

Human Behavior Genetics

Class #2

Welcome Back!

Reminders

- Check enrollment on BearFacts
- Potluck signup
- Homework: due at 4pm
 - General guideline: ~3-4 sentences/question
 - Grade for completion

Syllabus Review

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NATURE & NURTURE

HOME HOMEWORK RESOURCES

Class Syllabus

Download File
Fall 2015 Syllabus

Reading

Download File
"Time to Retire the Simplicity of Nature vs. Nurture" (Gopnik)

Download File
"Behavioral Genetics" (Baker)

Download File
"Two Lives--One Personality?" (Wright)

Download File
"Grandma's Experiences Leave a Mark on Your Genes" (Hurley)

The Syllabus

Facilitators:

Lisa Wilson - lwilson@berkeley.edu

Catherine Wang - cwang0127@berkeley.edu

Rosie Valentine - rvalentine@berkeley.edu

Lee Lazar - leelazar@berkeley.edu

Grading Policies:

Students will be graded on a pass/no pass basis.

- Lecture attendance - 30%
- Homework submission - 35% (2.7% x 13 assignments)
- Debate participation - 15% (5% x 3 debates)
- Final project & final project planning - 20%

A grade of 65% or above is considered passing. Students can miss up to 2 lectures, no questions asked. Missing three or more lectures or failure to complete a final project will result in an NP grade.

Homework:

Each week, students are responsible for completing the reading, as outlined in the syllabus, and answering assigned questions about the material. All readings and homework can be found on our class website. Homework is due by 4 PM on class days, submitted by Google Form. Late homework will not be accepted.

Date	Lecture	Topic/Concept	Reading/Doc
August 10	1. Introduction to Behavioral Biology	and why we study it	"From a Matter of Survival of Nature's Numbers"
September 7	2. Human Behavior	and why we study it	"The Human Condition"
September 14	3. The Twin Study	and why we study it	"Twin Studies: A Matter of Survival of Nature's Numbers"
September 21	4. Epigenetics	and why we study it	"Epigenetics: A Matter of Survival of Nature's Numbers"
September 28	5. Personality	and why we study it	"Personality: A Matter of Survival of Nature's Numbers"
October 5	6. Development & IQ	and why we study it	"Development: A Matter of Survival of Nature's Numbers"
October 12	7. Culture & Society	and why we study it	"Culture: A Matter of Survival of Nature's Numbers"
October 19	8. Language & Cognition	and why we study it	"Language: A Matter of Survival of Nature's Numbers"
October 26	9. Philosophy	and why we study it	"Philosophy: A Matter of Survival of Nature's Numbers"
November 2	10. Ethics	and why we study it	"Ethics: A Matter of Survival of Nature's Numbers"
November 9	11. Ethics	and why we study it	"Ethics: A Matter of Survival of Nature's Numbers"
November 16	12. Ethics	and why we study it	"Ethics: A Matter of Survival of Nature's Numbers"
November 23	13. Ethics	and why we study it	"Ethics: A Matter of Survival of Nature's Numbers"
November 30	14. Ethics	and why we study it	"Ethics: A Matter of Survival of Nature's Numbers"

- Debate 1: Twin Studies: Many studies identify genetically vulnerable twins at a young age, and then follow them throughout life. Overall, do you see twin studies as ethically sound practices? Are we just encouraging self-fulfilling prophecies and stigma? (*September 21st*)

When I grow up I want to be...





Split Up Into Groups

Behavior Genetics

The study of the influence of an organism's **genetic composition on its behavior** and the **interaction of heredity and environment** insofar as they affect behavior.



What is environment?

What is behavior?

From Baker...

Behavior:

Actions, personality, intelligence, thoughts,
unconscious reactions, holistic responses, inner
mental states, diseases, skills

Insects have it!

Pooh Bear's Behavior

- Constant hunger
- Slow cognitive processing
- Probably high blood pressure, high BMI
- Possible substance use disorder



What is environment?

Landscape; Traditionally, SES, family upbringing & parenting style.

Can actually include anything other than genes!
Molecules, social relationships, experiences.

Piglet's Environment



- Hundred Acre Wood
- Presumable no family, but many friends
- Best friend is a selfish bear
- Much smaller than everyone else → constant anxiety, low self esteem

Behavior Genetics

The study of the influence of an organism's **genetic composition on its behavior** and the **interaction of heredity and environment** insofar as they affect behavior.

Very broad terms!



What is heritability?

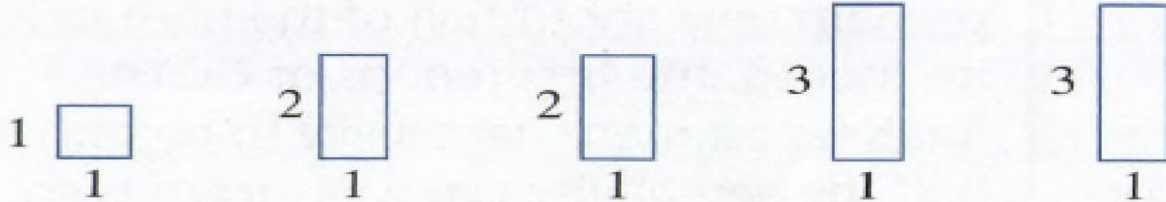
Heritability

Heritability is a statistical measure of the **portion of trait variation** that can be explained by genetics...

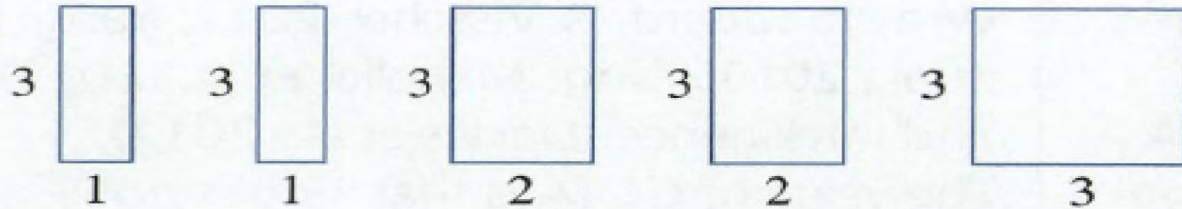
- For a **specific population**
 - At a **specific time**

Back to Rectangles...

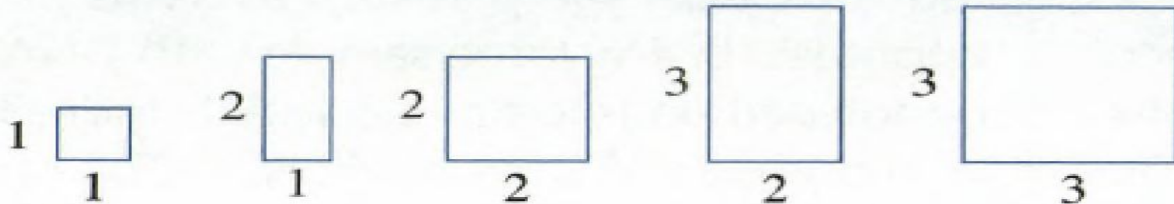
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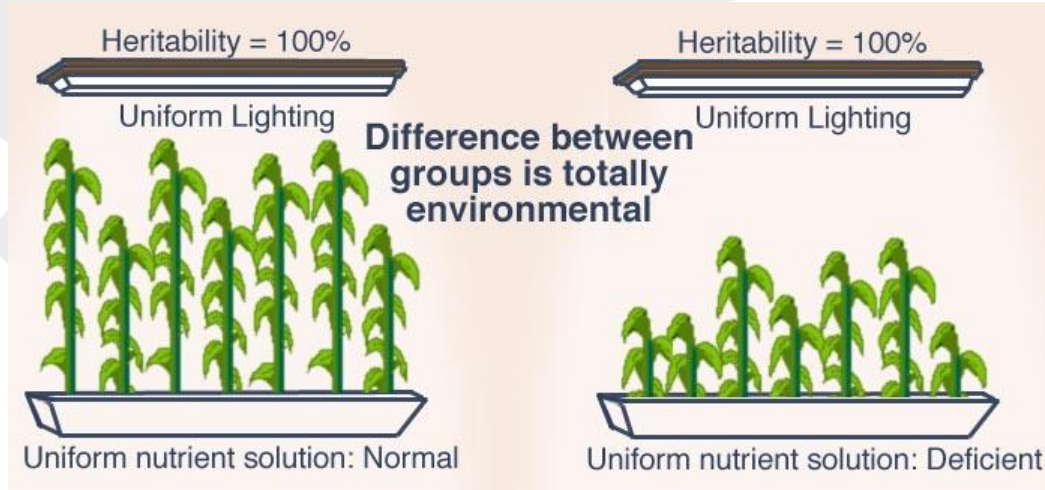
(c)



(d)



Lewontin's Thought Experiment



Arthur Jensen, Race + IQ

- Huge proponent of IQ as a measure of intelligence
- Found the heritability of IQ ~ 80%
- Looked at IQ differences between blacks and whites
- What did he do wrong here?

Using Heritability Incorrectly

→ social darwinism & eugenics



What Heritability is NOT

- Heritability cannot be applied to 1 individual
- 100% Heritability does NOT mean genetic determinism
 - You're still missing something crucial!

Heritability of Height

- White men in the U.S. - 80%
- Finnish men - 78%
- Finnish women - 80%
- China - 65%
- Africa - 65%
 - Why is heritability lower here?

From Scientific American...

Heritability allows us to examine how genetics directly impact an individual's height. For example, a population of white men has a heritability of 80 percent and an average height of 178 centimeters (roughly five feet, 10 inches). If we meet a white man in the street who is 183 cm (six feet) tall, the heritability tells us what fraction of his extra height is caused by genetic variants and what fraction is due to his environment (dietary habit and lifestyle).

Group discussion

Did this challenge your conception of the influence of genetics?

What did you think before this class?

Just for fun...

Heritability of height for our class & families:

n = 58

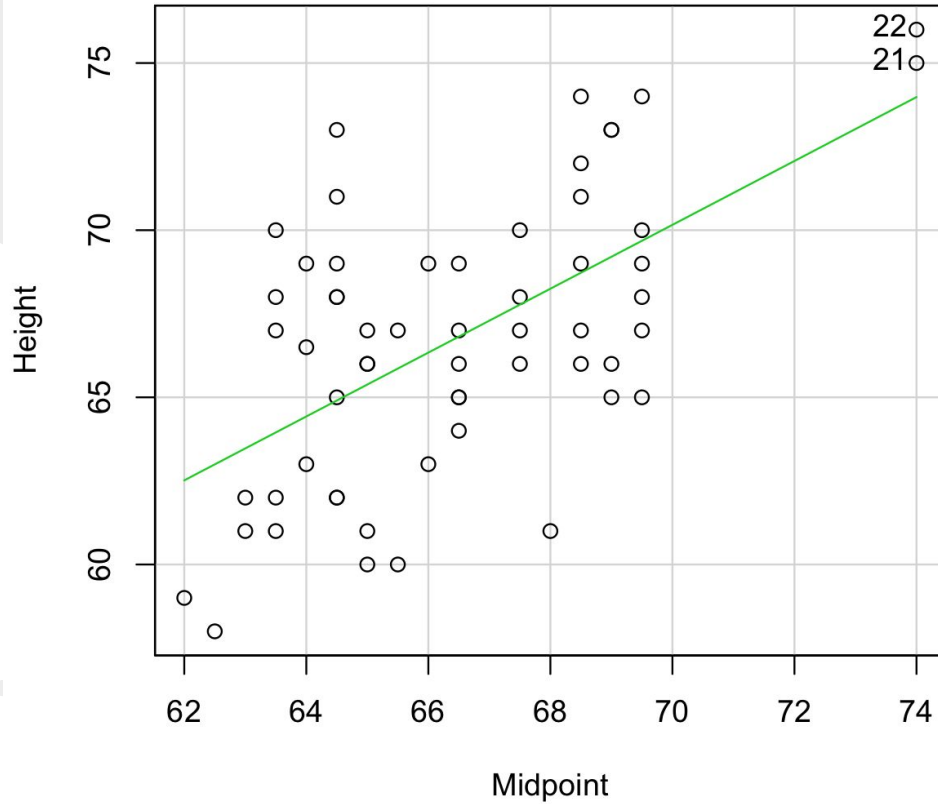
29 males, 29 females

For stats lovers: How did we get our numbers?

Compare child's height to average of parents' height.

Heritability = R^2

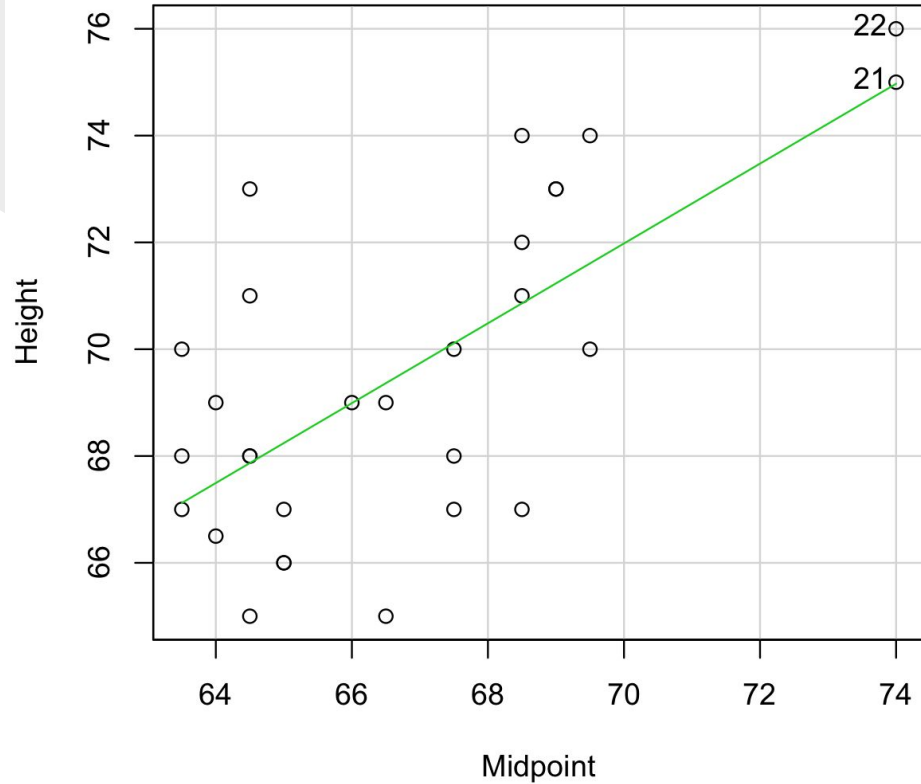
Class as a Whole:



$$R^2 = 0.3524.$$

Heritability = 35%

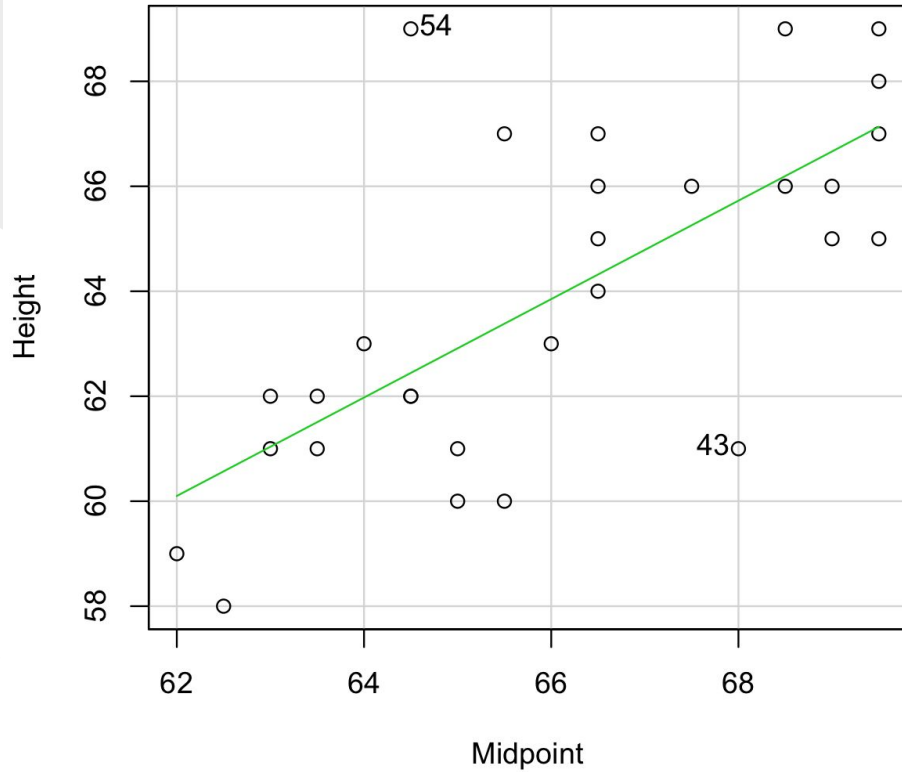
Males:



$$R^2 = 0.4687.$$

Heritability = 47%

Females:



$$R^2 = 0.4911.$$

Heritability = 49%



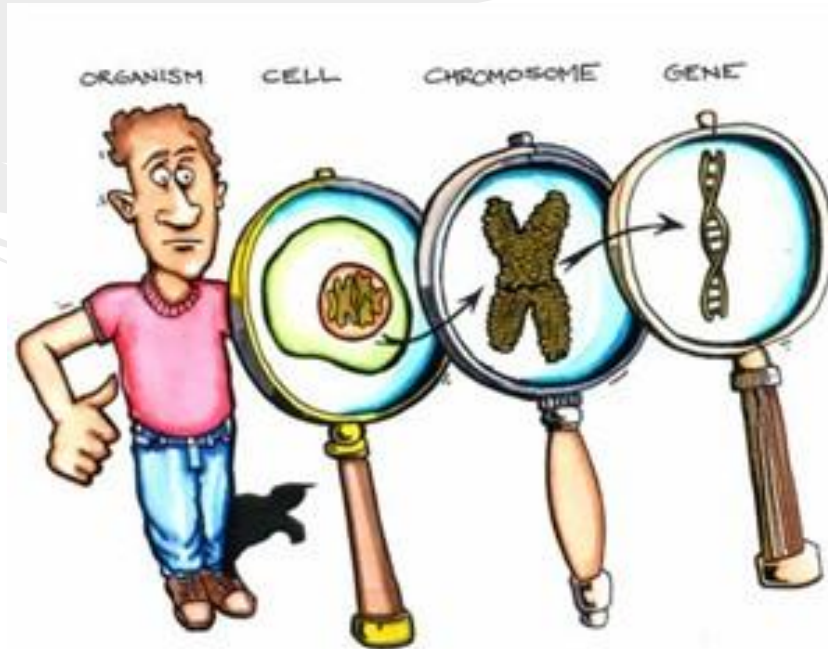
Why does heritability increase when we look at just males/just females?

BREAK



Genetics Review

It's all biochemistry!



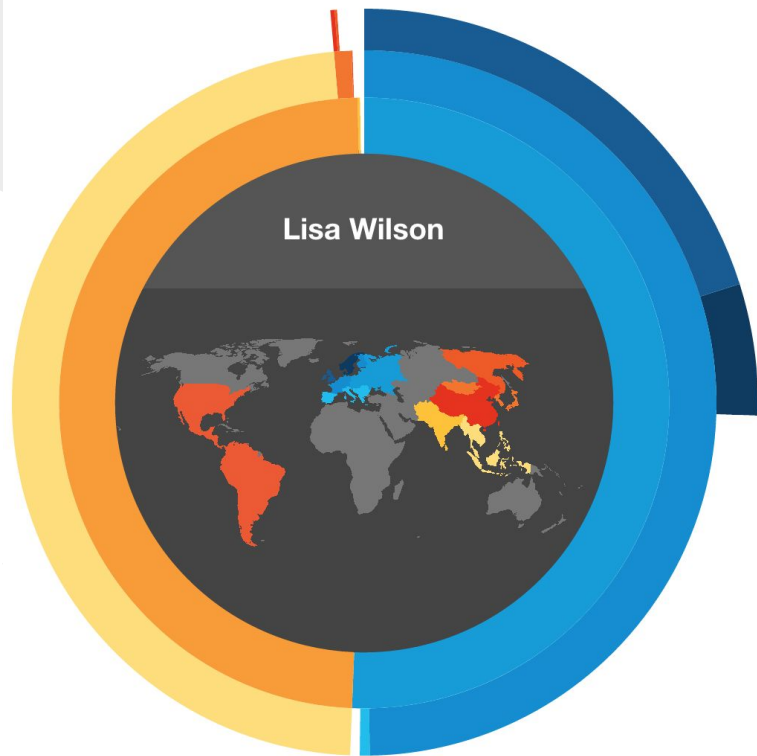
What do genes look like?



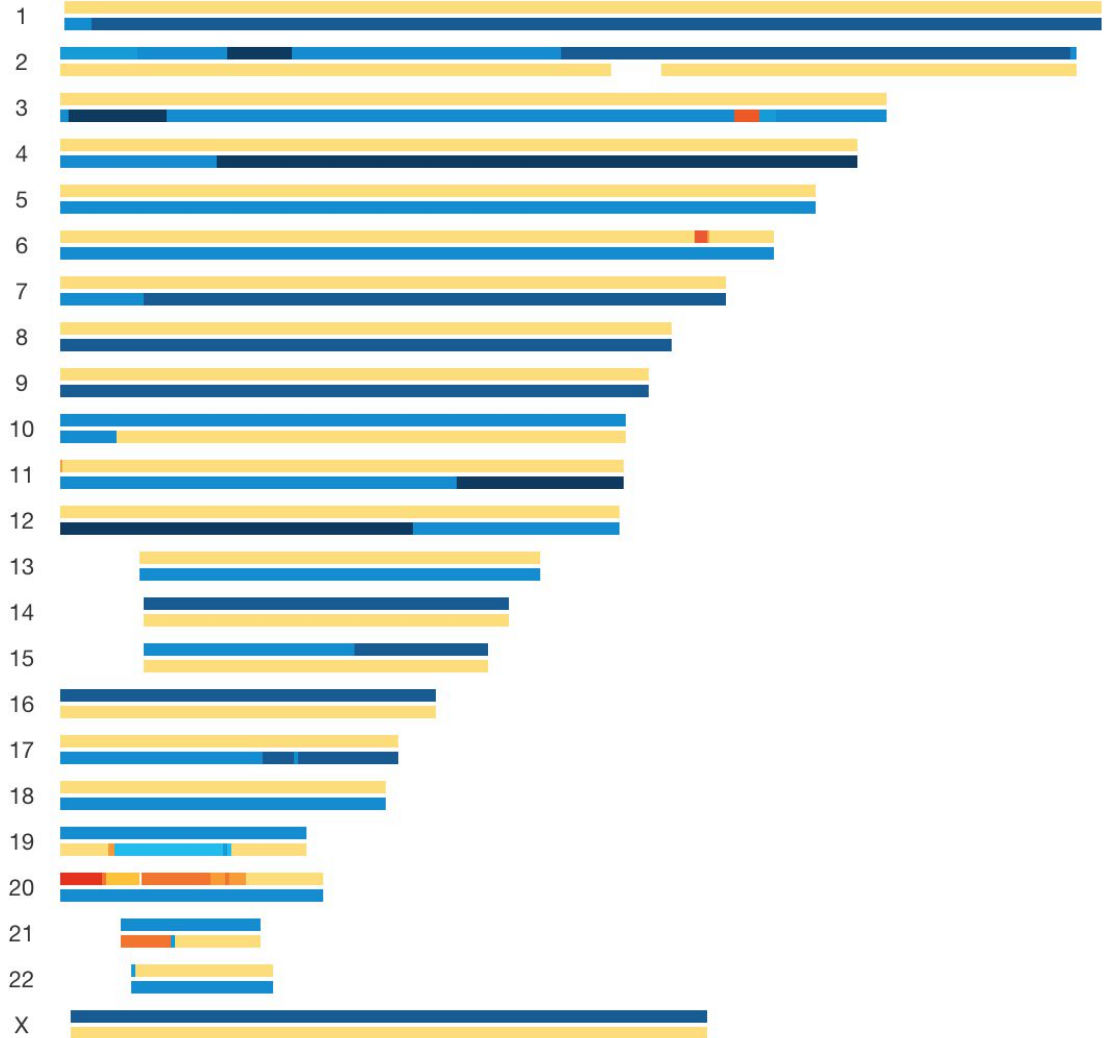
Half Your Genes from Mom, Dad



Half Your Genes from Mom, Dad



50.6%	European
20.1%	Northern European
5.4%	British & Irish
24.2%	Scandinavian
	Broadly Northern European
0.5%	Southern European
0.4%	Broadly Southern European
	Broadly European
49.0%	East Asian & Native American
48.0%	Southeast Asian
	East Asian
0.2%	Chinese
0.1%	Yakut
0.5%	Broadly East Asian
0.1%	Native American
0.2%	Broadly East Asian & Native American
0.1%	South Asian
0.2%	Unassigned
100%	Lisa Wilson



The Central Dogma

DNA → RNA → Protein/Other Things

Proteins/Other Things do stuff.

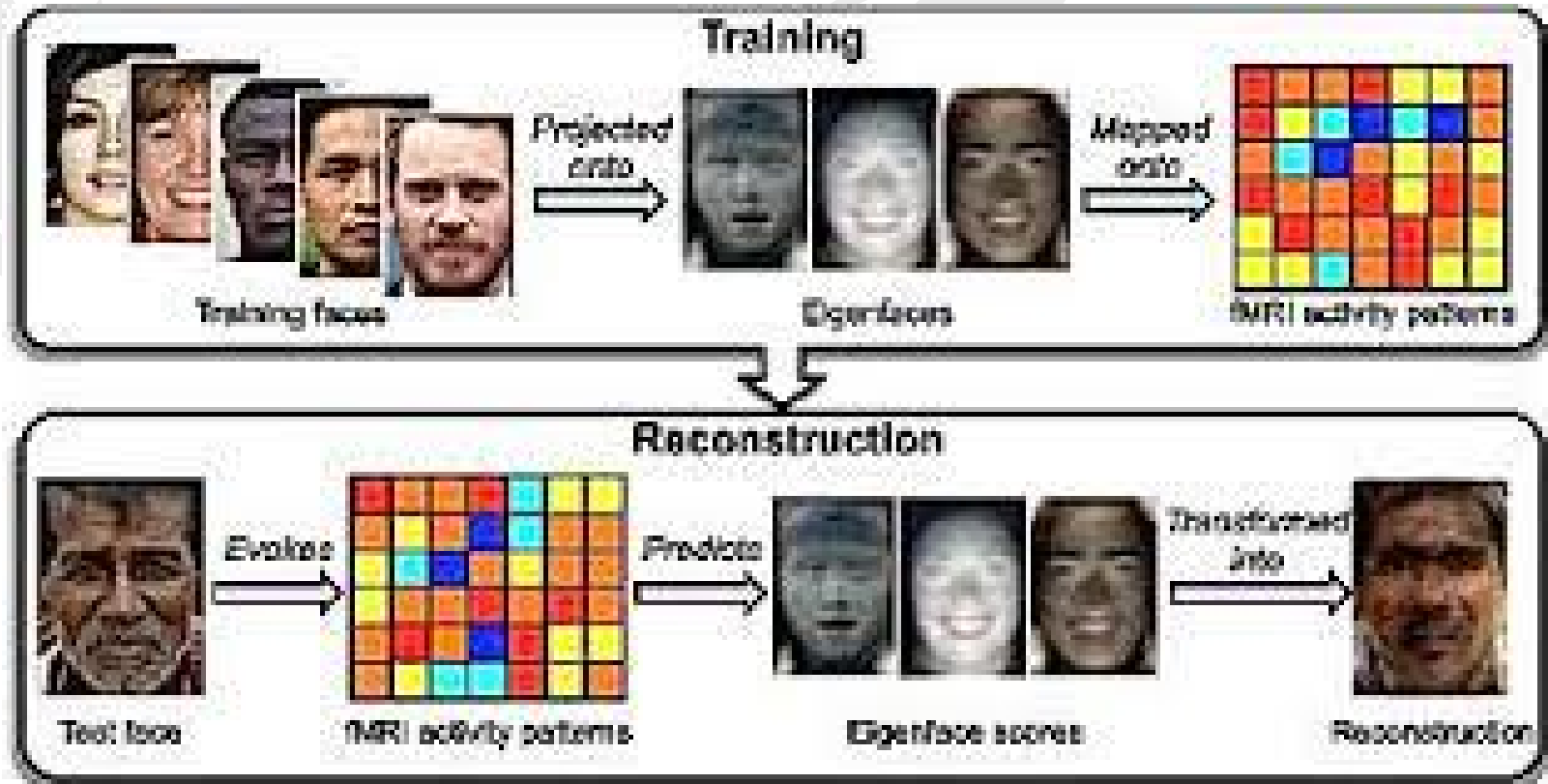
second base in codon

		second base in codon						
		U	C	A	G			
first base in codon	U	UUU Phe	UCU Ser	UAU Tyr	UGU Cys	U	third base in codon	
		UUC Phe	UCC Ser	UAC Tyr	UGC Cys			C
		UUA Leu	UCA Ser	UAA stop	UGA stop			
		UUG Leu	UCG Ser	UAG stop	UGG Trp			G
	C	CUU Leu	CCU Pro	CAU His	CGU Arg	U		
		CUC Leu	CCC Pro	CAC His	CGC Arg			C
		CUA Leu	CCA Pro	CAA Gln	CGA Arg			
		CUG Leu	CCG Pro	CAG Gln	CGG Arg			G
	A	AUU Ile	ACU Thr	AAU Asn	AGU Ser	U		
		AUC Ile	ACC Thr	AAC Asn	AGC Ser			C
		AUA Ile	ACA Thr	AAA Lys	AGA Arg			
		AUG Met	ACG Thr	AAG Lys	AGG Arg			G
	G	GUU Val	GCU Ala	GAU Asp	GGU Gly	U		
		GUC Val	GCC Ala	GAC Asp	GGC Gly			C
		GUA Val	GCA Ala	GAA Glu	GGA Gly			
		GUG Val	GCG Ala	GAG Glu	GGG Gly			G

DNA & Biochemicals →

Neurons firing; Muscle Movements; Autonomic
Response; Thoughts; Emotions; Actions

The brain is cool! It does almost everything.



Main Takeaway

Genes, in some way, control what's going on in your body. (Biochemistry)

Biochemistry, in some way, controls behavior.

Genes Don't MAKE You Do Anything

New genetic variants associated with coffee drinking



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That's Why More Physical Attributes Have Higher Heritability

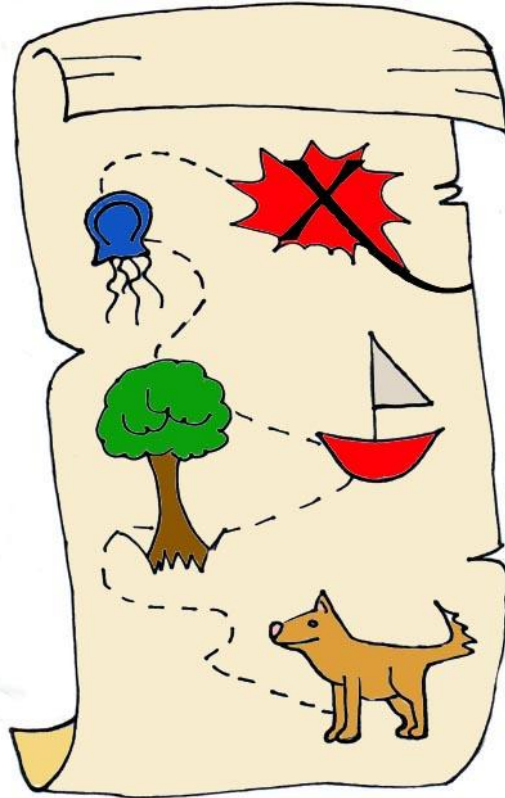
Height: ~ 0.8

BMI: ~ 0.75

Extraversion: ~ 0.4

Religiosity: ~ 0.15

Genes Provide the Map





Gene-Environment Correlation

Passive

Active

Evocative

Gene Environment Interaction

Monoamine Oxidase A: “Warrior Gene”

[rs909525\(A;G\)](#)

Magnitude: 2

Frequency: 20.4%

Repute:Bad

References:5

Probably one Warrior Gene and one non-Warrior Gene. Women with this combination usually have the 3 repeat MAOA Warrior Gene on one X chromosome and the 4 or 5 repeat MAOA non-Warrior Gene on the other X chromosome. The 3 repeat Warrior Gene makes people more aggressive and antisocial. If you are a man, there was a problem reading this SNP (or you are XXY).

[...more...](#)

Can we relate this to PKU?

- Amount of Phenylalanine in diet, IQ

The Genomic Revolution

- Anyone can have their genome sequenced.
- What are the consequences of that?

TedTalk: Genome Sequencing

http://www.ted.com/talks/richard_resnick_welcome_to_the_genomic_revolution/transcript?language=en

Reminders:

Homework is up!

Debate question:

Many studies identify genetically vulnerable twins at a young age, and then follow them throughout life. Overall, do you see twin studies as ethically sound practices? Are we just encouraging self-fulfilling prophecies and stigma?