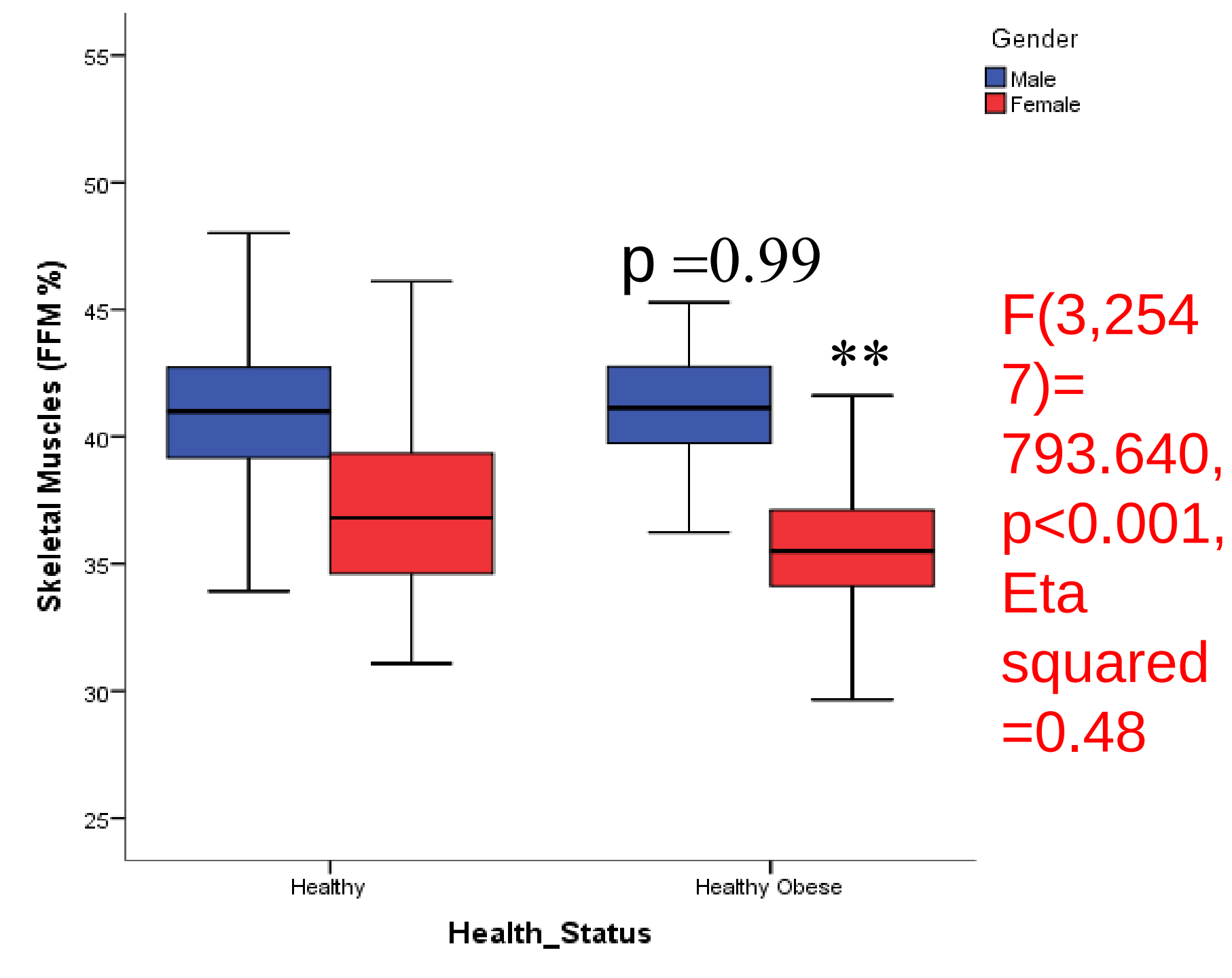
F(3,2547) = 2824.545, p<0.001, Eta squared =0.76



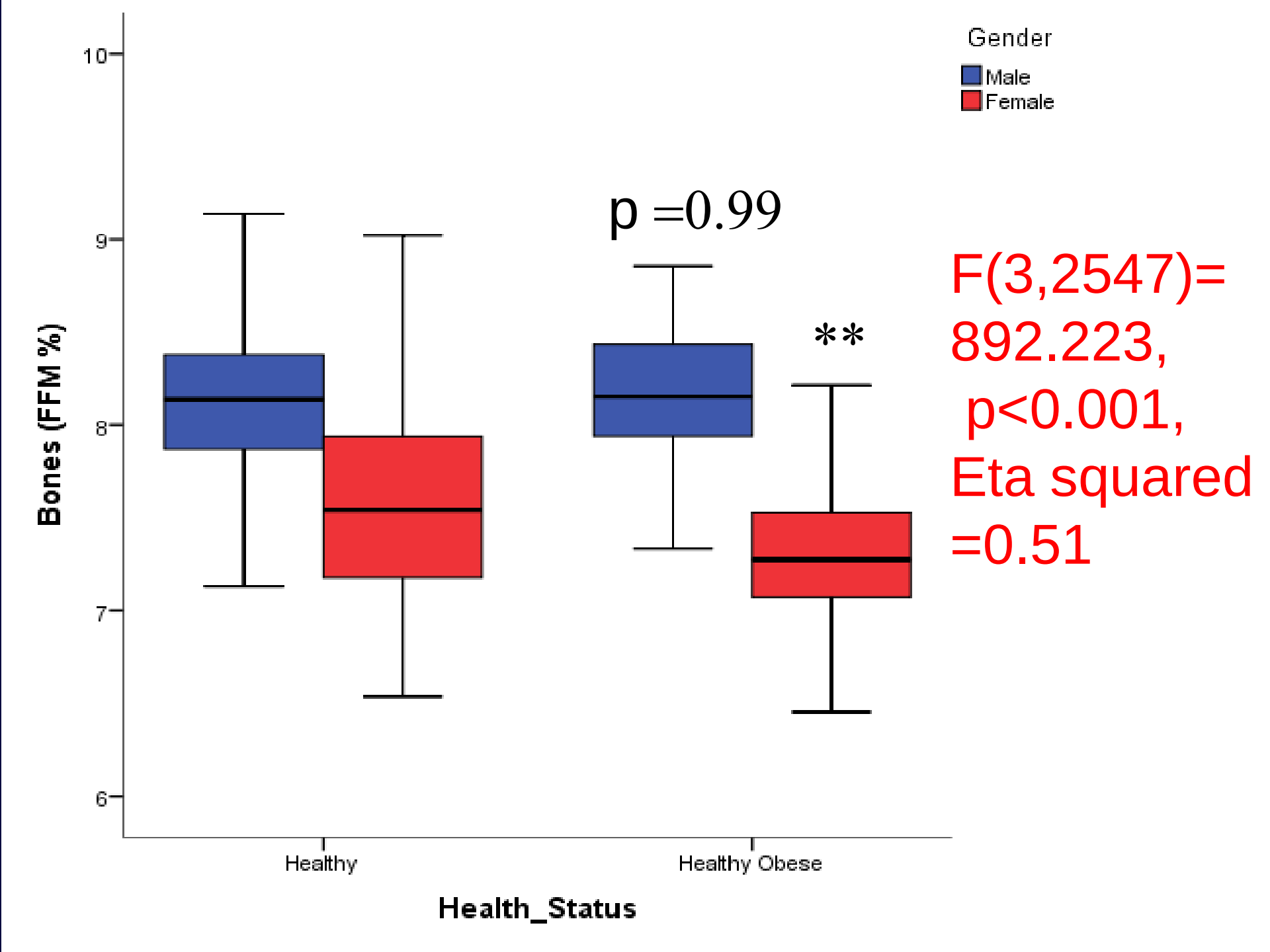
F(3,2547)= 2824.545, p<0.001, Eta squared =0.76



F(3,2547) = 1679.870, p<0.001, Eta squared =0.66



F(3,2547)= 793.640, p<0.001, Eta squared =0.48

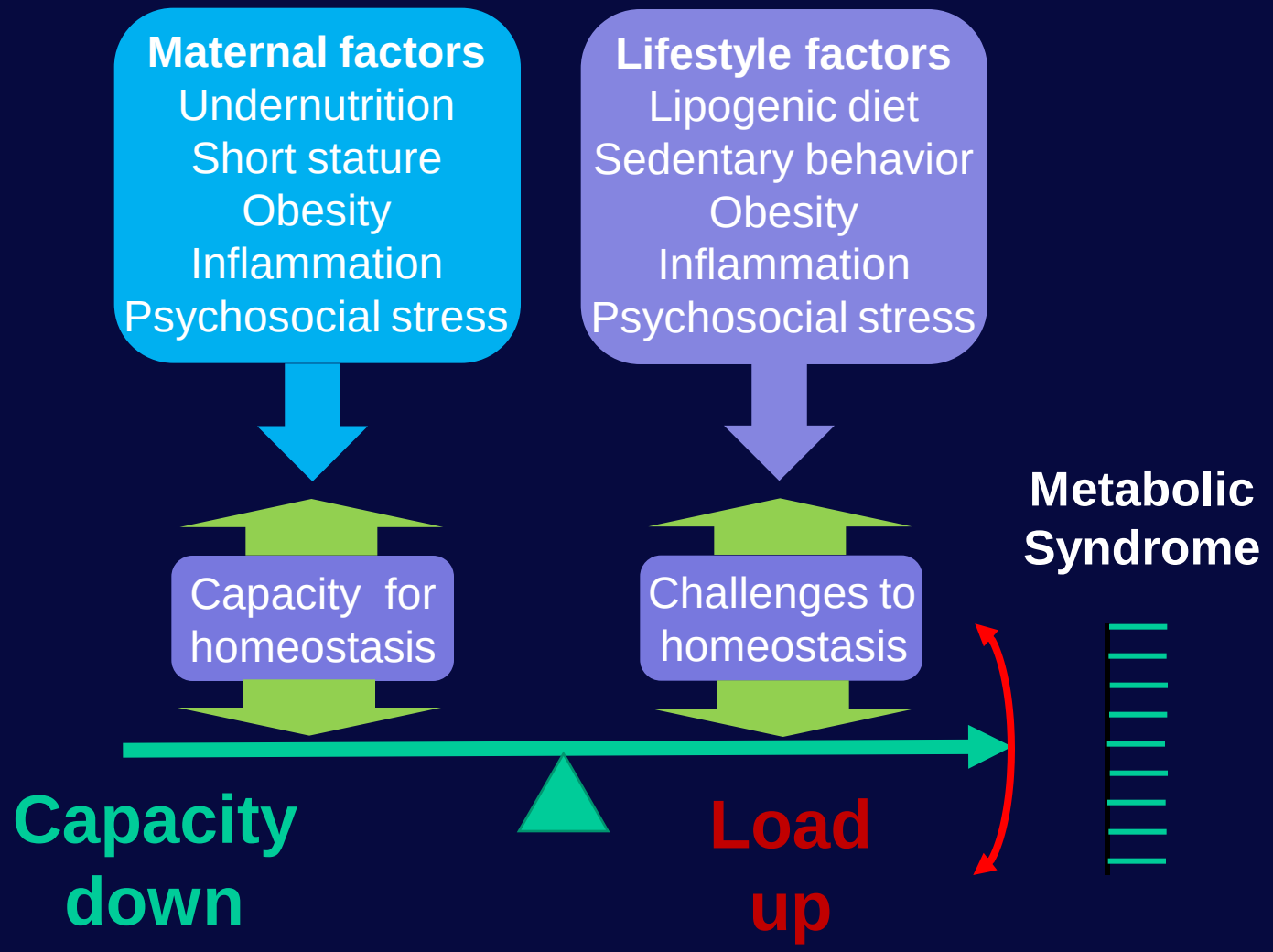


F(3,2547)= 892.223, p<0.001, Eta squared =0.51

"Chronic Stress and Inflammation Syndrome" (CSIS)

Psychologic and Physical Manifestations
Dysphoria, MUS, Osteosarcopenia

The capacity-load conceptual model (I)

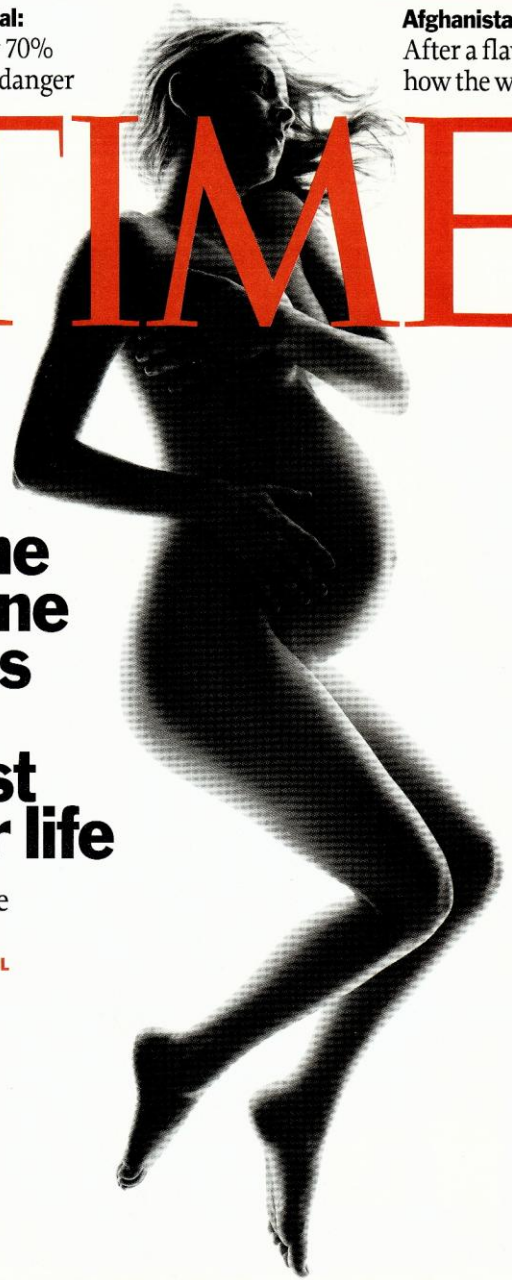


OCTOBER 4, 2010

Environment Special:
The oceans—why 70% of our planet is in danger

Afghanistan:
After a flawed election, how the world can help

TIME



How the first nine months shape the rest of your life

The new science of fetal origins

BY ANNIE MURPHY PAUL

40 >
9 770928 843102

BAHRAIN ... BD 2.50
BELIZE ... BZ $ 9.00
CYPRUS (E.C.) ... £4.50
DENMARK ... kr 45.00
ESTONIA ... 70 EEK
FINLAND ... €4.90
GIBRALTAR ... £4.50
GREECE ... €4.50
HUNGARY ... Ft 850.00
ISRAEL ... NIS 24.00
JORDAN ... JD 2.500
KUWAIT ... KD 2.000
LEBANON ... LL 6,500
LITHUANIA ... Lt 16.00
MALTA ... £4.50
MAURITIUS ... Rs 140.00
MOROCCO ... DH 35.00
NIGERIA ... N 450.00
NORWAY ... kr 45.00
OMAN ... RO 2.000
POLAND ... 14.90 PLN
PORTUGAL Cont. ... €4.50
QATAR ... QR 20.00

RER ALBANIA LEK 650.00
ROMANIA ... LEI 10.66
SAUDI ARABIA SAR 20.00
SLOVAKIA ... €4.50
SLOVENIA ... €4.20
SPAIN ... €4.50
SWEDEN Inc. taxi ... kr 39.00
SWITZERLAND ... SFR 6.00
TANZANIA ... TZS 4,700
TUNISIA ... DT 4.000
TURKEY Inc. taxi ... YTL 5.50
U.A.E. ... AED 25.00
UGANDA ... USH 7,000
VENEZUELA ... BsF 20

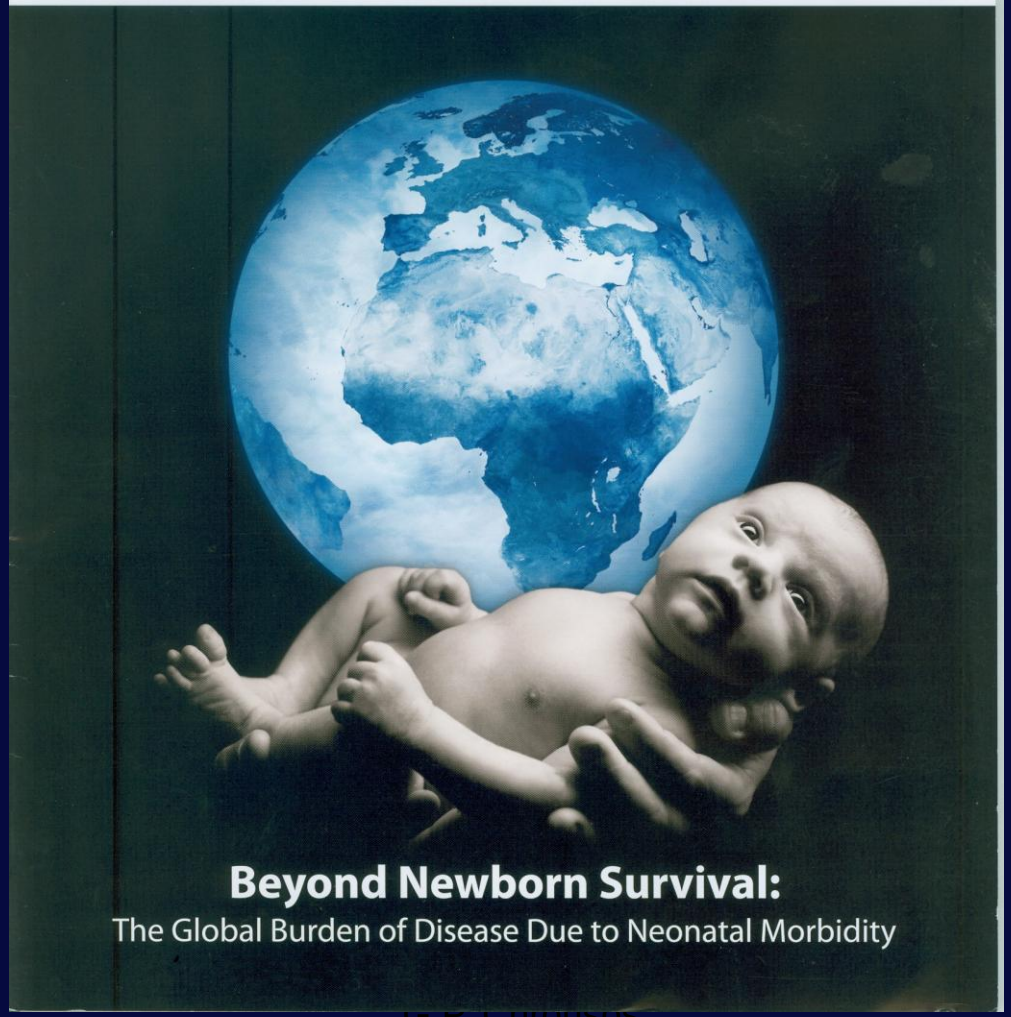
www.time.com

www.nature.com/pr
December 2013 | Volume 74 | Supplement 1

Pediatric RESEARCH

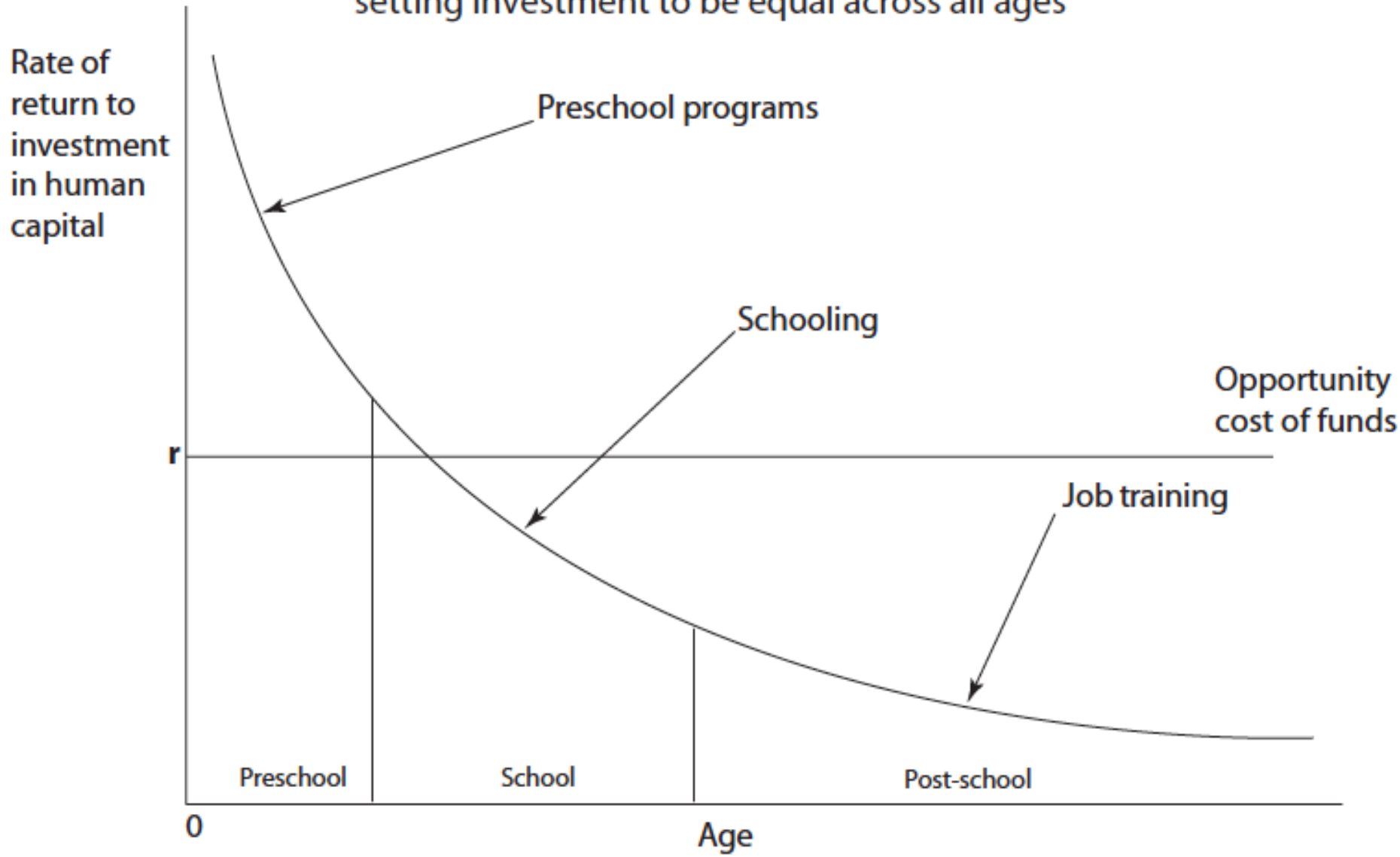
Published on behalf of the
International Pediatric Research Foundation

IPRF
International Pediatric
Research Foundation



Beyond Newborn Survival:
The Global Burden of Disease Due to Neonatal Morbidity

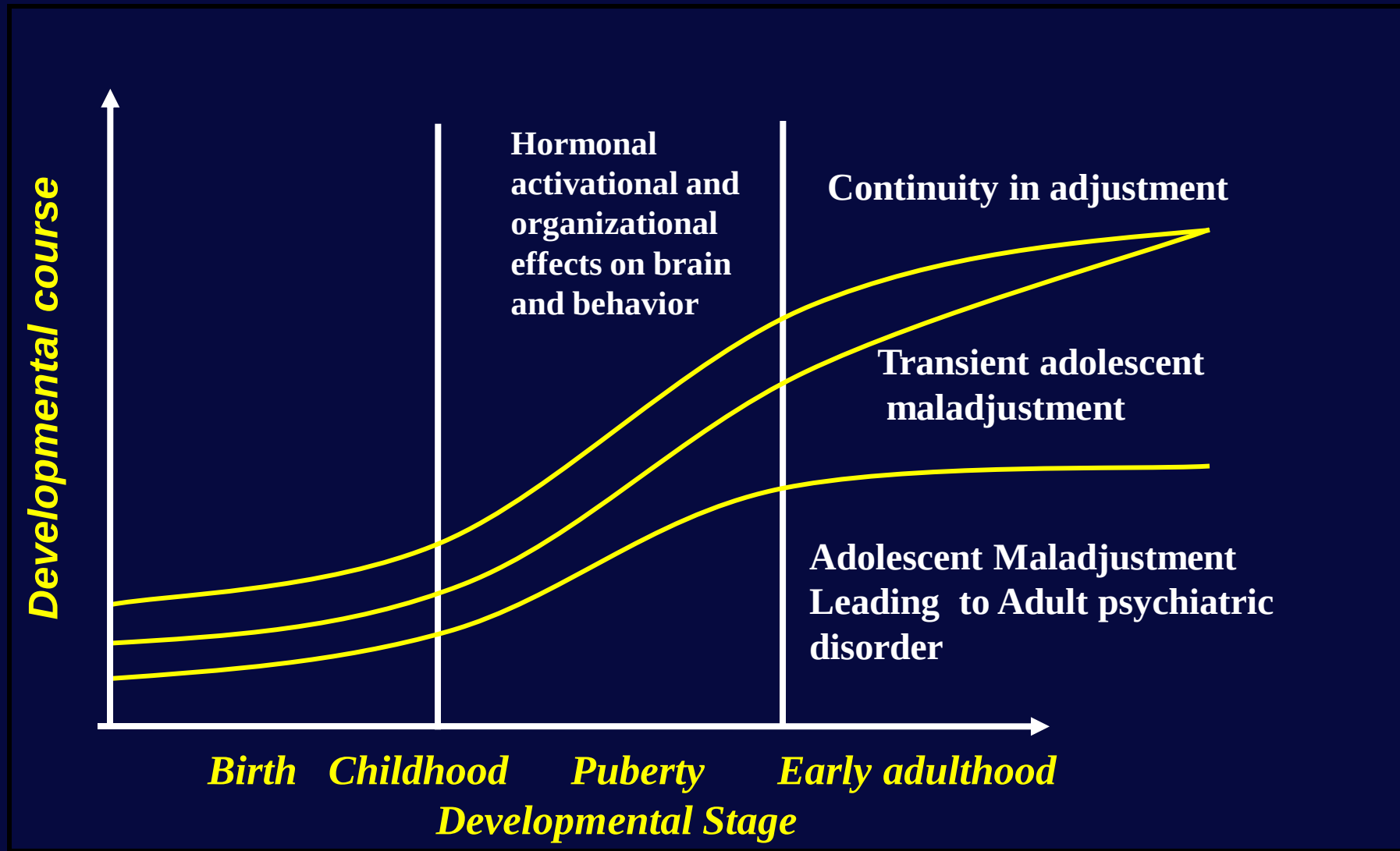
Figure 2.6
(a) Rates of return to human capital investment initially setting investment to be equal across all ages



Rates of return to human capital investment initially setting investment to be equal across all ages

Carneiro and Heckman 2003

The developmental pathways through adolescence and into adulthood



Identify Signs of Stress Early (I)

General:

- Disrupted sleeping
- Tearfulness
- Erratic / Poor eating
- Low mood / Self-esteem
- Argumentative

Identify Signs of Stress Early (II)

Physical:

- Upset stomach
- Headaches
- Anxiety / Panic Attacks
- Inflamed skin
- In more serious cases, self-harm, eating disorders and suicidal thoughts

A steady SES-health gradient and poorer health

Smoking, drinking, obesity, poor diet and sedentary lifestyle.

Lifestyle risks only account for a small portion of the SES-health gradient.

Although access to healthcare is a real problem faced by many low-income families, it does not fully account for the SES-health gradient.

The gradient exists even in countries with socialized healthcare.

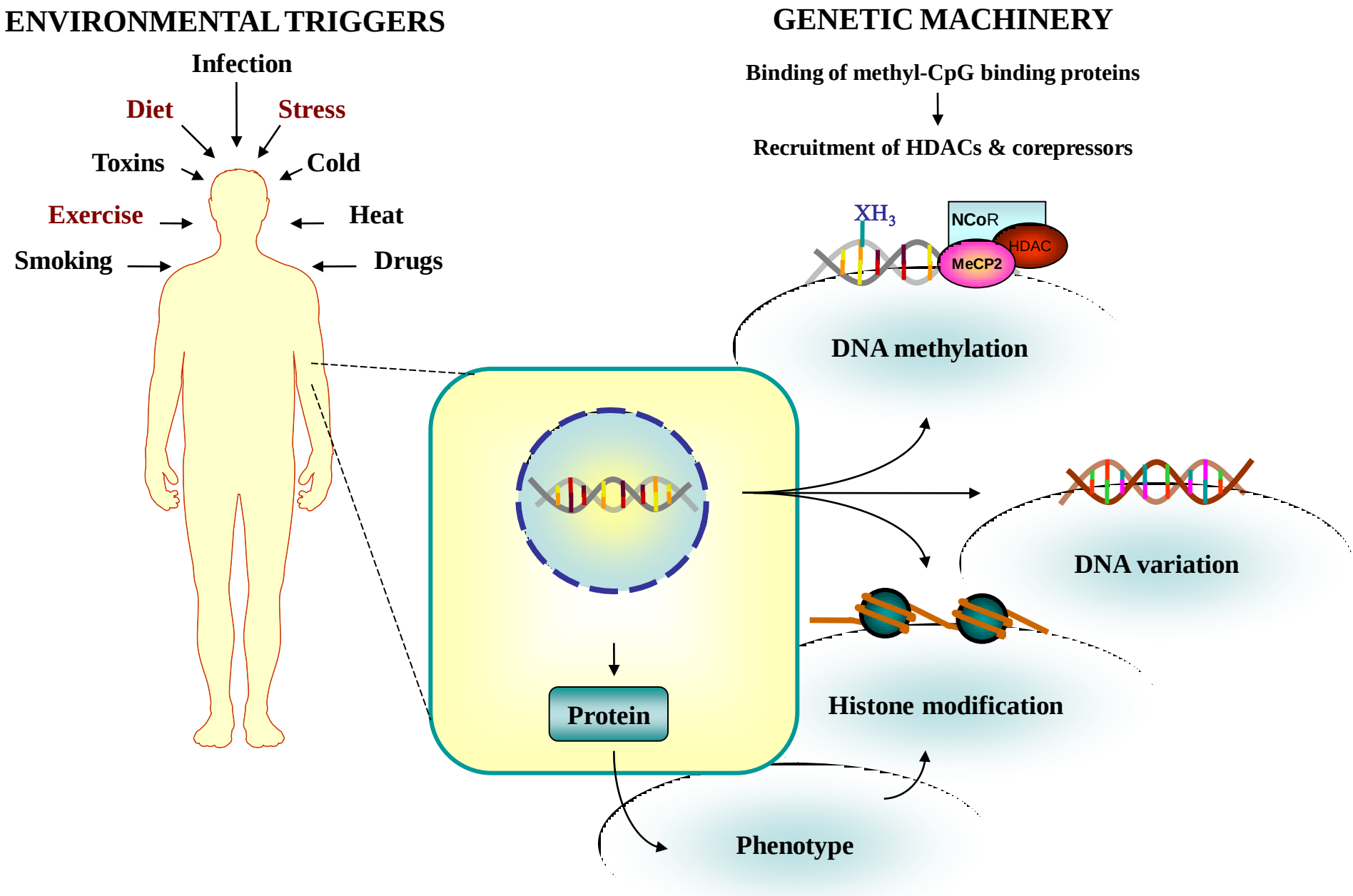
Dysregulated stress response systems

Chronic social stress associated with poverty actually sensitizes multiple components of the nervous system, heightening physiological reactions to even mildly stressful or threatening events

Under chronic stress, physiological responses not only occur more frequently, but also tend to increase in magnitude and duration, taking longer to recover to baseline levels.

Over time, repeated and exaggerated stress responses become entrenched, placing individuals at risk for developing stable patterns of high-reactivity, and leading to higher resting heart rate, blood pressure, and circulating stress hormones such as cortisol.

ΕΠΙΓΕΝΕΤΙΚΗ



CTRA Gene Cluster

Function	Genes
Pro-inflammatory	*IL1A, IL1B, IL6, IL8, TNF, PTGS1, PTGS2, FOS, FOSB, FOSL1, FOSL2, JUN, JUNB, JUND, NFKB1, NFKB2, REL, RELA, RELB*
Type I interferon responses	*GBP1, IFI16, IFI27, IFI27L1-2, IFI30, IFI35, IFI44, IFI44L, IFI6, IFIH1, IFIT1-3, IFIT5, IFIT1L, IFITM1-3, IFITM4P, IFITM5, IFNB1, IRF2, IRF7-8, MX1-2, OAS1-3, OASL*
Antibody synthesis	*IGJ, IGLL1, IGLL3*

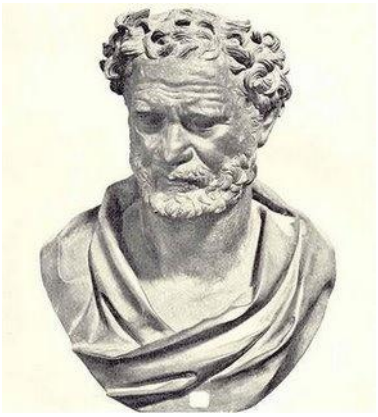
Antoni MH *et al. Psychoneuroendocrinology.* 2016; 74: 269-277

Epigenetic Changes and Poverty

Gene	Average *p* value	Standardized average *p* value
CD44	1.44E−09	6.52
ZNF827	7.79E−10	6.75
MAD1L1	1.30E−08	5.70
UBE4A	2.42E−09	6.33
NLRC5	1.45E−08	5.66
SPARC	1.32E−09	6.55
SFRS8	1.69E−09	6.46
EZH2	3.48E−09	6.19
MEFV	3.95E−09	6.14
CHST15	9.00E−09	5.84
PAQR5	4.50E−09	6.10
OTUD6B	6.58E−08	5.09
NDRG1	2.42E−08	5.47
WDFY1	5.34E−08	5.17
EBF4	1.05E−06	4.06
SLC7A7	1.91E−08	5.55
DTX3L	1.78E−07	4.72
PARP9	1.78E−07	4.72
SLC24A4	2.64E−08	5.43
VTI1A	4.29E−08	5.25

McDade TW *et al*. *Am J Phys Anthropol*. 2019; 169(1): 3-11

Lifestyle Factors
Stress Management
Chronic Stress
Chronic Disease
Family Structure
Daily Living Conditions
Economic Structure
Social Structure



“Γῆρας καί πενία
δύο τραύματα δυσθεράπευτα”

Δημόκριτος
470-370 π.Χ

Physical and Emotional Stress

- Complexity- Human Uniqueness
- Concepts of Homeostasis and Stress
- Stress Mechanisms
- Effects of Stress in Secondary and Tertiary Education
- **Coping with Stress**

“Κράτιστον δη προς αλυπίαν φάρμακον ο λόγος και η δια τούτου παρασκευή προς πάσας του βίου μεταβολάς”.

“The best medicine to attain consolation is Logos, and through it the preparation for all the vicissitudes of life”.

Π

Πλούταρχος Plutarch

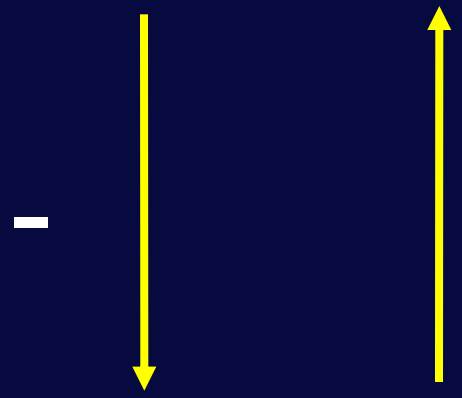
What can we do about stress?

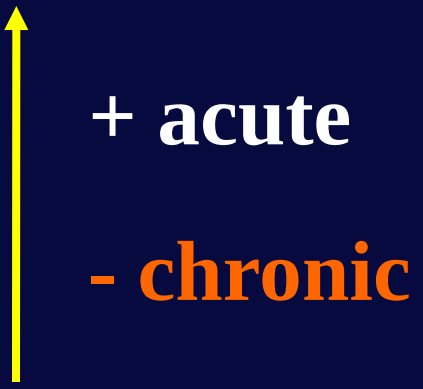
- **Social prerequisites**
- Nutrition
- Exercise
- Sleep
- Timing regularity
- Learning
- Experiencing "*Flow*"
- "Noopedia" methods
- "Meaning"

Basic Social Prerequisites

- Safety, Security
- Social Integration
- Competence
- Authenticity
- Autonomy
- Environment

MC/ML System Tone





Stress System Tone

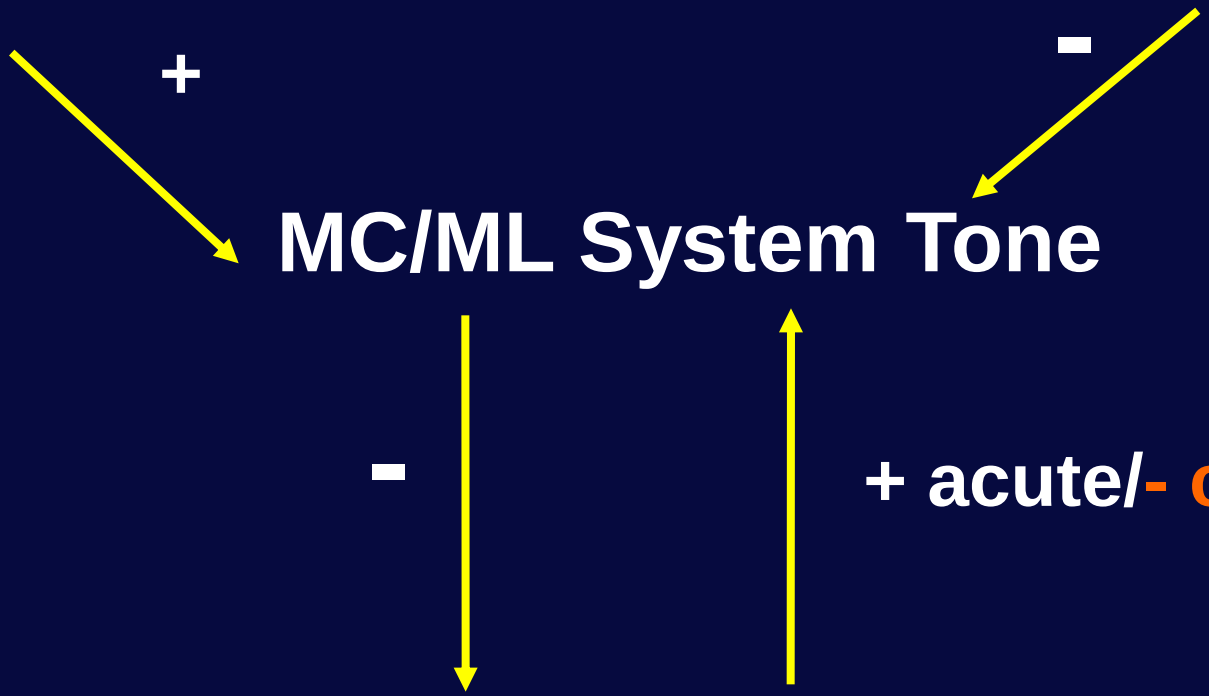
“Επιστήμη ποιητική ευδαιμονίας”.

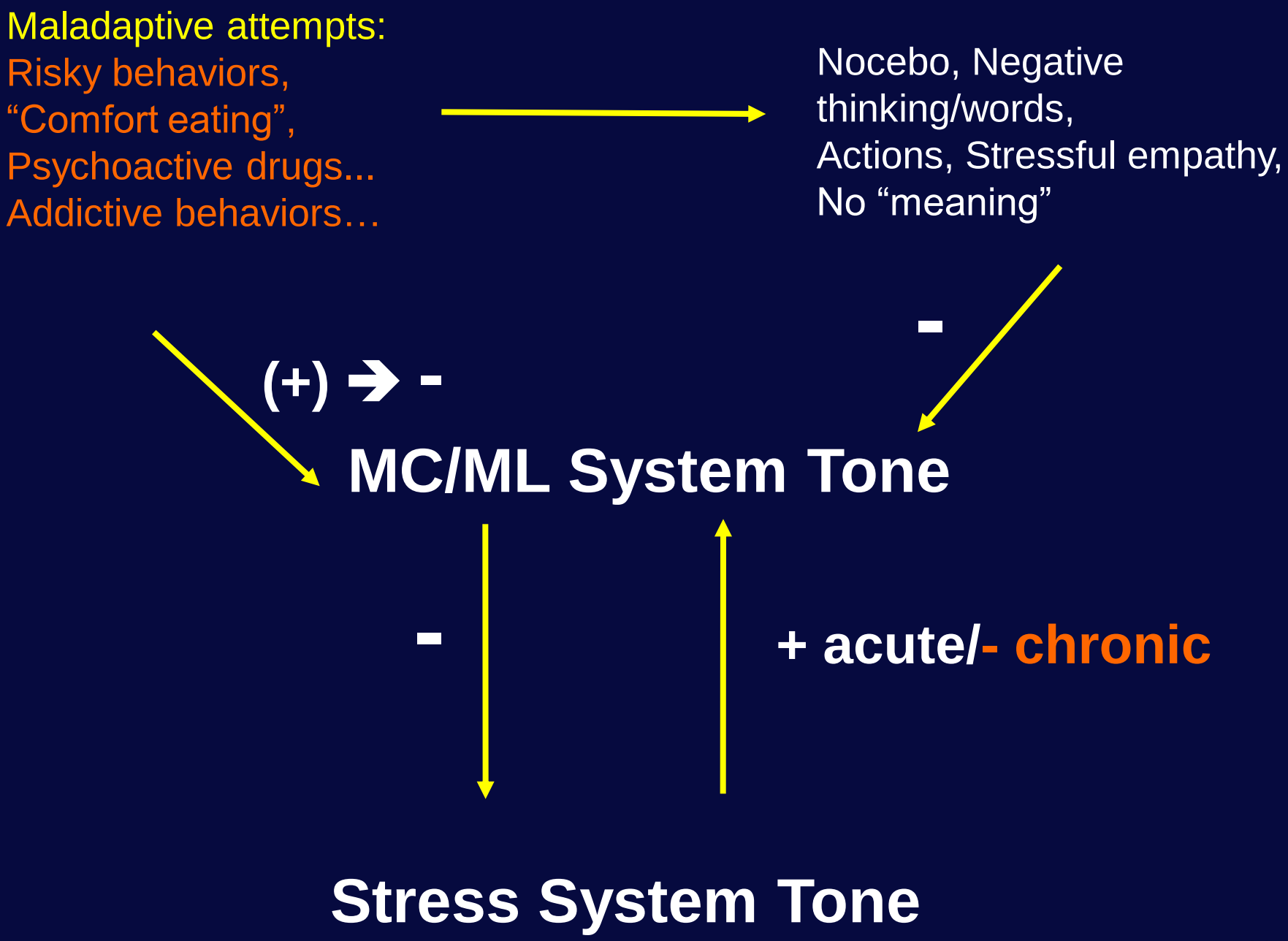
“Science brings eudaimonia”.

Πλάτων Plato

Placebo,
Positive thinking/words/
actions, Compassion, Learning,
“Flow”, “Noopedia” methods
“Meaning”

Nocebo, Negative
thinking/words,
actions, Stressful
empathy
No “meaning”




Maladaptive attempts:
Risky behaviors,
“Comfort eating”,
Psychoactive drugs...
Addictive behaviors…
Nocebo, Negative thinking/words, Actions, Stressful empathy, No “meaning”
(+) ➔ -
-
MC/ML System Tone
-
+ acute/- chronic
Stress System Tone

Advice for Students

- Stay connected to the things that nourish you: family, friends, sports, hobbies

- Eat well and rest, particularly as exam times near

- Remember, there's not just one direct path to your future

Advice for Parents

- Stay Calm
- Set Reasonable Goals
- Set Reasonable Goals
- Get Perspective Together
- Create A Calm Study Environment
- Let them Study In Their Own Way
- Take Care Of Them
- Talk Often

“Ουκ έστιν ηδέως ζην άνευ του φρονίμως και καλώς και δικαίως, ουδέ φρονίμως και καλώς και δικαίως, άνευ του ηδέος”

“Δεν γίνεται να ζει κανείς ευχάριστα, αν δε ζει φρόνιμα, καλά και δίκαια, αλλά ούτε η φρονιμάδα, η καλοσύνη και η δικαιοσύνη νοούνται χωρίς την ευχαρίστηση”

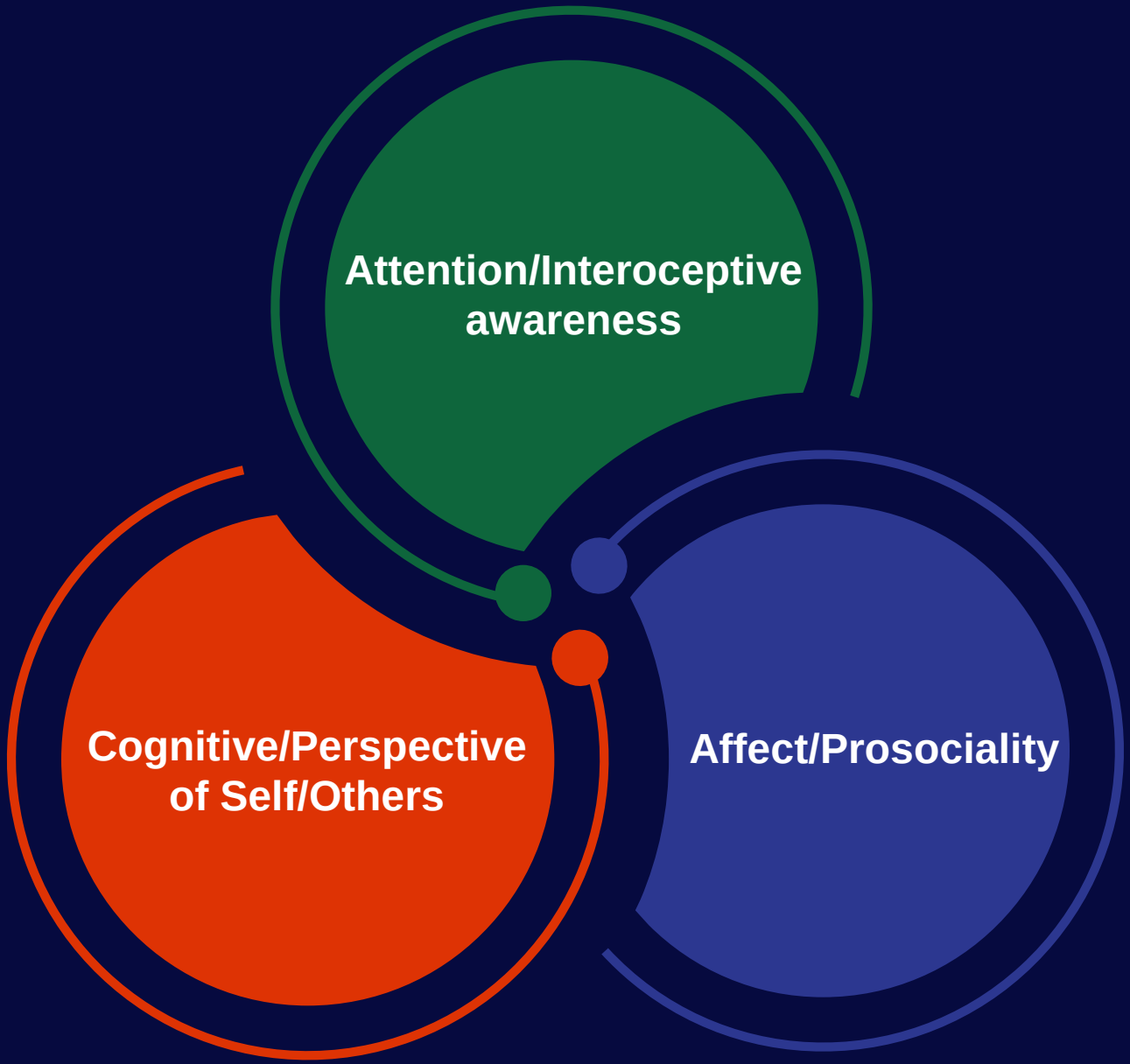
“You cannot live pleasurably if you do not live wisely, goodly and fairly, however, wisdom, goodness and justice cannot be conceived without pleasure”

Επίκουρος
Epicurus

“It is not that the Way broadens Humans; It is humans that broaden the Way.”

Confucius, the Analects

NOOPEDIA METHODS



«....έδειξε με τις πράξεις του και την μέθοδο της λογικής του ότι για να είναι κάποιος ευτυχής πρέπει να είναι καλός.....»

"....he showed with his deeds and the method of his logic that for somebody to be happy one has to be good…"

Αριστοτέλης, Επικήδειος στον Πλάτωνα
Aristotle, Eulogy to Plato 4cent BCE

Epicurean 4 Qualities of Mind that Alleviate Suffering and Bring Happiness

- ***Φιλία = friendship, love***
- ***Παρρησία = truth telling, sincerity***
- ***Εύνοια = good will***
- ***Χάρις = gratefulness***

4 Qualities of Mind that Alleviate Suffering

- ***Metta = loving kindness***
- ***Karuna = compassion***
- ***Mudita = feeling the joy of others***
- ***Upekkha = ataraxia, equanimity***

The Modern Core Virtues

- ***Self-discipline***
- ***Courage***
- ***Justice***
- ***Wisdom***
- ***Humanity***
- ***Self-transcendence***

From Peterson and Seligman: 2004

“Ουκ έστιν ηδέως ζην άνευ του φρονίμως και καλώς και δικαίως, ουδέ φρονίμως και καλώς και δικαίως, άνευ του ηδέος”

“Δεν γίνεται να ζει κανείς ευχάριστα, αν δε ζει φρόνιμα, καλά και δίκαια, αλλά ούτε η φρονιμάδα, η καλοσύνη και η δικαιοσύνη νοούνται χωρίς την ευχαρίστηση”

“You cannot live pleasurably if you do not live wisely, goodly and fairly, however, wisdom, goodness and justice cannot be conceived without pleasure”

.

⊕□Ψ |J⟩|∫

Epicurus

EYTYXIAN EYXON

Search for happiness

JULY 8 / JULY 15, 2013

SUMMER DOUBLE ISSUE / Best Books for the Beach 96

Same-Sex Triumph 15 Cuba's Evolution 58 Royal Baby 46

TIME

Why Americans are wired to be happy—and what that's doing to us

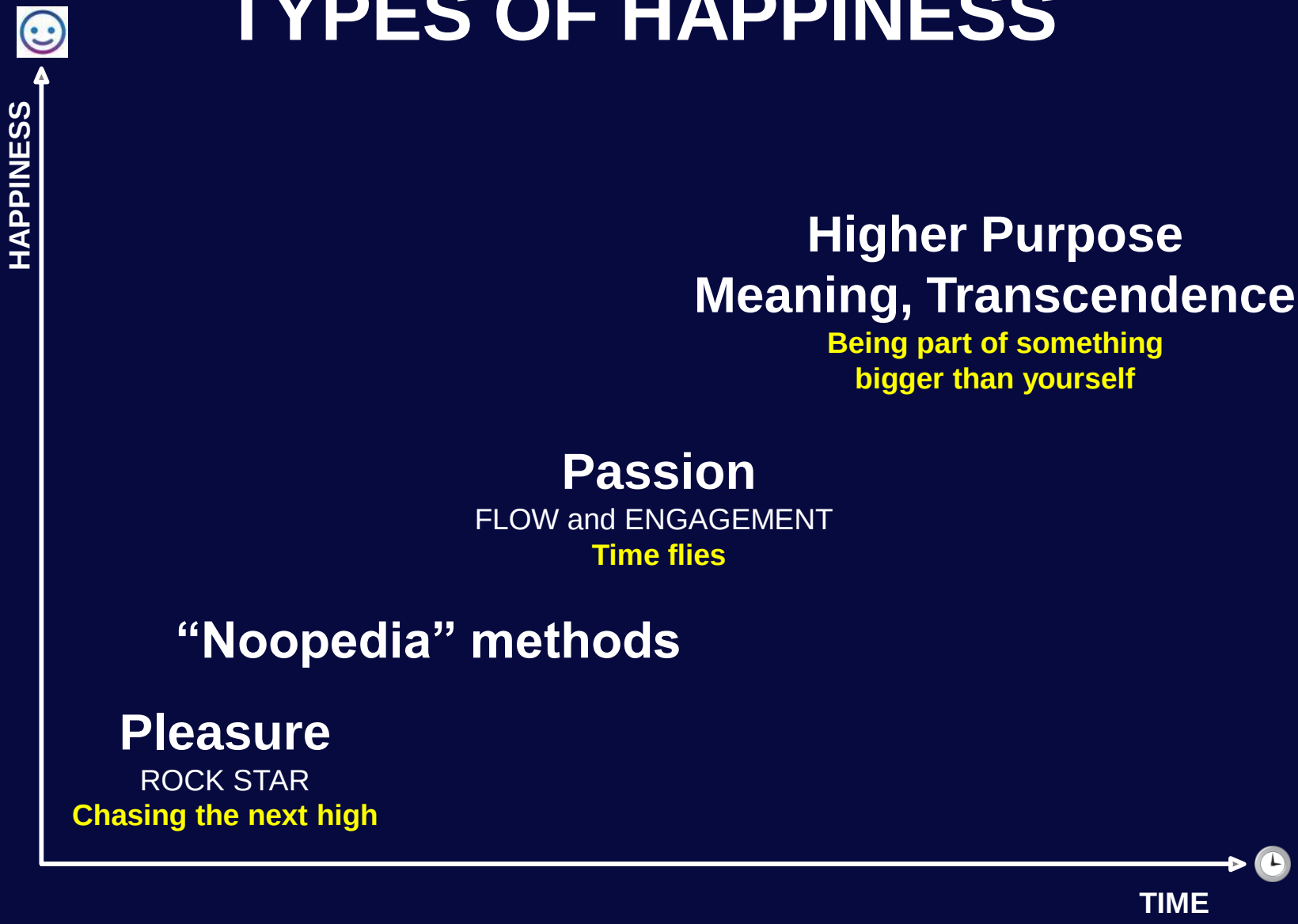
BY JEFFREY KLUGER

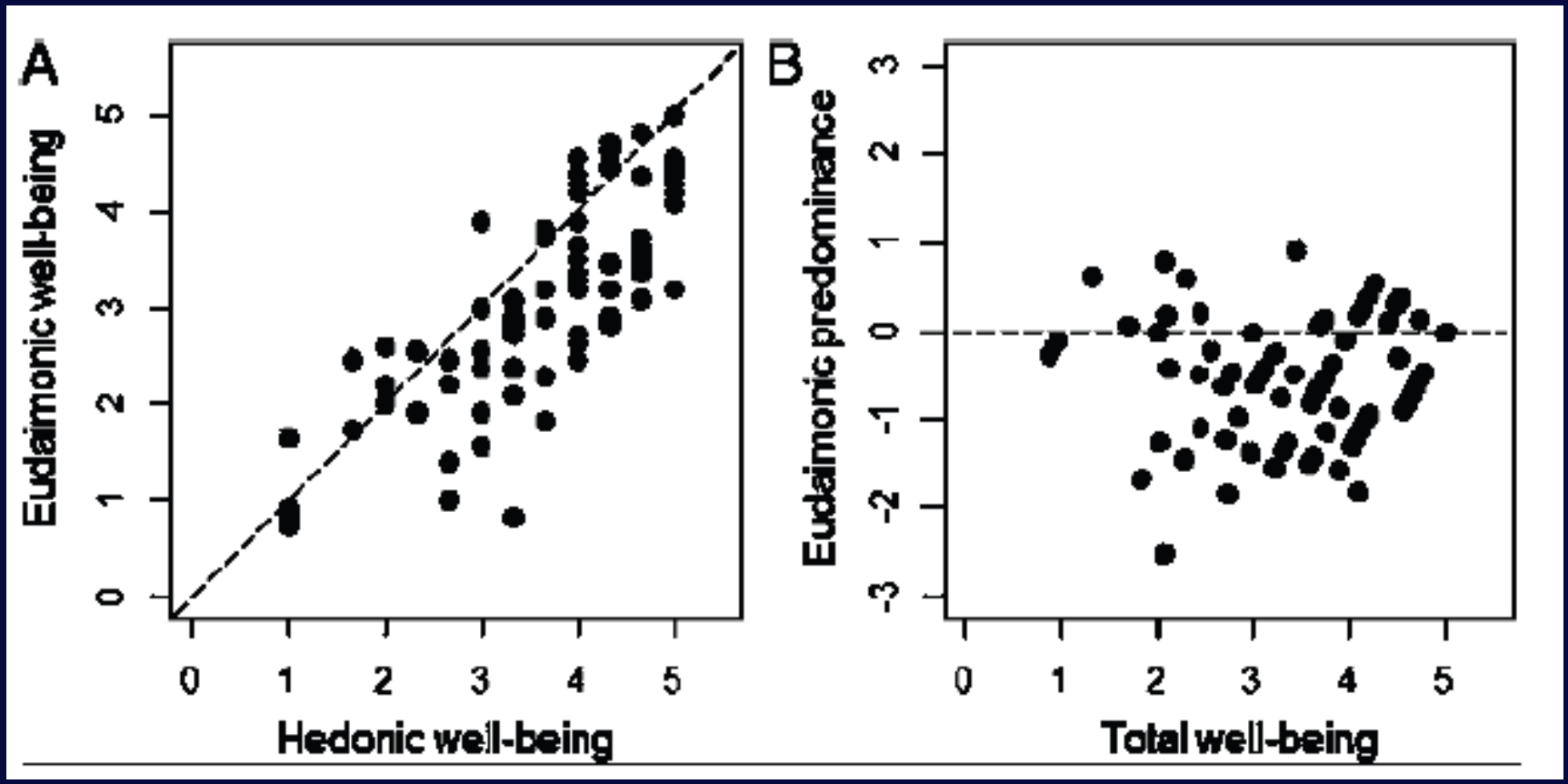
Does Facebook bring you down? TIME poll, 34

Jon Meacham on what Jefferson meant 38

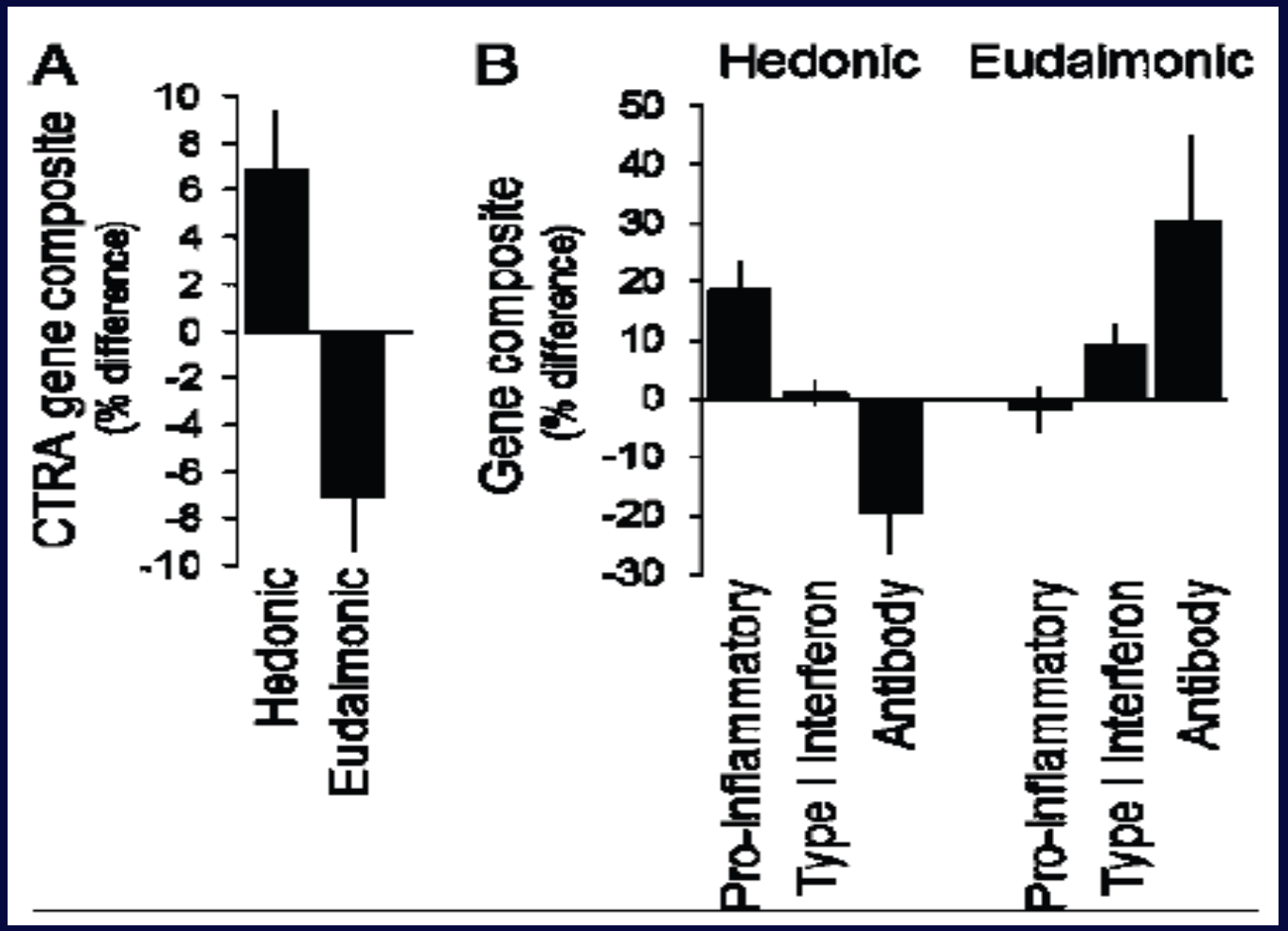
time.com

HAPPINEES FRAMEWORK
TYPES OF HAPPINESS





Fredrickson BL *et al. PNAS* 2013; 110 (33): 13684-13689



Fredrickson BL *et al. PNAS* 2013; 110 (33): 13684-13689

The Economist

Gore anoints Dean
PAGES 12 AND 33

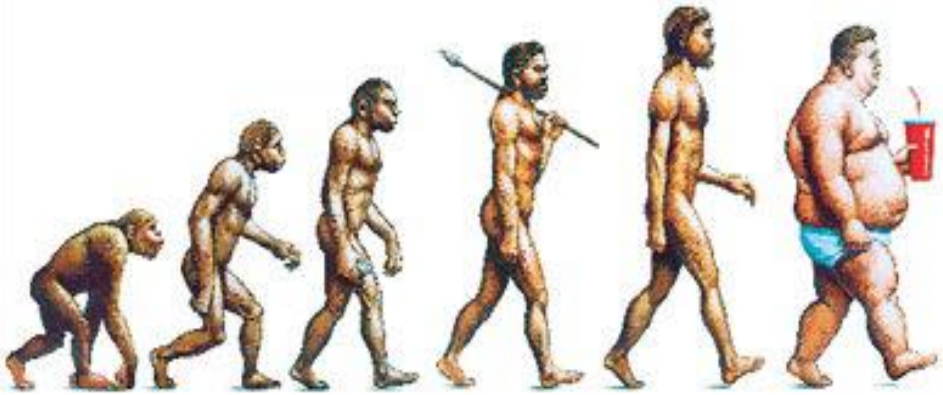
America's Taiwan test
PAGES 12 AND 29

The future of flight
PAGES 79-81

A SURVEY OF FOOD
AFTER PAGE 52

DECEMBER 13TH-19TH 2003 www.economist.com

The shape of things to come

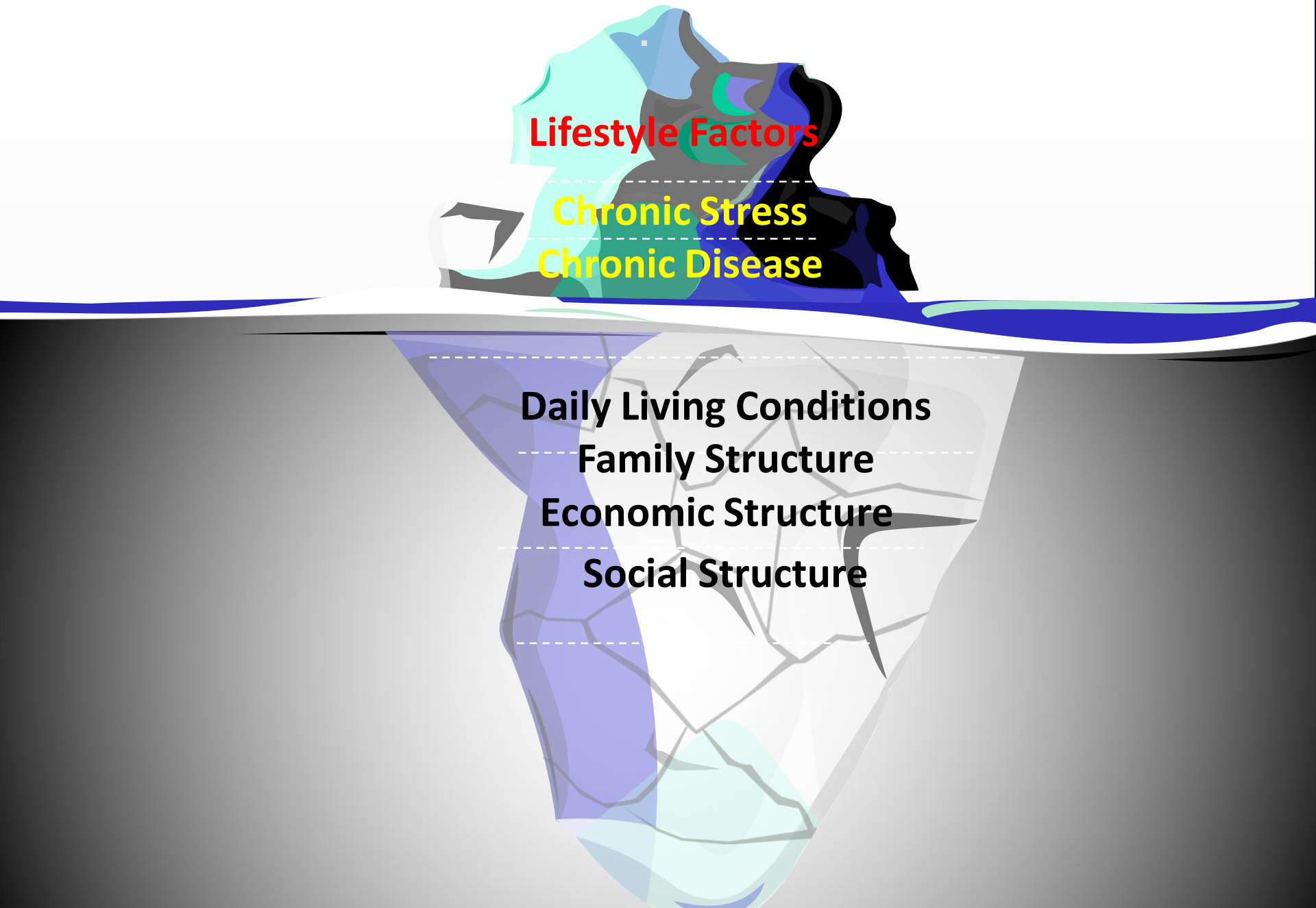


US$4.95 · C$6.95

Selections of Genetic and Epigenetic Networks Participating in Functions Important for Human Survival and Species Preservation

RESPONSE TO SURVIVAL THREAT	SELECTIVE ADVANTAGE	CONTEMPORARY DISEASE
Combat starvation	Energy conservation	Obesity
Combat dehydration	Fluid and electrolyte conservation	Hypertension
Combat infectious diseases	Potent immune reaction	Autoimmunity/Allergy
Anticipate adversaries	Arousal/fear	Anxiety/insomnia
Minimize exposure to danger	Withdrawal	Depression
Prevent tissue strain/damage	Retain tissue integrity	Pain and fatigue syndromes
Prevent social disruption	Retain social integrity	Evil behaviors (psychopathy, racism, fanaticism, chauvinism, etc.)

Chrousos, Amer J Med 2004


Lifestyle Factors
Chronic Stress
Chronic Disease
Daily Living Conditions
Family Structure
Economic Structure
Social Structure

ENVIRONMENTAL STRESSORS

Starvation
Dehydration
Injurious agents-inflammations
Adversaries-anticipation
Adversaries-avoidance
Injury-minimization
Social disruption

Maternal Stress,
Embryogenesis

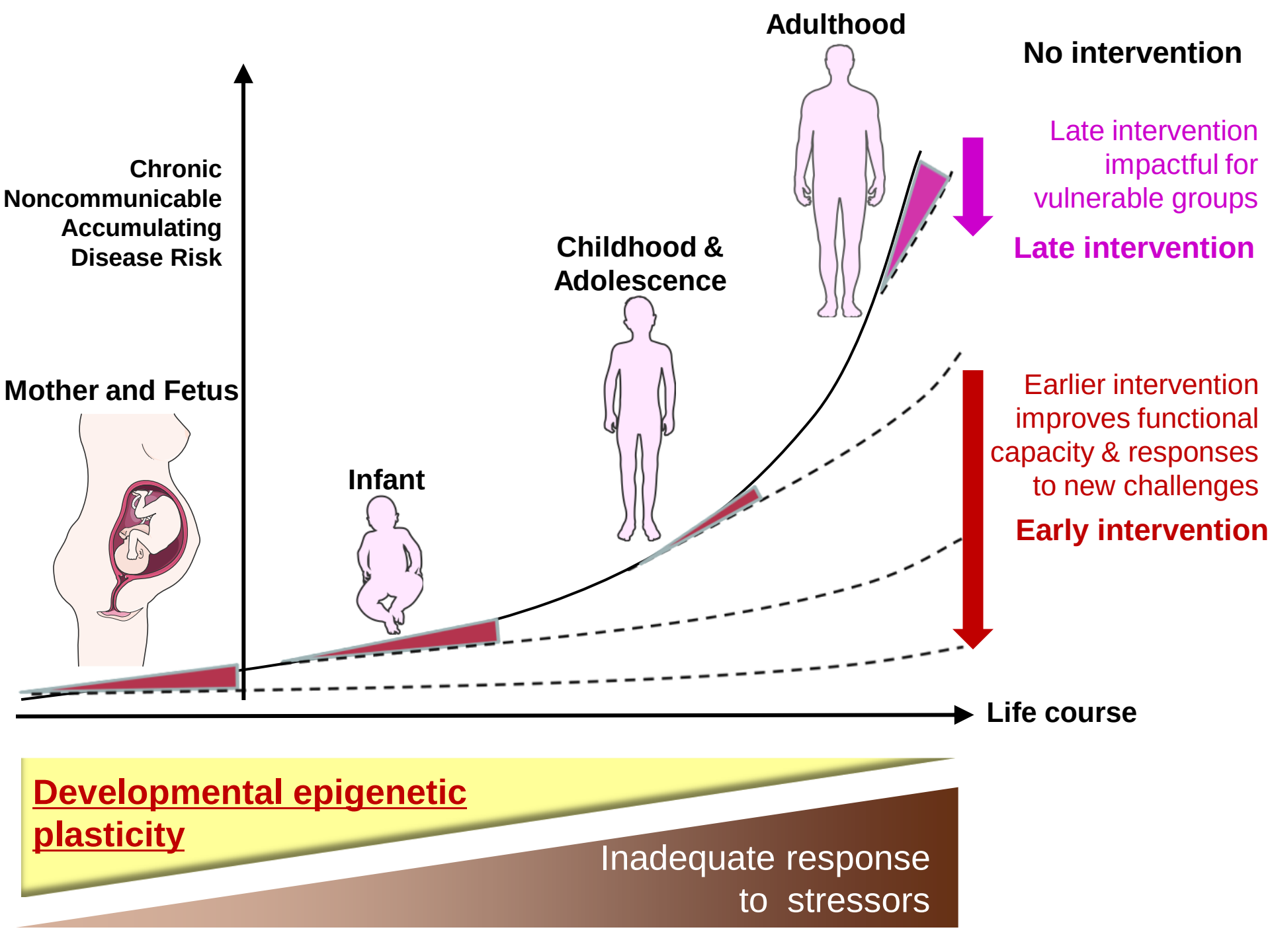
Species *vs.* Individual

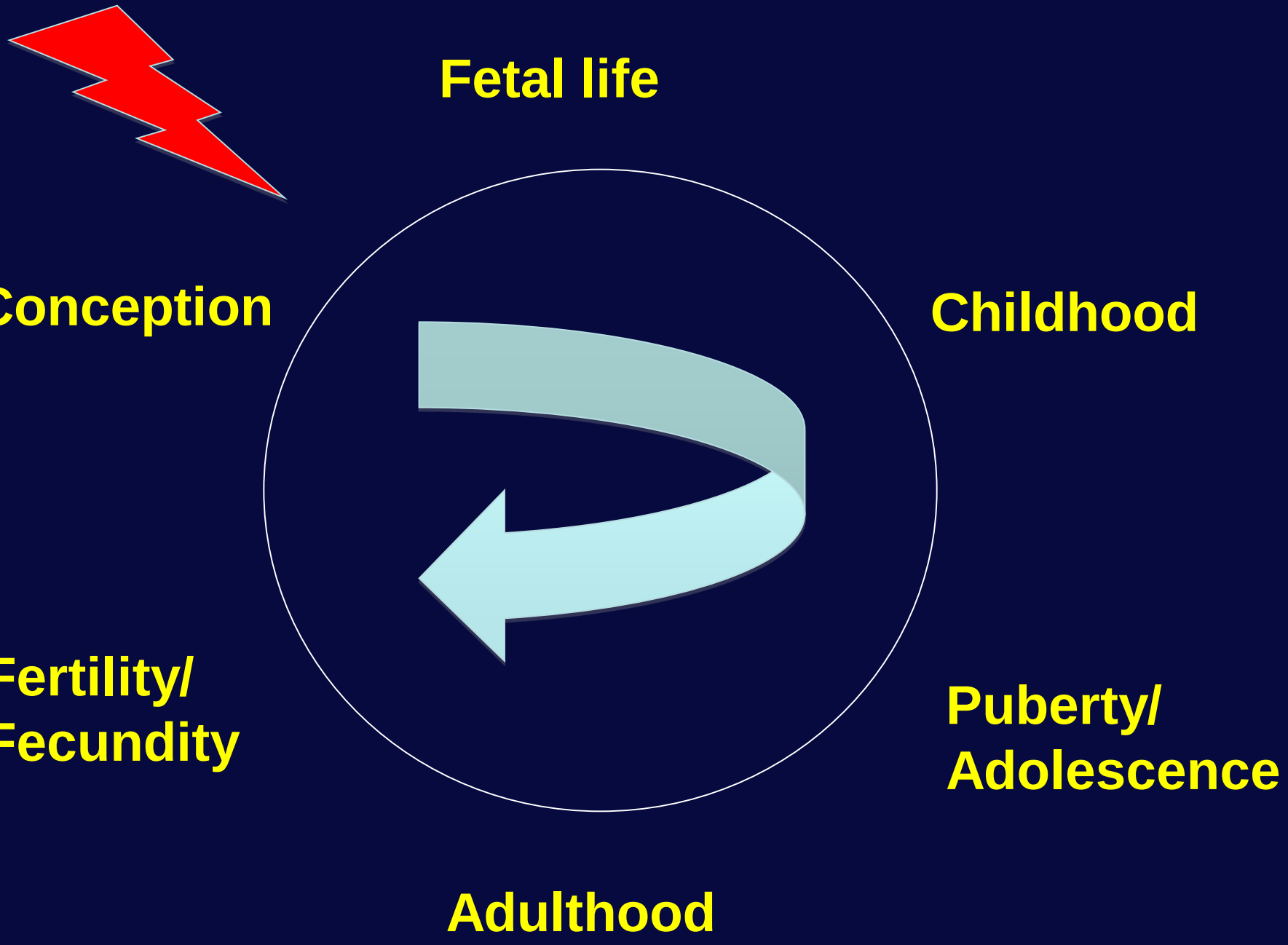
Evolution
Genetics
CNS complexity

Development
Epigenetics
CNS plasticity

Genotype ⇄ Epigenotype

Phenotype


Adulthood
No intervention
Late intervention impactful for vulnerable groups
Late intervention
Chronic Noncommunicable Accumulating Disease Risk
Childhood & Adolescence
Mother and Fetus
Infant
Earlier intervention improves functional capacity & responses to new challenges
Early intervention
Life course
Developmental epigenetic plasticity
Inadequate response to stressors


Fetal life
Childhood
Puberty/
Adolescence
Adulthood
Fertility/
Fecundity
Conception