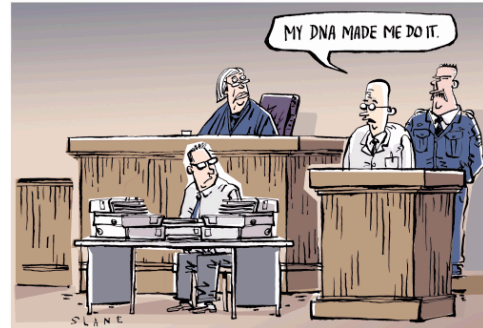


Announcement Extra Credit, 3/12

- Priscilla Wald
 - Professor of English at Duke University
- Lecture: "Clones, Chimeras, and Other Creatures of the Biotechnological Revolution: Toward a Genomic Creation Myth"
- LNCO 3850 @ 3:30PM
- In essay form: summary of main points, how it applies to the course, and some critical/reflective comments

1

Genes & Responsibility?



2

Thought Experiment

Joe is a normal father of two, but at age 35 he starts to behave as a pedophile. Medical examinations reveal a tumor in his brain. Once the tumor is removed, he no longer behaves as a pedophile. Years pass without incident, until Joe once again behaves as a pedophile. Scans reveal another tumor in his brain.

Questions:

- if Joe had attempted to have sex with a child and was captured by police, should he be held responsible?
- Should he be punished?

3

Last Time

- Nature vs. Nurture
- 3 Behavioral Genetic Studies
 - Twin Studies ✓
 - Linkage Studies ✓
 - Association Studies
- 4 Difficulties with Behavioral Genetics

4

Aggression & Responsibility

- Flies and Foxes
- Hatfields & McCoys, Chromosomes, and MAOA
- Responsibility?

5

Flies



Fruitless (*Fru* gene)

- A single point mutation affects courting behavior and male/female fighting strategies:
 - Head butts (F/M)
 - Jabs (M~F)
 - Boxing (M)
- Also, effects on formation of dominance hierarchies in males, but not females

– Videos at http://www.nash.usc.edu/neuro/journal/9in12/supplfor/in1809_s1.html

6

Silver Fox Domestication Project (1970s to present)



From Lyudmila Trut, Early canid domestication: The farm-fox experiment. *American Scientist* (87), March-April 1999; 160-169.

Foxes closely related to dogs; farmed but not domesticated.

Farm-foxes normally exhibit distinct patterns of aggressive and fear-aggressive behavior toward humans.

Dimitriy Belyaev et al. (1969, 1979) hypothesized that a selection of farm foxes for less fearful and less-aggressive (tame) behavior would yield a strain of domesticated fox. In parallel, foxes were also bred selectively to preserve wild-type "aggressive" behavior.

Joint study with Cornell University, Institute of cytology and Genetics (Russia), and University of Utah ⁷

"Aggressive" Foxes



"Tame" Foxes



Silver Foxes

- Demonstrated that biology is an important determinant in aggression... (~10 generations a dramatic effect).
- Curiously, the "tame" foxes also exhibited other physical characteristics similar to domestic dogs... a suite of phenotypes resulted even though selected for a single trait. (Linkage?)



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What does behavioral genetics tell us about aggressive behavior in humans?

11

Hatfields and McCoys

- Famous family-feud in America, started in Civil War era.
- Study found that descendants of McCoys have rare inherited disease that leads to hair-trigger rage and violent outbursts: Von Hippel-Lindau disease.
- Causes tumors on the adrenal gland, which makes adrenaline and catecholamines – too much causes high blood pressure, headaches, heart palpitations, etc. Also, appears to effect either impulse control or hyper-sensitivity to social cues.



http://dsc.discovery.com/news/2007/04/05/hatfield_his.html?category=history&guid=20070405153030&dcitc=w19-502-ak-0000

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Chromosomes XY & XYY

- Commonly thought that males (XY) are more aggressive than females (XX).
- 1960s-1970s studies of prison inmates found a high incidence of male individuals with an extra Y chromosome – “XYY syndrome.”
- The conclusion was that tendency to violence or “anti-social” behavior was explained, in part, by the syndrome.
- Study was criticized for poor statistical methods, biased sample, and failing to compare to “normal” population.

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1993 MAOA Case study

- 1993 report in *Science* described Dutch family in which several males exhibited borderline mental retardation and “abnormal behavior, including disturbed regulation of impulsive aggression.”
- They had a complete absence of activity of MAOA (monoamine oxidase), an enzyme that breaks down many key neurotransmitters. The mutation was carried on the X chromosome.
- Study had limited application because complete absence of MAOA is very rare and may implicate other processes.

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2002 MAOA Study

- New Zealand longitudinal study of “antisocial” behavior in males
 - 20+ years following 1,037 children from Dunedin, NZ
 - Note: Animal studies suggested levels of the enzyme MAOA (a function of genotype) correlated with antisocial or violent behavior, but none studied effects of environment on this genotype.
- Looked at (442) males with differences in the promoter region of the gene for MAOA, which determines gene expression.
 - Low vs. high MAOA production
 - If effect, expect low-MAOA allele to result in higher levels of aggression/anti-social behavior.
- Also, looked at environmental correlates, such as childhood abuse, arrest record, etc.

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2002 MAOA Study

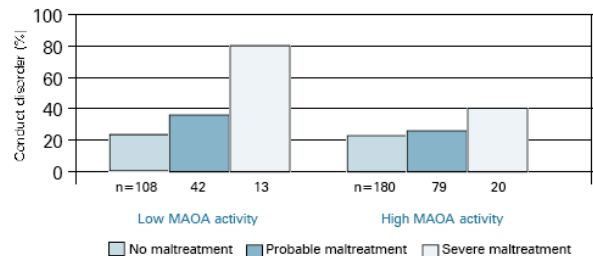


Figure 7. Individuals who were abused as children and had low levels of an enzyme known as MAOA were twice as likely to engage in antisocial or violent behavior as individuals who had been abused as children but had high levels of the MAOA enzyme. (Based on A Caspi et al., “Role of Genotype in the Cycle of Violence in Maltreated Children,” *Science* 297 (2002): 851-54.)

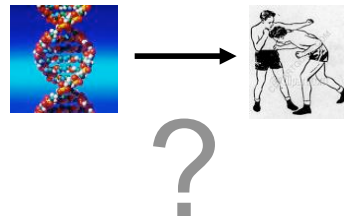
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What should we make of this?

- Should people with a “lowMAOA allele” be considered less **responsible** for their aggressive or anti-social behavior?
- Much depends on the causal story...how do genes cause “anti-social” behavior?

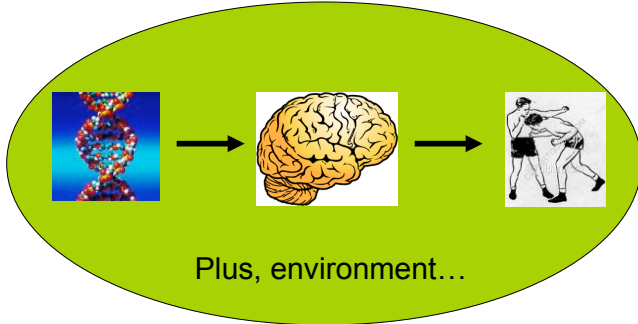
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Do Genes Cause Behavior?



18

Causal Pathways



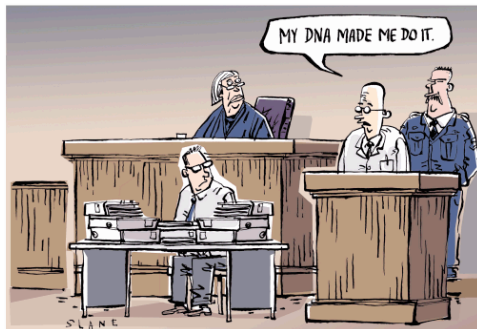
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Strength of Genetic Cause?

- Causal Pathway: Low-MAOA allele mechanism involves lack of enzyme that breaks-down neurotransmitters.
 - Even though genes don't cause behavior, directly, a gene-brain-behavior pathway implicates genes causally.
- How should we interpret the causal influence of genes?
 - Remember, nature vs. nurture: genes have a **stronger** or **weaker** influence (H estimate).
 - Is the "low MAOA" allele a **predisposition**? In certain environments, increases chance of "anti-social" behavior?

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Genes and Responsibility?



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Assumptions of Legal Responsibility

- Criminal liability presupposes that ordinary persons are capable of controlling their behavior in virtue of being rational and having "free-will".
 - Law is anti-deterministic
- But, allows excusing conditions:
 - Insanity defense
 - Diminished capacity
- Is there a plausible "genetic defense"?

Dresser, Rebecca. (1999). Criminal Responsibility and the "Genetics Defense". And Mary Crossley, "The "Genetics Defense": Hurdles and Pressures." Both in Botkin, J. R. et al. Genetics and Criminality. Washington, DC: American Psychological Association.

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Insanity Defense

- Applies only when it could be "clearly proved that, at the time of the committing of the act, the party accused was **labouring under such a defect of reason, from a disease of the mind, as not to know the nature and quality of the act he was doing; or, if he did know it, that he did not know he was doing what was wrong.**" (Knowledge condition.)
- If genetic condition contributes to the impairment of the defendant's ability to reason at the time – not know what he/she is doing, or not know that what he/she is doing is wrong – then a genetic condition may provide excuse under legal insanity.

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Diminished Capacity

Some jurisdictions add to the insanity defense a "irresistible impulse" excuses:

Someone whose mental disease or defect "**completely deprives the person of the power of choice or volition**" at the time of the violation. (Control condition.)

In effect, the person has a diminished capacity to act responsibly. If a genetic condition has the effect of diminishing that persons capacity to act responsibly, then it might be an excusing condition.

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Does what we know about the genetics of aggression apply to any of these excusing legal conditions?

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Casey vs. Utah

Fictional

Sam Casey is on trial for assaulting and hospitalizing Q. Public. At trial the prosecutor lists Casey's long record of trouble with the law, including violent offences, and argues that Casey has shown he doesn't care for the law or the safety of others. He should be found guilty and punished accordingly.

26

Casey vs. Utah

Fictional

The defense attorney does not deny Casey's police record, but adds that genetic tests show Casey has the predisposition to aggressive anti-social behavior because he has the "low MAOA" allele. He argues Casey should not be found guilty for reasons of "diminished capacity" as a result of his genetic condition which impairs his ability to control anti-social impulses.

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Guilt?: Consider

- MAOA study shows genes predispose, and at an early age... domino effect if in abusive environment.
- The courts recognize excusing conditions, such as insanity and irresistible impulse; shouldn't low MAOA qualify as well?
- Previously, many argued that it is unfair to judge a person on the basis of their genotype, because it is "not in their control."
- Alternatively: regardless of Casey's genetic make-up, the fact that he harmed Q. Public suggests we should find Casey guilty, if for no other reason than to send a message.

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You, the Jury: Part 1

Should Casey be found guilty, legally culpable for harming Q. Public?

Why or why not?

29

You, the Jury: Part 2

If Casey is guilty, should the genetic defense apply to his sentencing (the type of punishment)?

Why or why not?

30

Legal Analyses

- XYY Defenses in 1970s were unsuccessful...why?
- "An insanity defense based on chromosomal abnormality should be possible only if one establishes with a high degree of medical certainty an etiological [causal] relationship between the defendant's mental capacity and the genetic syndrome. Further, the genetic imbalance must have so affected the thought processes as to interfere substantially with the defendant's cognitive capacity or with his ability to understand or appreciate the basic moral code of his society."
- In other words: It was difficult to show that XYY was connected to a particular behavior, especially the one in question.

(Quoted by Dresser 1999, 168.)

Dresser, Rebecca. (1999). Criminal Responsibility and the "Genetics Defense". And Mary Crossley, "The "Genetics Defense": Hurdles and Pressures." Both in Botkin, J. R. et al. *Genetics and Criminality*. Washington, DC: American Psychological Association.

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MAOA?

- Only establishes one condition (among others – environment) that **predisposes** an individual to aggressive behavior. Legal analyses suggest that this is not likely to meet insanity or diminished capacity defenses.
- And, not clear how to connect one's genetic predisposition to any particular act.

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Sentencing?

If genetic defenses are unlikely for guilt, will a "genetic defense" have any mitigating influence on sentencing?

According to Appelbaum (2005), no reported cases...

Question:

Should genetic information mitigate sentences?

33

Consider Parallels? Criminal conduct of addicts and alcoholics

- *Robinson v California* (370 U.S. 660, 1962)
 - majority opinion asserted that treating addiction as a criminal offence = cruel and unusual punishment, 8th.
- *Powell v. Texas* (392 U.S. 514, 1968)
 - Plurality upheld conviction of Powell because "public behavior which may create substantial health and safety hazards." (deterrent)
 - 4 Justices disagreed, because conviction punished Powell "for being in a condition he is powerless to change."

34

Remember Thought Experiment

Joe is a normal father of two, but at age 35 he starts to behave as a pedophile. Medical examinations reveal a tumor in his brain. Once the tumor is removed, he no longer behaves as a pedophile. Years pass without incident, until Joe once again behaves as a pedophile. Scans reveal another tumor in his brain.

Question:

- Is this case any different than the low-MAOA case?

35

Legal *status quo*

Courts uphold the anti-deterministic presumption that informs notions of responsibility in law; namely that people are generally able to control their behavior.

So, it is unlikely – in the near future – that behavioral genetics will play a serious role in changing the legal *status quo*.

Question:

Should the legal *status quo* be challenged with a "genetic defense"?

36

Future Policy? Predicting and Preventing

If a genetic condition predisposes an individual to greater chance of aggression (anti-social behavior):

- Should we track people with this genetic condition?
- Should we pre-emptively restrict/restrain these individuals?

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Summary

- Studies on Violence:
 - Foxes, Flies, XYY, MAOA
- Causal Story
 - How do we get from genes to behavior?
 - Relative strength of causal pathways (cf. H estimates)
- Responsibility
 - Legal assumptions
 - Excusing conditions
 - Guilt vs. Sentencing
 - Legal *status quo*
 - Prediction and Prevention

38

Epilogue

What does behavioral genetics tell us about ourselves?

Consider the following quotes and what they have to say about the message of behavioral genetics:

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Ultimately a complex causal story...

It is enormously important to remember that genes are but one component of fabulously complex biological, and ultimately biopsychosocial systems... [A] fuller account [of complex behaviors] will require thinking in terms of nonlinear and dynamic interactions among many genes, hormones, nutrients, and other biological factors in the "internal" environment that is the body. And as genetics always will be only one important part of biology, biology always will be only one important part of any richer account of human behavior. Such an account will have to consider, not only interactions *among* social and biological factors in the "external" environment, but will have to consider the complex interactions *between* the internal and external environments."

Eirik Parens, quoted by Mary Crossley, "The "Genetics Defense": Hurdles and Pressures," in Botkin (1999, 176).

40

Stanton Peele

"The goal of determining what portion of behavior is genetic and environmental will always elude us. Our personalities and destinies don't evolve in this straightforward manner. Behavioral genetics actually shows us how the statistical plumbing of the human spirit has reached its limits. Claims that our genes cause our problems, our misbehavior, even our personalities *are more a mirror of our culture's attitude than a window for human understanding and change.*"

41

James Watson

"We are as yet in the early days of our attempts to understand the genetic underpinnings of our behavior...But this is a fast-moving area of research...The future promises a detailed genetic dissection of personality, and it is hard to imagine that what we discover will not tip the scales of the nature/nurture debate more and more in the direction of nature – a frightening thought for some, but only if we persist in being held hostage to a static, ultimately meaningless dichotomy. To find that any trait, even one with formidable political implications, has a mainly genetic basis is not to find something set immutably in stone. It is merely to understand the nature upon which nurture is ever acting, and those things we, as a society and as individuals, need to do if we are better to assist the process. Let us not allow transient political considerations to set the scientific agenda. Yes, we may uncover truths that make us uneasy in the light of our present circumstances, but it is those circumstances, not nature's truth, to which policy makers ought to address themselves."

42

What does behavioral genetics
tell us about ourselves?

Is it an insight into our true nature?

or

Is it a mirror of our hopes and fears?