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

James (Jim) Fallon
Professor
Psychiatry and Human Behavior
Anatomy and Neurobiology
University of California, Irvine

CJAB
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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.....

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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?
COPY NUMBER VARIANTS

FALLON

COPY NUMBER VARIANTS

Father (mixed race)

Mother (mixed race)

length = scaled log(length)

Presence of CNV

freq

length = log(heterozygosity)

1 2 3 4 5 6 7 8 9 10 11 12

1 2 22 X Y

FALLON © Gary Roberts
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**

- High vulnerability 
- Genetic alleles

**Early Abuse**

- Functional brain loss
- Orbital/medial PFC, amygdala
TIMING OF THE TRAUMA IS VERY IMPORTANT
DIAGNOSIS vs Traits
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 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
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**

**BORDERLINE PSYCHOPATHS**
Moral, Intellectual, ProSocial, Sociopaths-acquired

**PSYCHOPATH**
Cleckliam 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
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-talers, 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 antisocial behavior, but 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, and 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 supernormal personalities.

CHARISMATIC PSYCHOPATH

is charming, attractive liars. They are usually gifted at some talent or another, and they use it to the best advantage. They are always less an attracter than a leader, and almost everything they own, even their lives.

“PSYCHOPATH”  “SOCIOPATH”  “FOLLOWER”  “LEADER”
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

- CINGULATE CORTEX
- MEDIAL PREFRONTAL CORTEX
- ORBITAL CORTEX
- INSULA
- AMYGDALA
- PARAHIPOCAMPAL

Also called the “LIMBIC LOBE” also part of SOCIAL BRAIN
Two Empathy Axes, Four kinds of Empathy

- Cognitive Empathy
- In-Group Empathy
- Out-Group Empathy
- Emotional Empathy

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Emotional Empathy vs Cognitive Empathy
Emotional vs Cognitive Empathy
Neural Correlates of Hate

Semin Zeki*, John Paul Romaya

PLoS ONE | www.plosone.org

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BRAIN DEVELOPMENT

KEY EPOCHS OF FRONTAL LOBE BRAIN DEVELOPMENT
CRITICAL PERIODS of brain development

- BIRTH
- PUBERTY
- LATE TEENS
- FIRST MATURITY
- SECOND MATURITY
- PEAK BRAIN MATURITY & PERFORMANCE
- DEATH

0-3 | 9-14 | 18-21 | 24-27 | 33-40 | Late 60s

FALLON
The pre-teenage prefrontal system
The maturing (and switching) teenage prefrontal system
The mature adult prefrontal system in balance
Competition for control of emotional behavior

- Amygdala
- Nucleus Accumbens
- Orbital/Ventricomedial Cortex
- Behavior
## General Psychiatric traits and Genetics

<table>
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<tr>
<th>GENE</th>
<th>Example Effect</th>
<th>Some Interactions</th>
<th>Positive vs Negative Effect</th>
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<td>Group- increase lying for group</td>
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<td>met-met WORRIER</td>
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<td>childhood- met stronger</td>
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Psychopathic traits and Genetics

MAOA-L ("warrior gene")
“High Risk” serotonin transporter
NE transporter
TH [TPH1,2]
Androgen receptor
DAGK1
DBH
COMT
NOS1

+ low emotional empathy alleles

Aggression and violence
Empathy, altruism genetics

Oxytocin receptor
Testosterone receptor
Vasopressin receptor
GABA  GABRB3
Dopamine DRD4, DRD5
IGF2
COMT
OXY related CD38
CRF  GRIN1 cortisol

OXTR  G more emp than A
more T, less generous
AVPR1A
empathy variance
KIN VS NON KIN  em altruism
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.
EPIGENETICS
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.

**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.

**EXTREME STRESS**
- Cocaine
- Early trauma
- Maternal behavior
- Toxins
- Abandonment

**GENES**
Epigenetic differences:

Psychopathy
vs
Sociopathy
vs
PTSD
TYPES OF EPIGENETIC EFFECTS

INTRAGENERATIONAL (personal)

TRANSGENERATIONAL
TRANSGENERATIONAL EPIGENETIC EFFECTS
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
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 are...

“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