

“Nature vs Nurture: The Battle For the Control of Behavior”

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IDENTITY

and the
nature-nurture
question

How many unique humans can there be?

GENES (20% of “genome”)

~21,000 coding genes

~10 promoters per gene

~4,000,000 RNA regulators

~ 4,000,000 SNPs (single nucleotide polymorphisms)

~100 copy number variants (CNVs) per person

~500,000 insertion-deletions (INDELS) per person

~ 100,000 transversions

NON CODING transposons (80% of genome)

So about the same number as genes, but also tissue specific

= 10^{61} number based on genetics + $10^{9?}$ epigenetic combos

= 10^{70} number of possible individuals + $10^{10?}$ mutations

How many unique humans can there be?

...so, referencing this otherwise useless chart....

$1 \times 10^3 = 1$ thousand

$1 \times 10^6 = 1$ million

$1 \times 10^9 = 1$ billion

$1 \times 10^{12} = 1$ trillion

$1 \times 10^{15} = 1$ quadrillion

$1 \times 10^{18} = 1$ quintillion

$1 \times 10^{21} = 1$ sextillion

$1 \times 10^{24} = 1$ septillion

$1 \times 10^{27} = 1$ octillion

$1 \times 10^{30} = 1$ nonillion

$1 \times 10^{33} = 1$ decillion

$1 \times 10^{36} = 1$ undecillion

$1 \times 10^{39} = 1$ duodecillion

$1 \times 10^{42} = 1$ tredecillion

$1 \times 10^{45} = 1$ quattuordecillion

$1 \times 10^{48} = 1$ quindecillion

$1 \times 10^{51} = 1$ sexdecillion

$1 \times 10^{54} = 1$ septendecillion

$1 \times 10^{57} = 1$ octodecillion

$1 \times 10^{60} = 1$ novemdecillion

$1 \times 10^{63} = 1$ vigintillion

$1 \times 10^{66} = 1$ unvigintillion

$1 \times 10^{69} = 1$ duovigintillion

$1 \times 10^{72} = 1$ trevigintillion

$1 \times 10^{75} = 1$ quattuorvigintillion

$1 \times 10^{78} = 1$ quinvigintillion

$1 \times 10^{81} = 1$

sexvigintillion

$1 \times 10^{84} = 1$ septenvigintillion

$1 \times 10^{87} = 1$ octovigintillion

$1 \times 10^{90} = 1$ novemvigintillion

$1 \times 10^{93} = 1$ trigintillion

$1 \times 10^{96} = 1$ untrigintillion

$1 \times 10^{99} = 1$ duotrigintillion

$1 \times 10^{100} = 1$ googol

1×10^{81}

possible unique humans

And there are **10^{82} atoms in the universe**

About the same as the number
of possible unique humans...

So no two humans will ever be the same...

But it gets a touch more complicated than that

Transposons



3 most vulnerable times for epigenetic modifications due to stressors, etc

- 1-Postconception
- 2-Postnatal
- 3-Pre-conception

Alterations in sperm

IDENTICAL TWINS

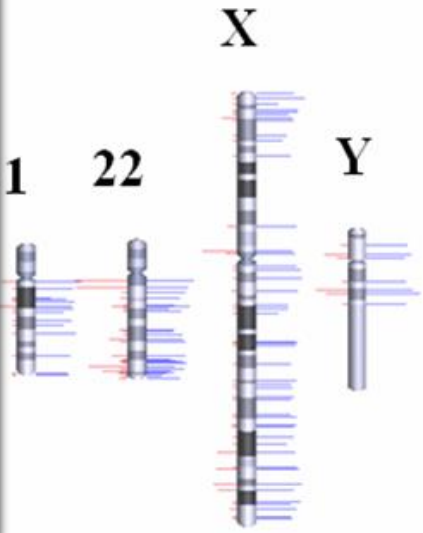
Aren't identical twins genetically identical?



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NEVER

COPY NUMBER VARIANTS



Two thought experiments you should be able to answer within the hour....

1) One of the arguments often heard from prosecutors is when defendants have siblings that....

“have the same DNA and were raised in the same abusive household but they didn’t commit a capital offense.”

How does a defense attorney create a dialogue which will engage jurors?

2) What is the more important determinant of Normal vs criminal behavior?

DIAGNOSIS vs Traits

CATEGORICAL DIAGNOSIS VS TRAITS

EXAMPLE

OBSESSIVE AND COMPULSIVE PERSONALITY TRAITS

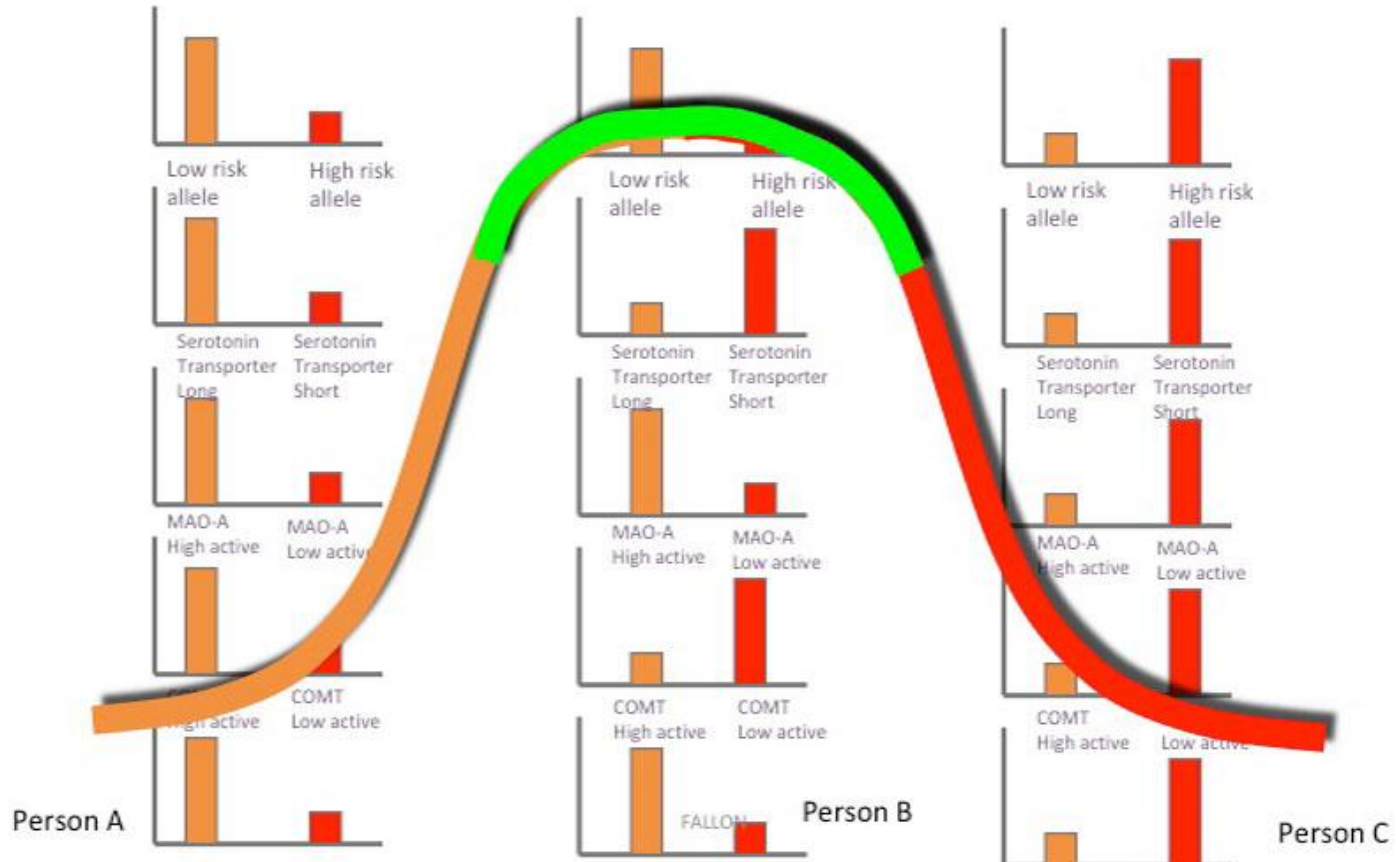
VS

OBSESSIVE COMPULSIVE DISORDER

VS

OBSESSIVE COMPULSIVE PERSONALITY DISORDER

FROM TRAITS TO CATEGORICAL DIAGNOSIS



MOST PEOPLE WITH THESE
PERSONALITY DISORDERS HAVE
EXPERIENCED

**SERIOUS EARLY
CHILDHOOD TRAUMA**

AND/OR

ABANDONMENT

TWO BIOLOGICAL DETERMINANTS (“NATURE” –i.e., basic genes and brain connections) PERMANENTLY ALTERED EPIGENETICALLY BY EARLY TRAUMA (“NURTURE” i.e., environment)

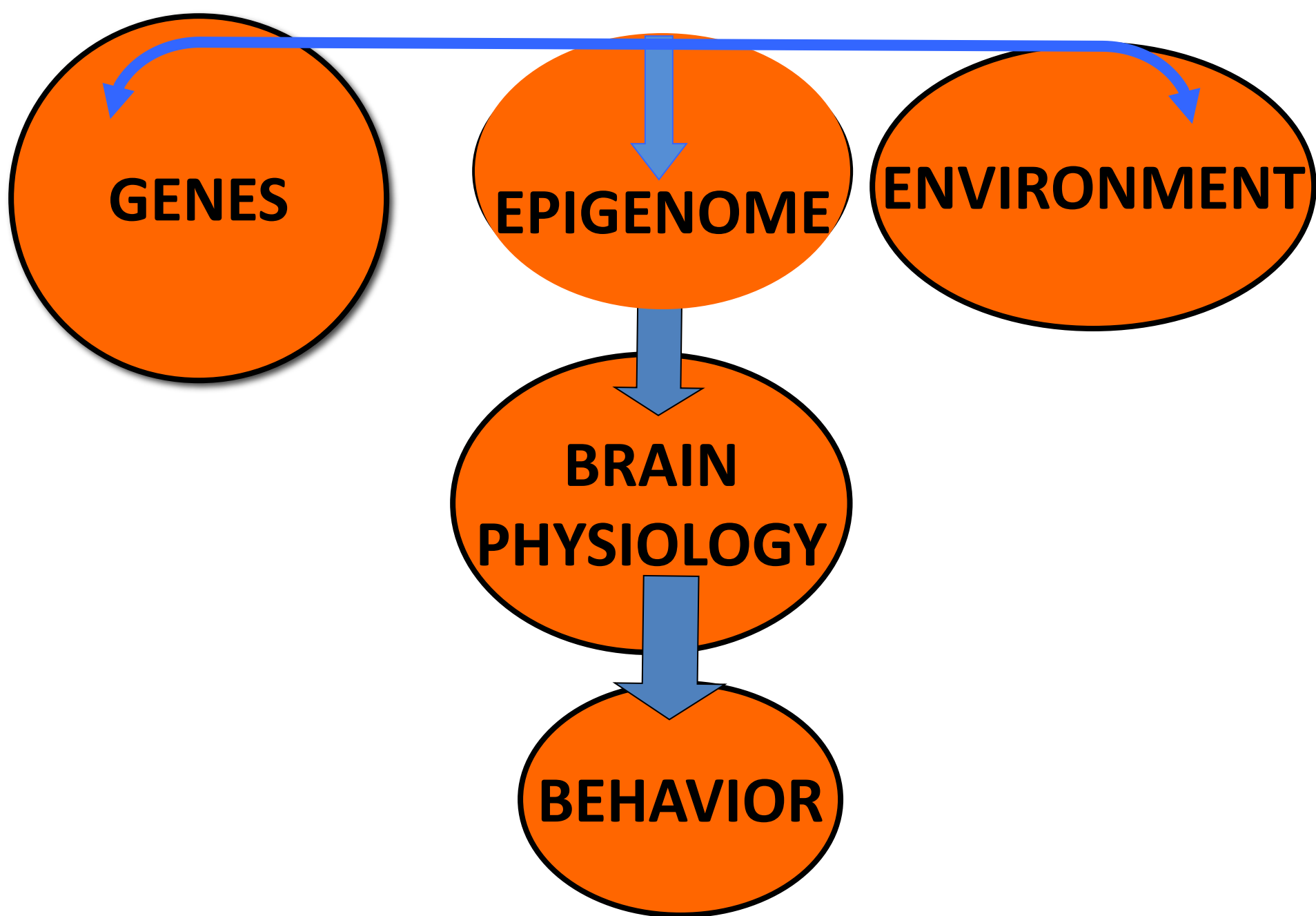
Psychopathy



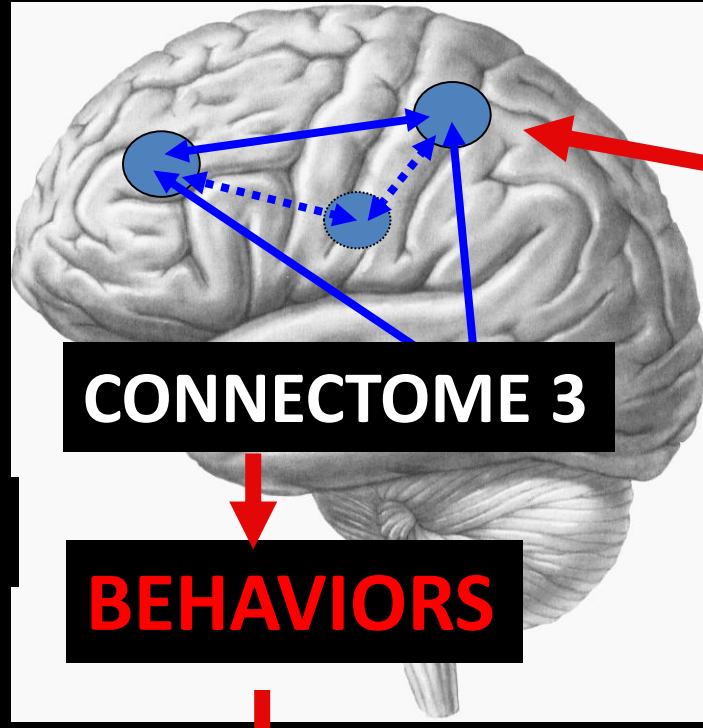
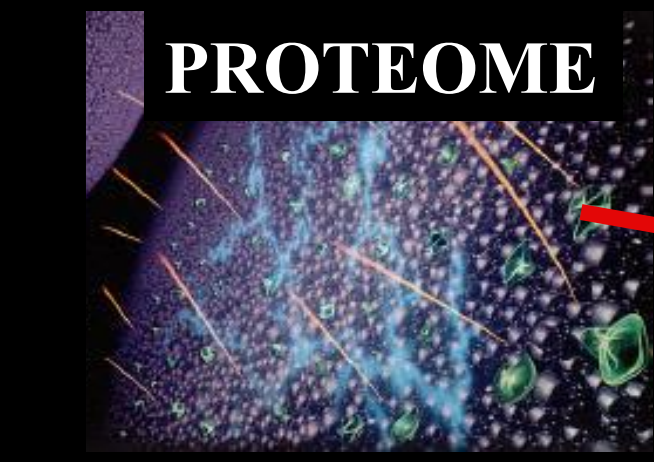
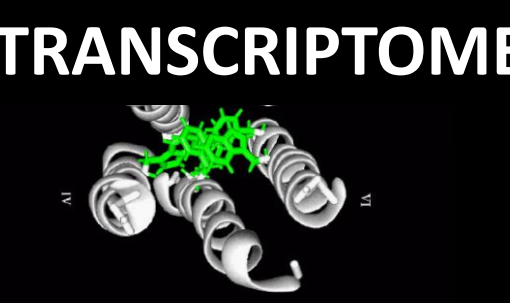
Early
Abuse

High vulnerability
genetic alleles

Functional brain loss
orbital/medial PFC, amygdala

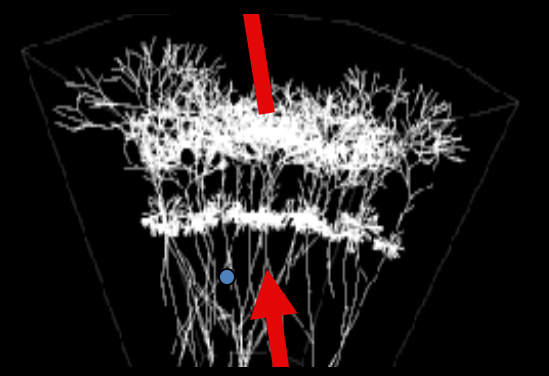
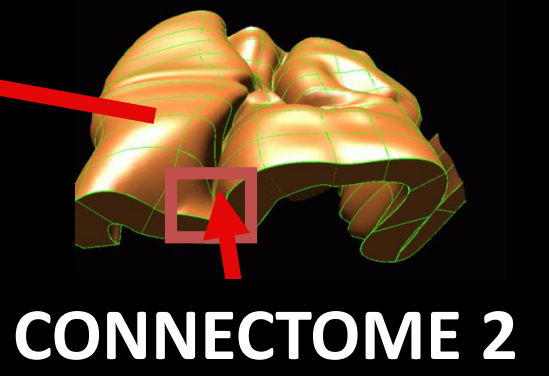


TIMING OF THE TRAUMA IS VERY IMPORTANT



BEHAVIORS

DISORDER



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DIAGNOSIS vs Traits

CRIMINAL POPULATION

Hare Psychopathy Checklist

Factor 1

Core Personality traits- Aggressive narcissism
(correlated with extraversion, positive affect, sociability)

1. Glibness/superficial charm
2. Grandiose sense of self-worth
3. Pathological lying
4. Cunning/manipulative
5. Lack of remorse or guilt
6. Emotionally shallow
7. Callous/lack of empathy
8. Failure to accept responsibility for own actions

FACTOR 1

Factor 2

Socially deviant lifestyle - People with Anti-Social Personality Disorder
score high in these (correlated with criminality)

1. Need for stimulation/proneness to boredom
2. Parasitic lifestyle
3. Poor behavioral control
4. Promiscuous sexual behavior
5. Lack of realistic, long-term goals
6. Impulsiveness
7. Irresponsibility
8. Juvenile Delinquency
9. Early behavioral problems
10. Revocation of conditional release

FACTOR 2

**More useful for
the normal
population**

Psychopathic Personality Inventory (PPI)-
not necessarily criminal or aspd- asps based on behavioral
patterns vs personality/character traits. **Psychopathic Personality
Inventory: Factors and Subscales**

PPI-1: Fearless dominance

Social influence
Fearlessness
Stress immunity

PPI-2: Impulsive Antisociality

Machiavellian egocentricity
Rebellious nonconformity
Blame externalization
Carefree nonplanfulness

Also Coldheartedness

Theodore Roosevelt (1.462)
John F. Kennedy (1.408)
Franklin D. Roosevelt (1.079)
Ronald Reagan (.912)

Personality Disorders And Crime: Psychopathy

The most perniciously criminal psychiatric disorders: Personality Disorders, Cluster B- ASPD/Psychopathy and NPD

MALIGNANT NARCISSIST

Quintessential tetrad, most pure evil

DARK TETRAD

All plus sadism

DARK TRIAD

All except sadism

MACHIAVELLIAN

Normal in regular life, ruthless in business

FANATIC ZEALOTS

PSYCHOPATH

Clecklian and Casanova - lovable scoundrel

ASPD - reckless disregard, irritable, aggressive, high arousal

Dissocial

Hare malicious, cunning, narcissism

PPI playful, low arousal state, fearless, stress immunity, fearless dominance

NARCISSISTIC PD

extreme emotion,
low self humor loyal

SOCIOPATH

Aka SECONDARY PSYCHOPATH

BORDERLINE PSYCHOPATHS

Moral, Intellectual, ProSocial,
Sociopaths-acquired

**CORE
TRAITS**

PRIMARY PSYCHOPATH

does not respond to punishment, apprehension, stress, or disapproval. They seem to be able to inhibit their antisocial impulses most of the time, not because of conscience, but because it suits their purpose at the time. They don't follow any life plan, and it seems as if they are incapable of experiencing any genuine emotion.

SECONDARY PSYCHOPATH

Is a risk-taker, but are also more likely to be stress-reactive, worriers, and guilt-prone. They expose themselves to more stress than the average person, but they are as vulnerable to stress as the average person. They are daring, adventurous, unconventional people who began playing by their own rules early in life. They are strongly driven by a desire to escape or avoid pain, but are unable to resist temptation.

Both primary and secondary psychopaths can be subdivided into:



DISTEMPERED PSYCHOPATH

is the kind that seems to fly into a rage or frenzy more easily and more often than other subtypes. Their frenzy will resemble an epileptic fit. They are also usually men with incredibly strong sex drives

CHARISMATIC PSYCHOPATH

is charming, attractive liars. They are usually gifted at some talent or another, and they use it to their advantage in manipulating others. They are usually fast-talkers, and possess an almost demonic ability to persuade others out of everything they own, even their lives.

PRIMARY PSYCHOPATH

does not respond to punishment, apprehension, stress, or disapproval. They seem to be able to inhibit their emotional responses.

“PSYCHOPATH”

it seems as if they are incapable of experiencing any genuine emotion.

SECONDARY PSYCHOPATH

Is a risk-taker, but are also more likely to be stress-reactive, worriers, and guilt-prone. They expose themselves to more stress than most people.

“SOCIOPATH”

who began playing by their own rules early in life. They are strongly driven by a desire to escape or avoid pain, but are unable to resist temptation.

Both primary and secondary psychopaths can be subdivided into:



DISTEMPERED PSYCHOPATH

is the kind that seems to fly into a rage or frenzy more easily and more often than other psychopaths.

“FOLLOWER”

CHARISMATIC PSYCHOPATH

is charming, attractive liars. They are usually gifted at some talent or another, and they use it to the advantage of others.

They are almost “LEADER”

of everything they own, even their lives.

NEURONATOMICAL CONNECTIONS

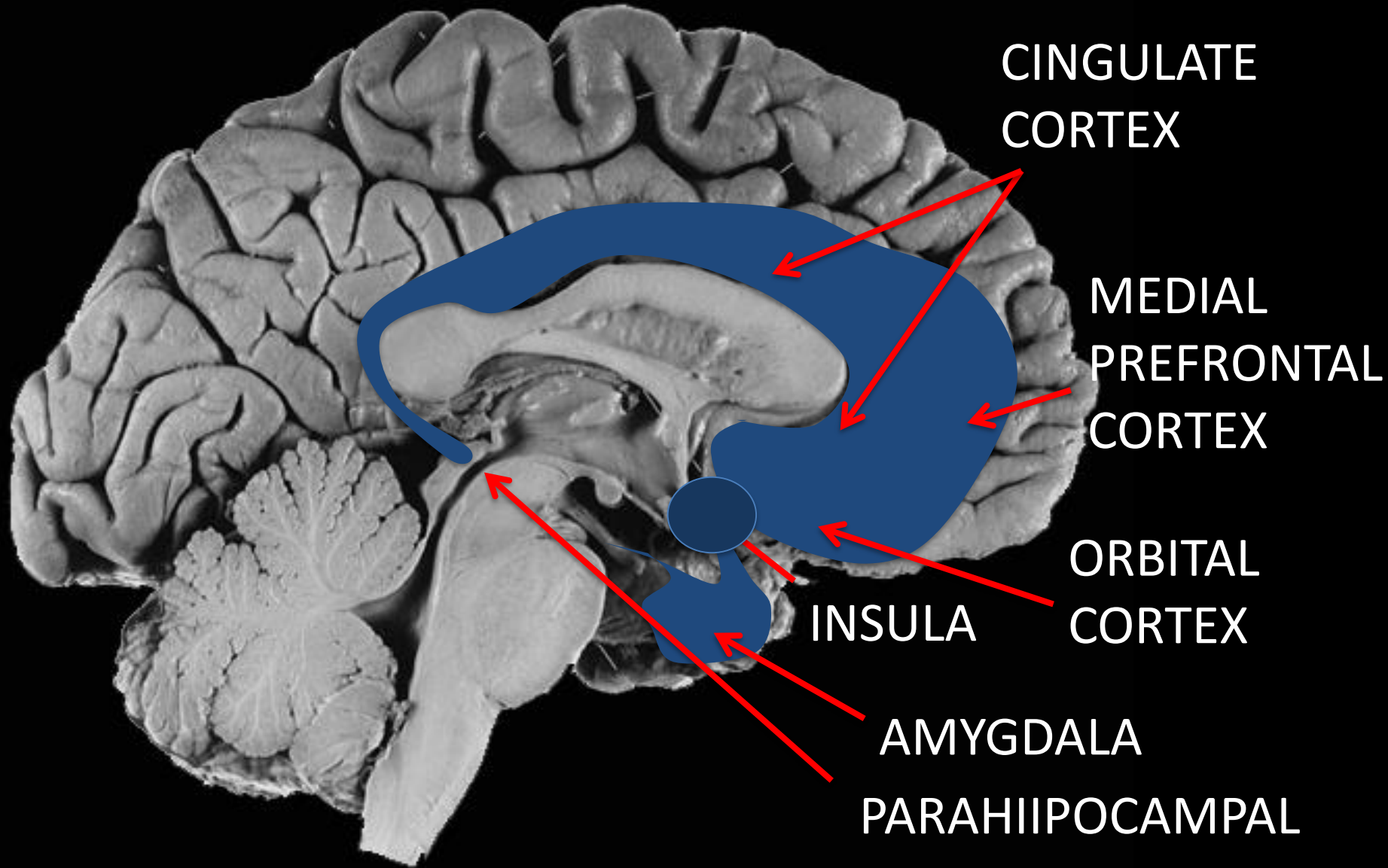
Some pervasive common traits in pernicious personality disorders of interest to criminality

Aggression and violence

Lack of moral reasoning

Lack of emotional empathy

Underactive areas of the psychopath brain



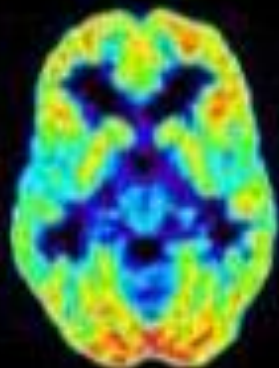
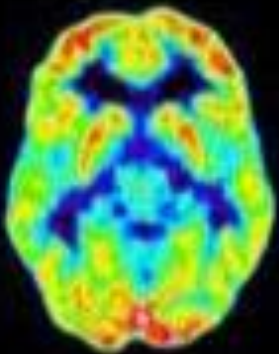
Also called the "LIMBIC LOBE" also part of SOCIAL BRAIN

normal

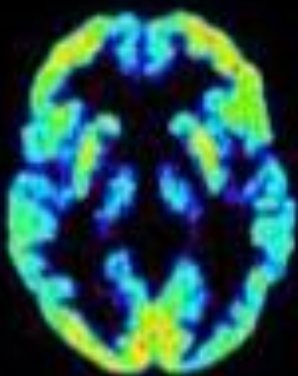
118

normal

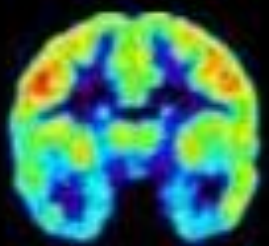
Psychopathic pattern



117



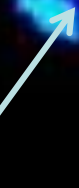
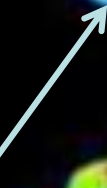
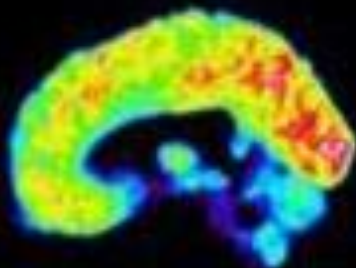
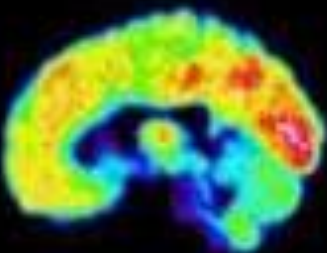
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14



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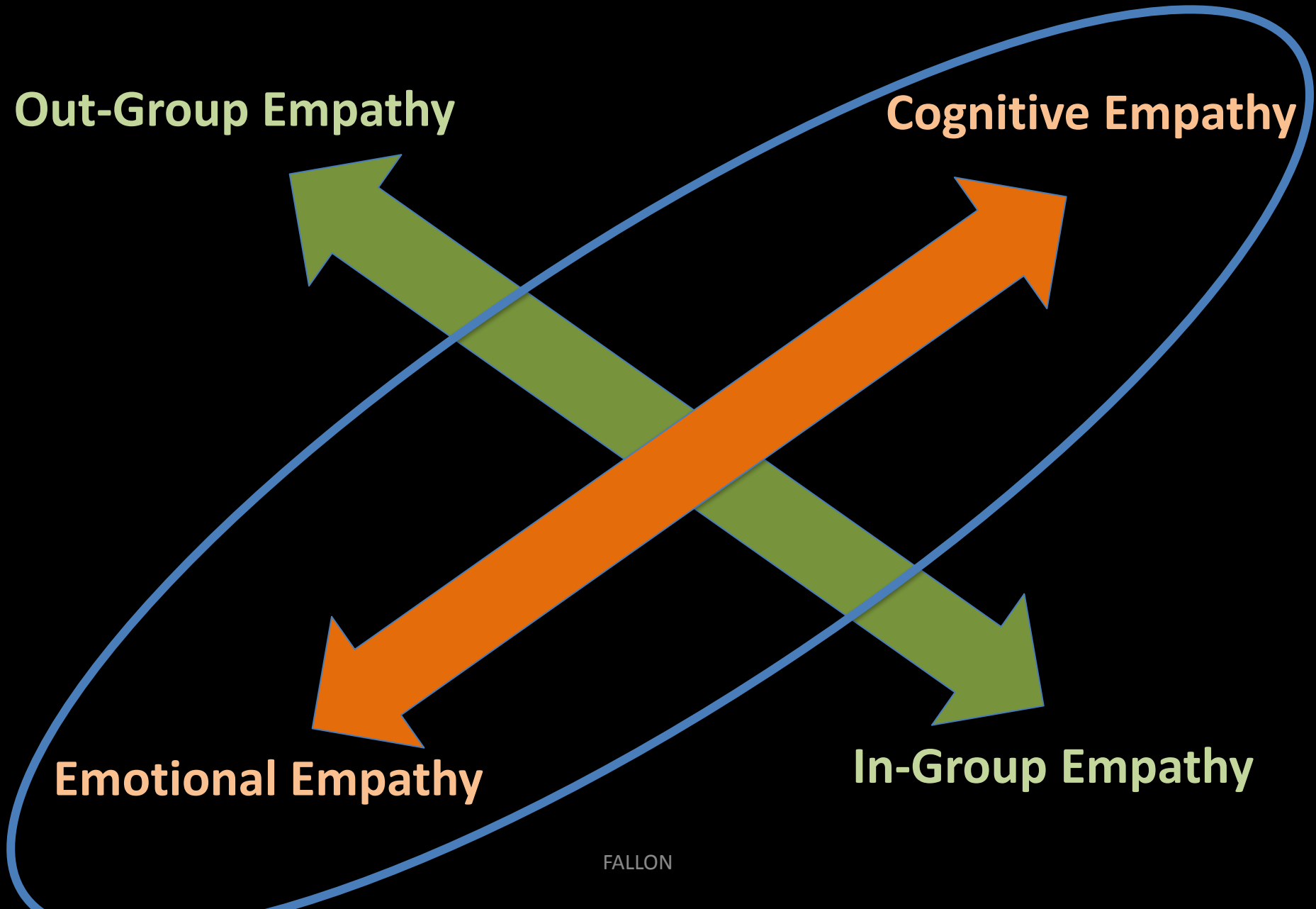
Two Empathy Axes, Four kinds of Empathy

Out-Group Empathy

Cognitive Empathy

Emotional Empathy

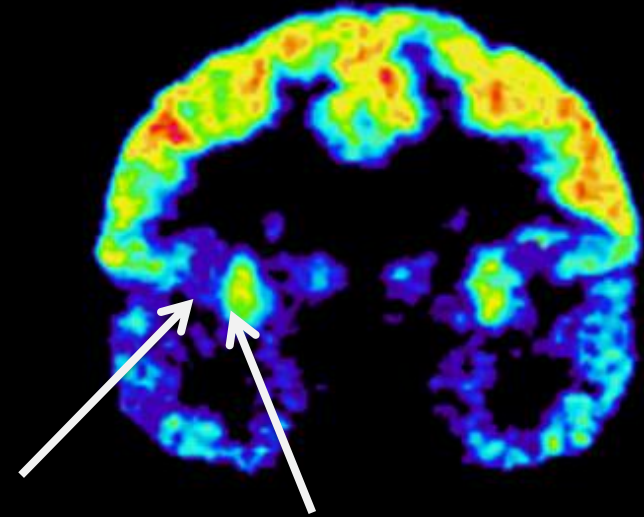
In-Group Empathy



Emotional Empathy vs Cognitive Empathy



Emotional vs Cognitive Empathy



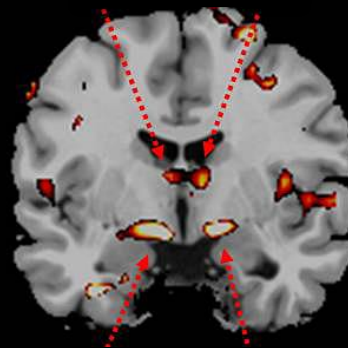
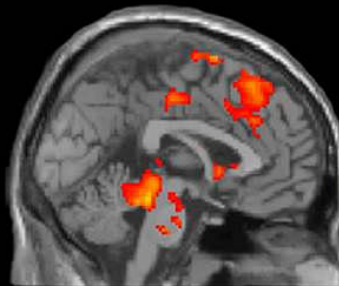
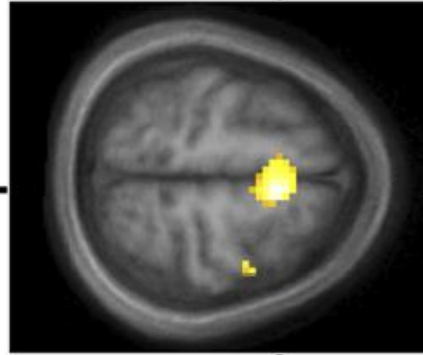
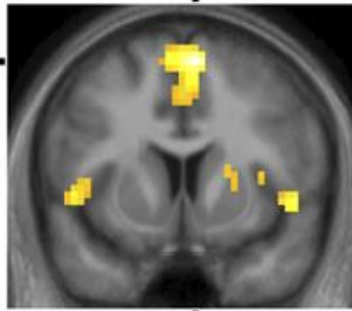
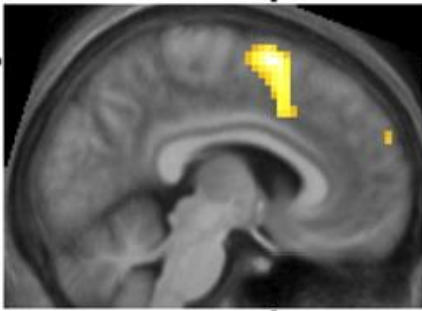
Emotional

Cognitive

Neural Correlates of Hate

Semir Zeki*, John Paul Romaya PLoS ONE | www.plosone.org

October 2008 | Volume 3 |



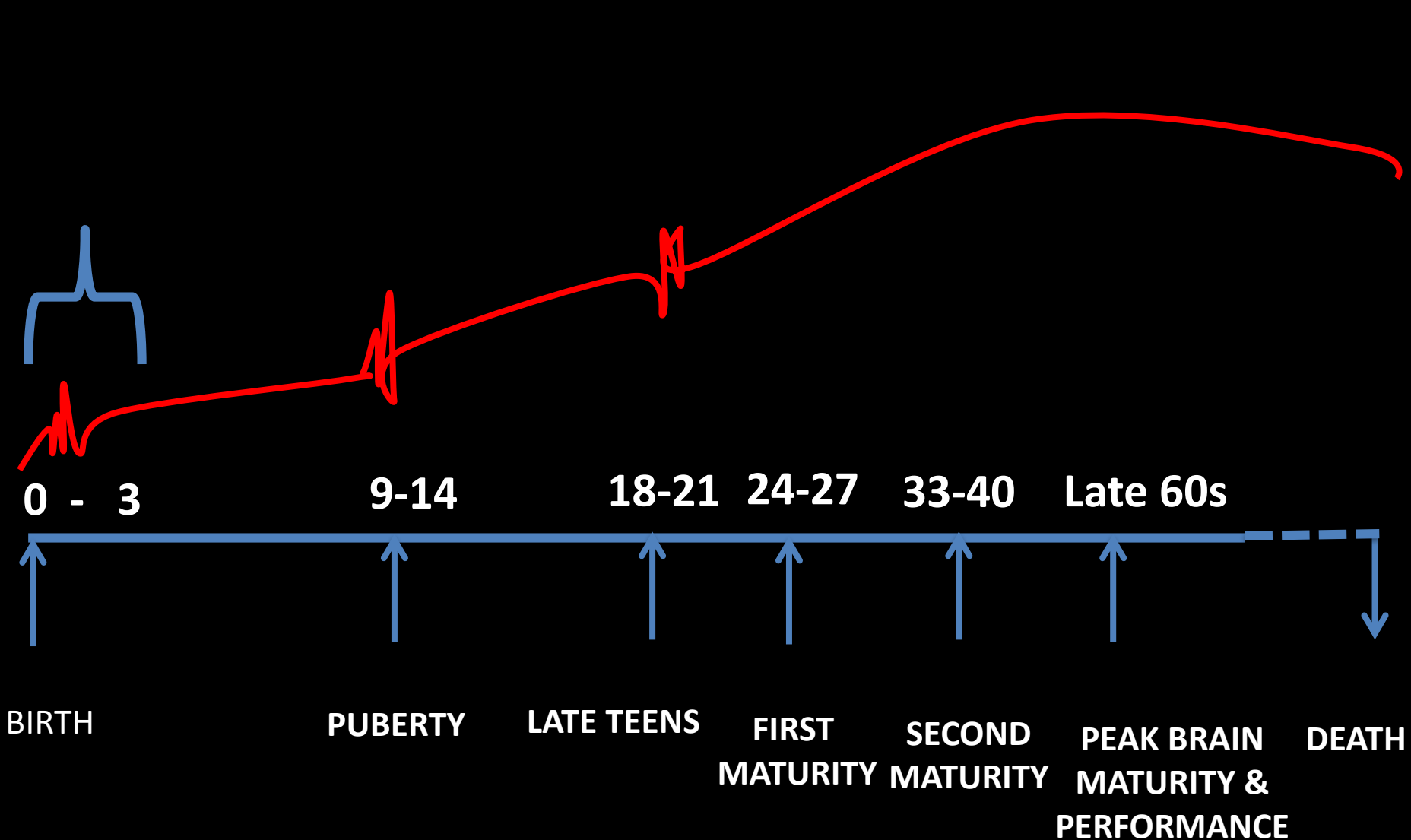
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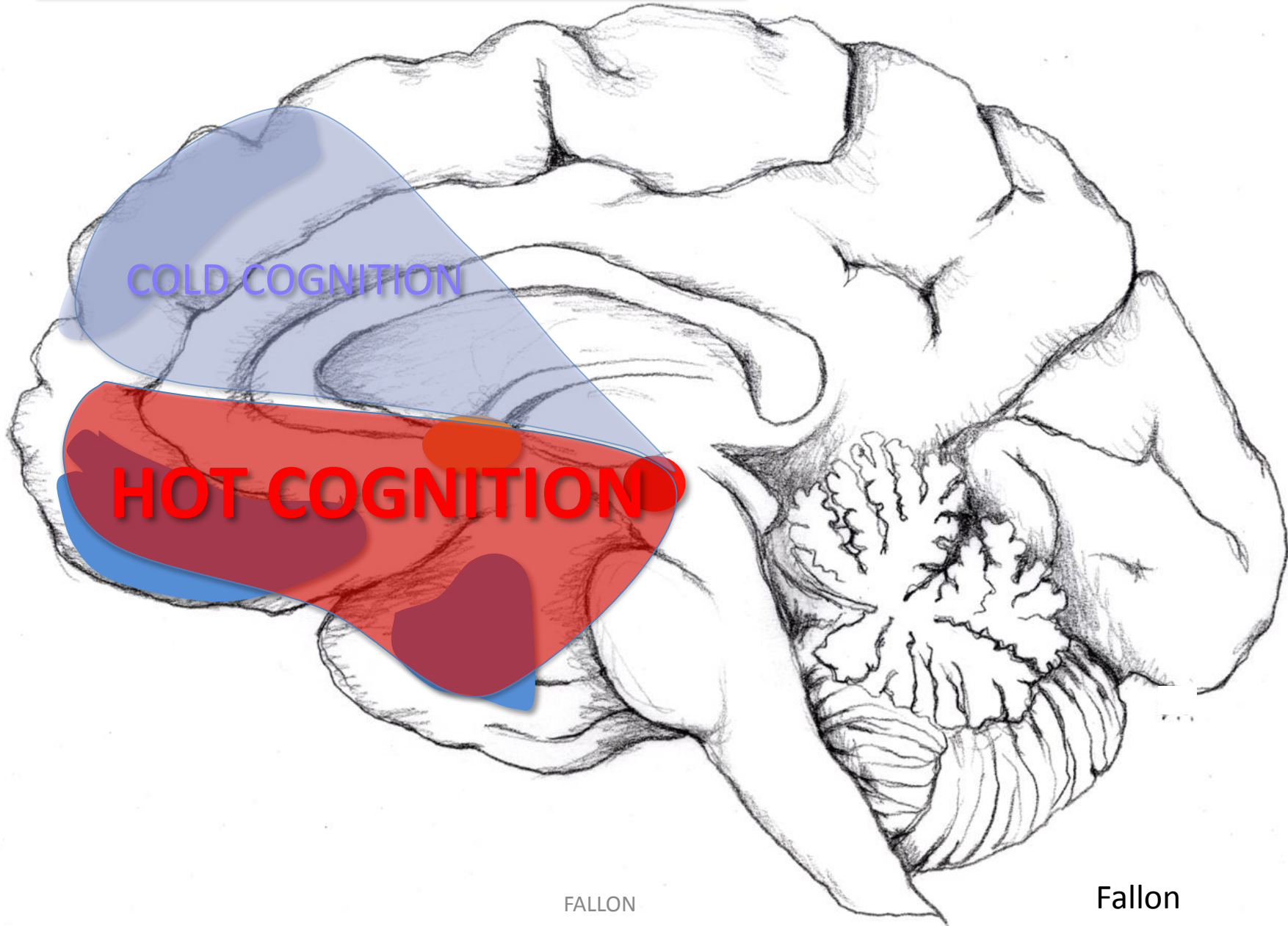
BRAIN DEVELOPMENT

KEY EPOCHS OF FRONTAL LOBE
BRAIN DEVELOPMENT

CRITICAL PERIODS of brain development



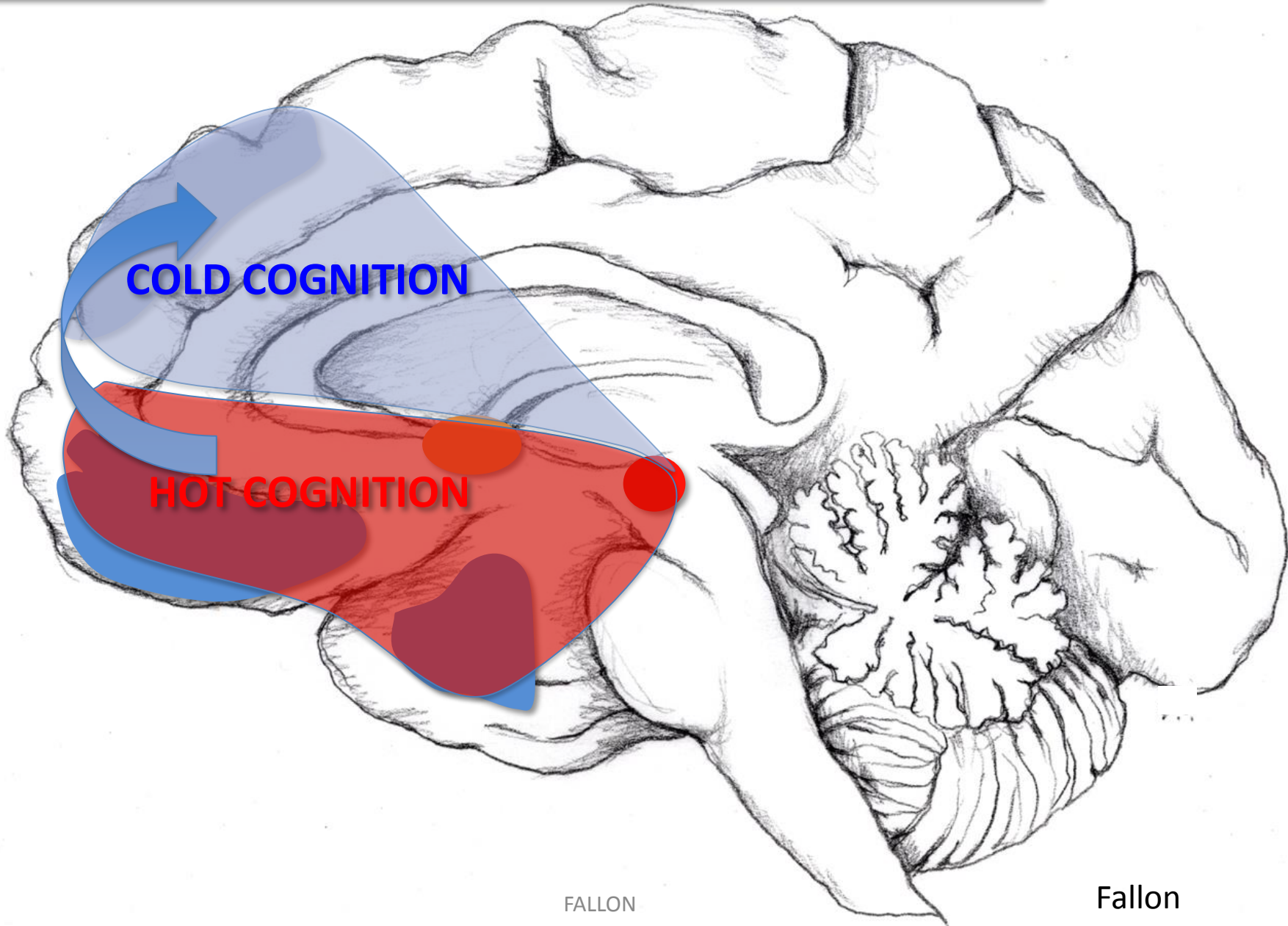
The pre-teenage prefrontal system



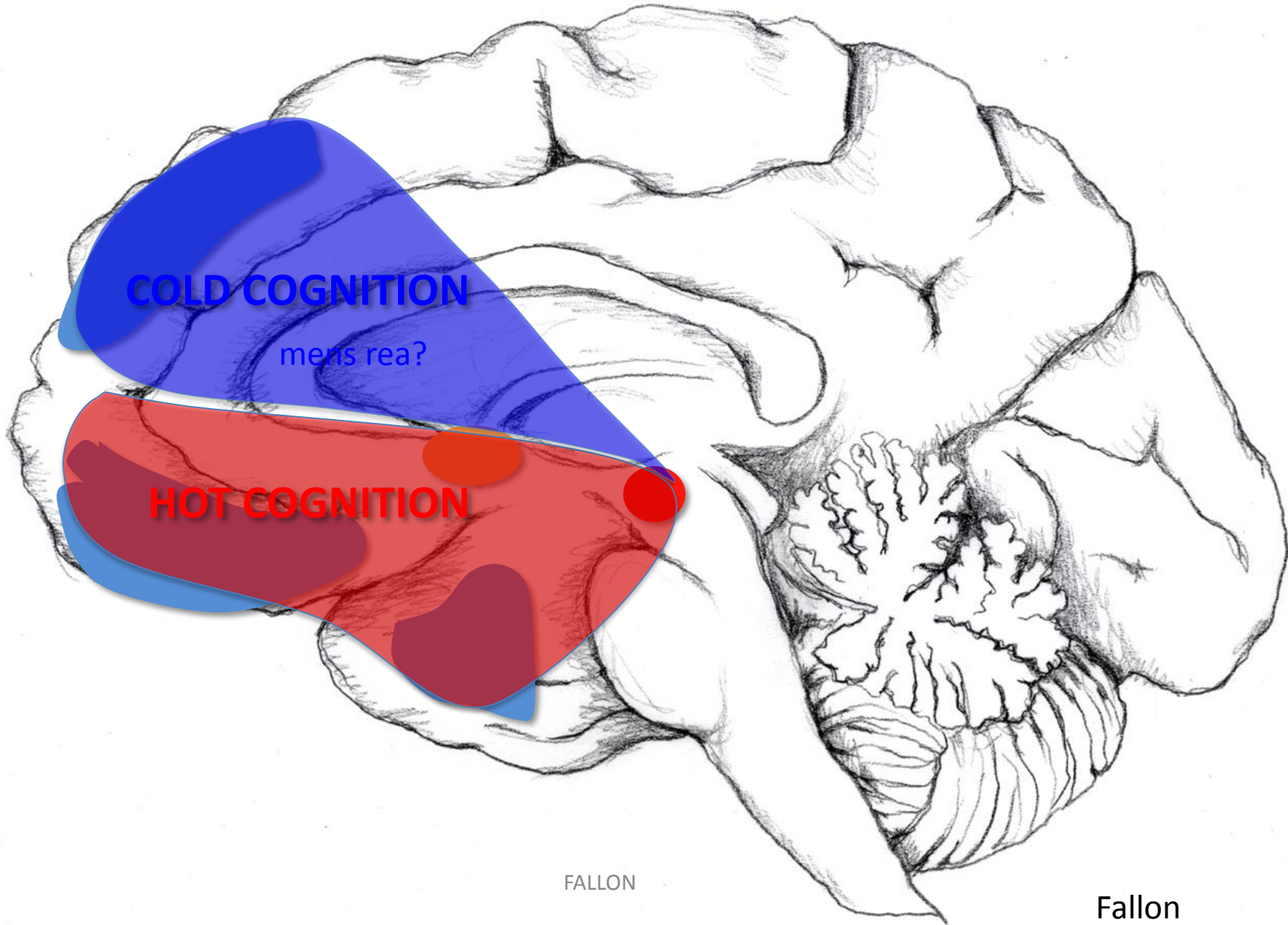
FALLON

Fallon

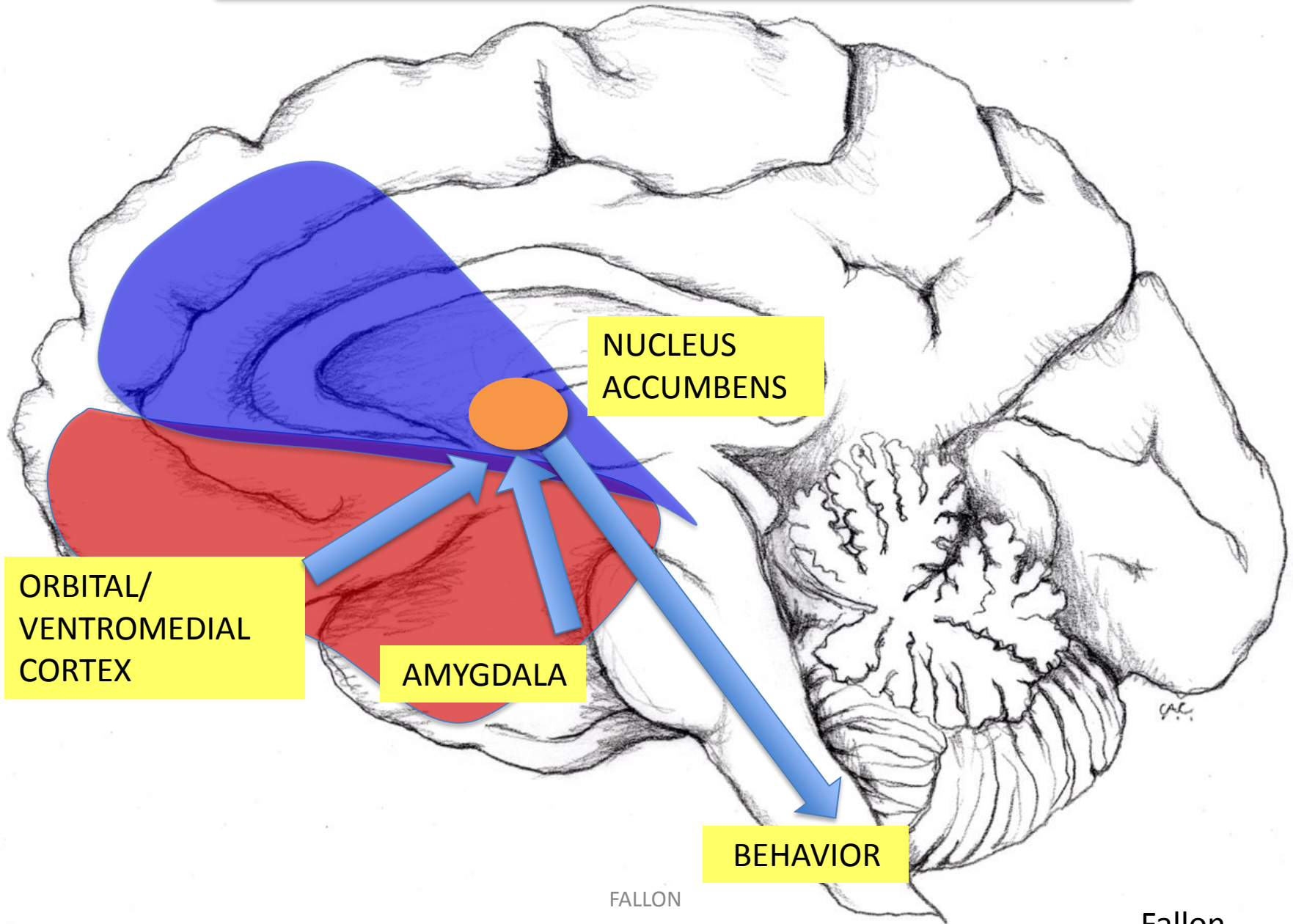
The maturing (and switching) teenage prefrontal system



The mature adult prefrontal system in balance



Competition for control of emotional behavior



GENES

General Psychiatric traits and Genetics

GENE	Example Effect	Some Interactions	Positive vs Negative Effect
MAO-A	serotonin levels	Early abuse	Abuse inc aggression
Serotonin Transporter	SERT affects aggression	Early environment	Abuse-Psychopathy Love- Offsets aggression
Oxytocin bond	Affects bonding	Self vs Other/Group Focus	Self- inc. interpersonal Group- increase lying for group
		Unequal \$\$\$ gains	Inc. envy, schadenfreude
COMT	Dopamine levels PFC	val-val WARRIOR met-met WORRIER	less efficient PFC more efficient PFC
BDNF	Memory and Anxiety	normal	inc memory, inc anxiety dec anxiety, dec memory
effect		stress	childhood- met stronger teen, adult- opposite

Psychopathic traits and Genetics

MAOA-L (“warrior gene”)

“High Risk” serotonin transporter

NE transporter

TH [TPH1,2]

Androgen receptor

DAGK1

DBH

COMT

NOS1

Aggression
and violence



+ low emotional empathy alleles

Empathy, altruism genetics

Oxytocin receptor	OXTR	G more emp than A
Testosterone receptor		more T, less generous
Vasopressin receptor	AVPR1A	
GABA GABRB3		empathy variance
Dopamine DRD4, DRD5		KIN VS NON KIN em altruism
IGF2		
COMT		
OXY related CD38		
CRF GRIN1 cortisol		

Transmitter Summary

Low Levels

Norepineprine (NE)
Serotonin (5-HT)
GABA
MAO

High Levels

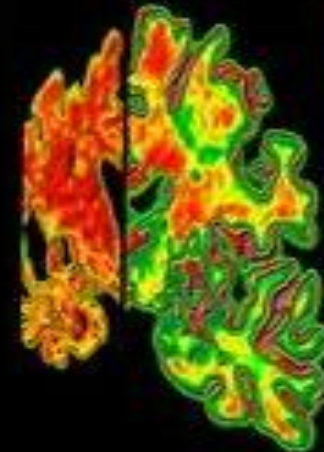
Dopamine (DA)
Glutamate



Leads to sensitivity to reward mechanisms, sensation seeking behavior, and the tendency to express oneself more aggressively.



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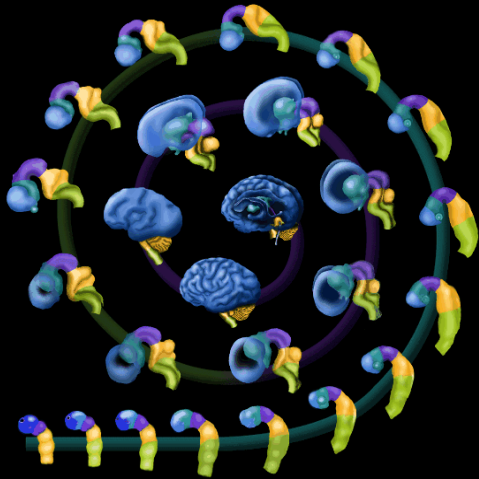
SASHA REID

EPIGENETICS

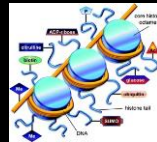


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Brain Development Normal



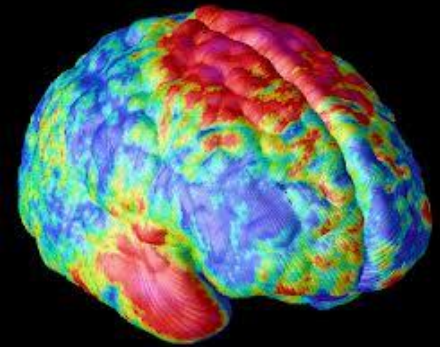
Genetic Mutation



Epigenetic Modifications

Brain Development Disorder

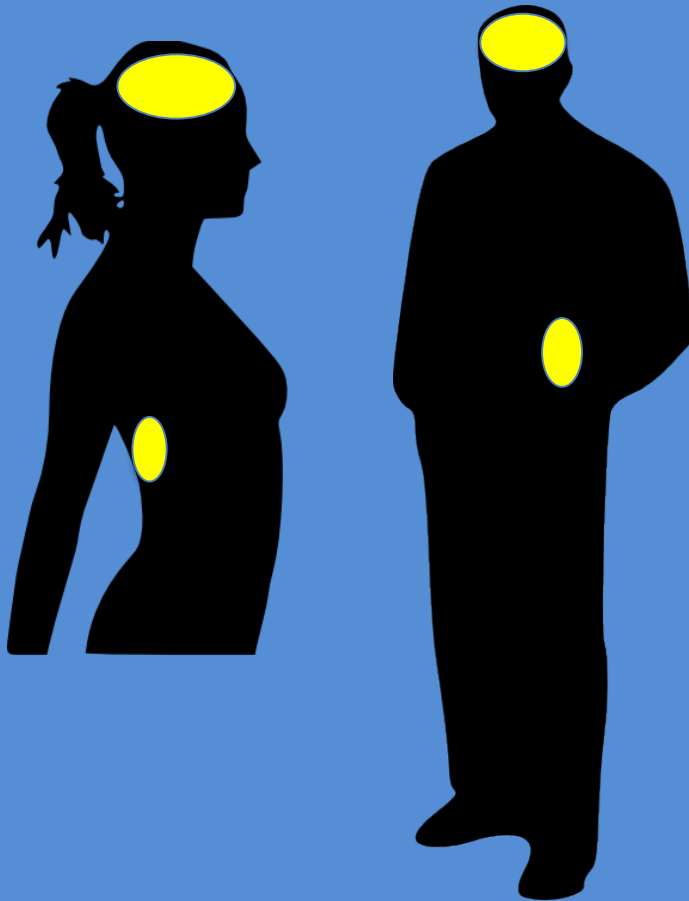
**SCHIZOPHRENIA
DEPRESSION
ALZHEIMERS**

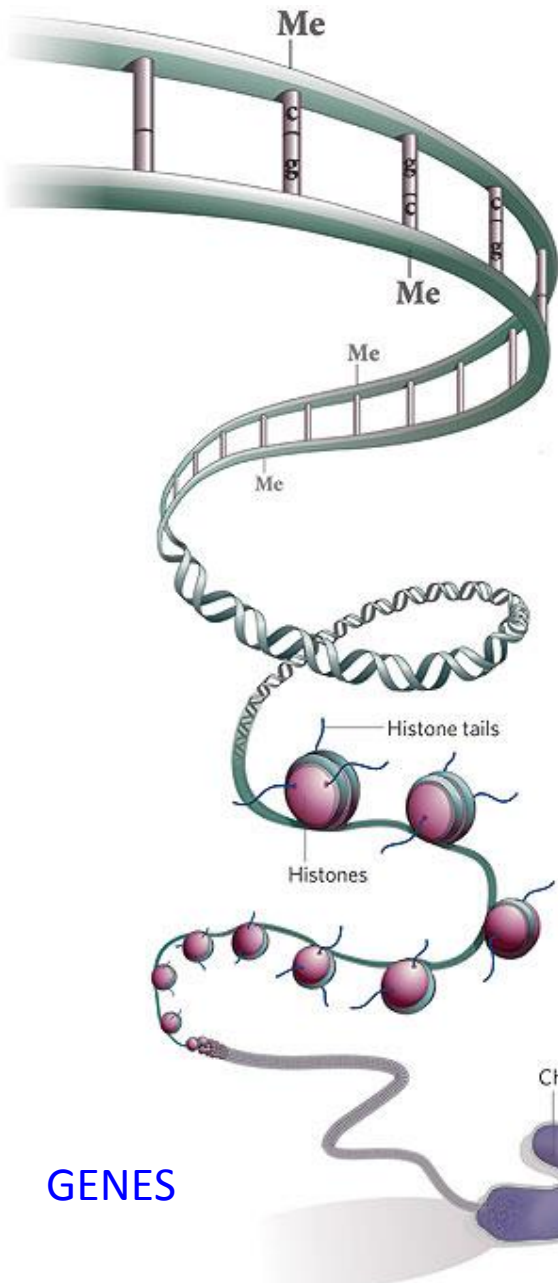


**PERSONALITY
DISORDERS
e.g.
PSYCHOPATHY**

TYPES OF EPIGENETIC EFFECTS

INTRAGENERATIONAL (personal)





The two main components of the epigenetic code

DNA methylation
Methyl marks added to certain DNA bases repress gene activity.

DNA METHYLATION

HISTONE MODIFICATION

Histone modification
A combination of different molecules can attach to the 'tails' of proteins called histones. These alter the activity of the DNA wrapped around them.

GENES

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EPIGENETIC EFFECTS

EXTREME STRESS

COCAINE

EARLY TRAUMA

MATERNAL BEHAV

TOXINS

ABANDONMENT



Epigenetic differences:

Psychopathy

VS

Sociopathy

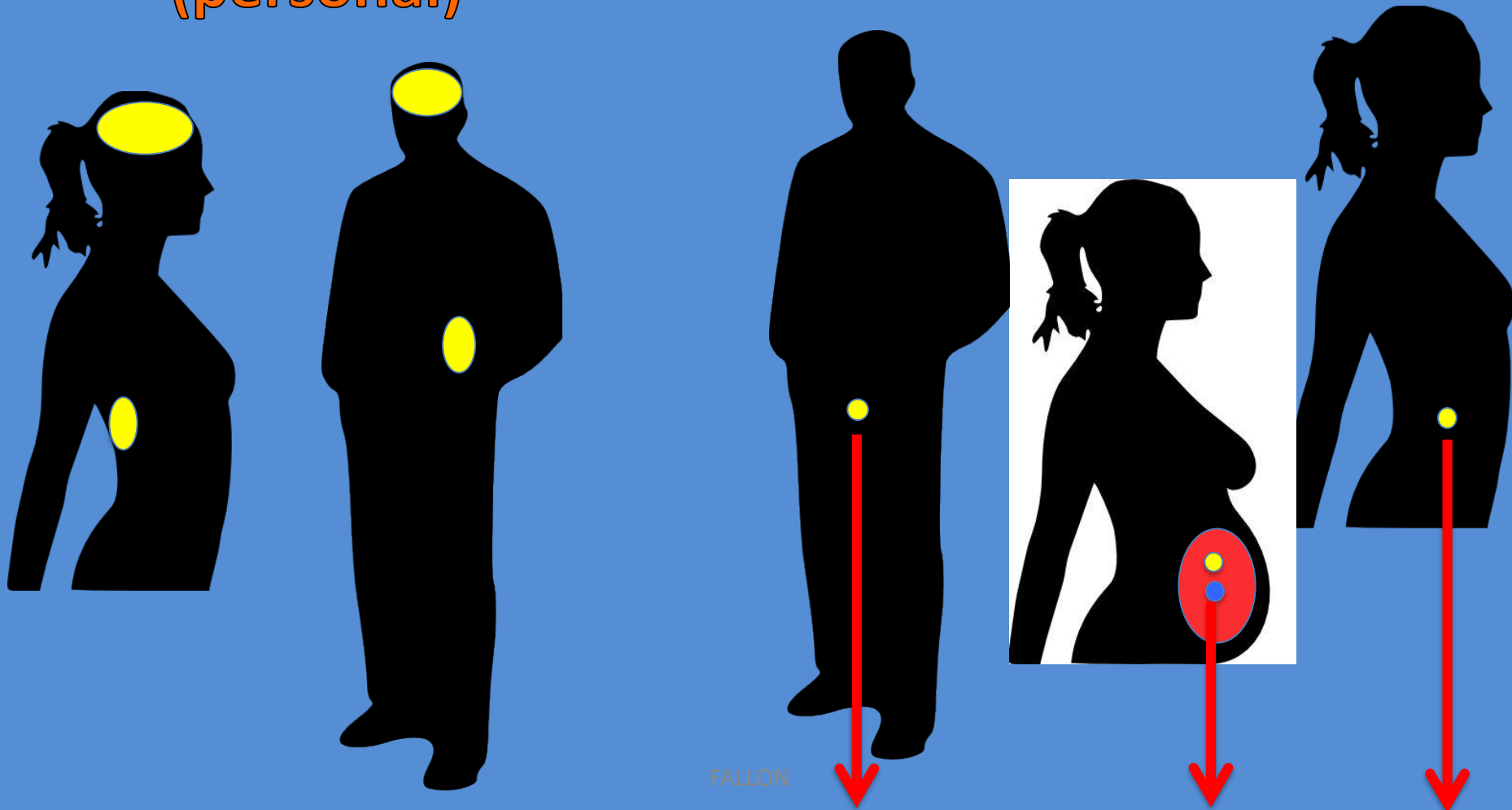
VS

PTSD

TYPES OF EPIGENETIC EFFECTS

INTRAGENERATIONAL
(personal)

TRANSGENERATIONAL



TRANSGENERATIONAL EPIGENETIC EFFECTS



Isr J Psychiatry Relat Sci - Vol. 50 - No 1 (2013)

Epigenetic Transmission of Holocaust Trauma: Can Nightmares Be Inherited?

Natan P.F. Kellermann

AMCHA, the National Israeli Center for Psychosocial Support of Survivors of the Holocaust and the Second Generation, Jerusalem, Israel

Transgenerational epigenetic violence- from neighborhoods to the world



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Two thought experiments you should be able to answer within the hour or so....

1) One of the arguments often heard from prosecutors is when defendants have siblings that....

“have the same DNA and were raised in the same abusive (or normal) household but they didn’t commit a capital offense.”

How does a defense attorney create a dialogue which will engage jurors?

2) What is the more important determinant of Normal vs criminal behavior?

What is “Good” for the species
Is often “Evil” for family life

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