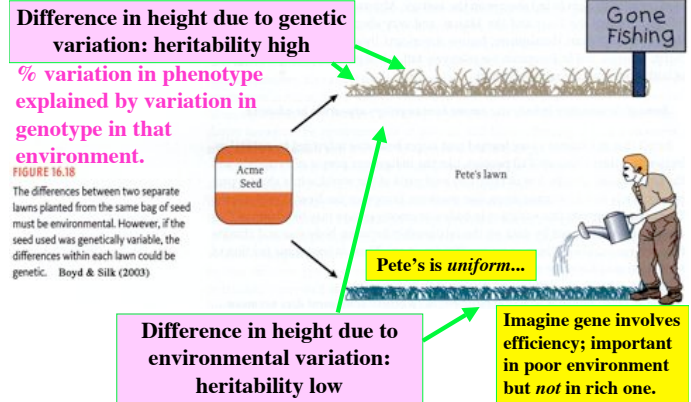


ANTH 102: Humans are cultural animals

LECTURE #11: Genotype and phenotype continued ... and continued ...

Course website: <http://weber.ucsd.edu/~jmoore/courses>

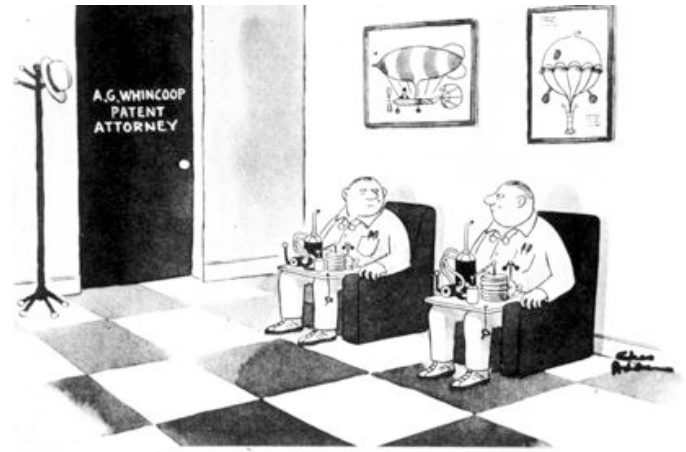
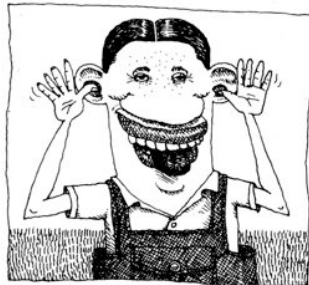
Genotype and phenotype - **heritability**



Involves Tinbergen's developmental question

- HEREDITY
- ENVIRONMENT
- Epigenesis**

The *two-way* interaction of genes and environment during individual development.



Separated at birth, the Mallifert twins meet accidentally.  
**Identical twins**

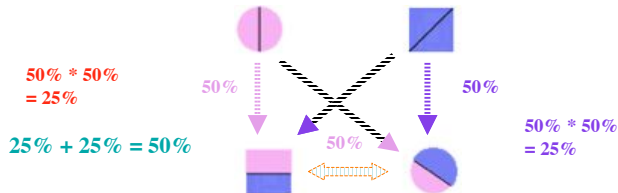
HERITABILITY

Try factor out shared environment, whatever left due genetics.

Proportion of genes shared is predictable, BUT sharing of any specific allele cannot be predicted (though science can directly measure, for some ...). When proportions, dealing with statistical 'knowledge' - *strong inference*.

Parent-offspring = 0.5 (50%) shared 'directly' each parent

Sibling = 0.5 (50%) shared probabilistically



HERITABILITY

$h^2 = \% \text{ variation in phenotype explained by variation in genotype.}$

$h^2 = .5 \implies \text{half variation in trait due to relatedness.}$

**HARD TO GRASP.**

$h^2 \text{ of trait 'have thumb' } = 0$

## HERITABILITY

$h^2 = \%$  variation in phenotype explained by variation in genotype.

Can heritability be changed?

## HERITABILITY

$h^2 = \%$  variation in phenotype explained by variation in genotype.

Can heritability be changed?

What if give population exactly same environment and experiences - what happens to  $h^2$ ?

## HERITABILITY

$h^2 = \%$  variation in phenotype explained by variation in genotype.

Can heritability be changed?

What if give population exactly same environment and experiences - what happens to  $h^2$ ?

$h^2$  *increases*. Why?

## Heritability of IQ $\approx .4 - .8$ in USA

Sibs reared **together** - IQ correlations:

Kinship: Correlation:

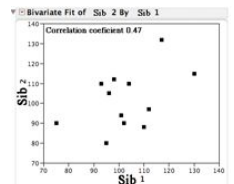
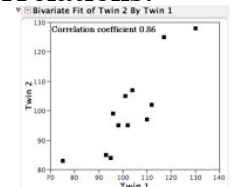
MZ .86 

DZ .60

Sib .47 

P-O .42

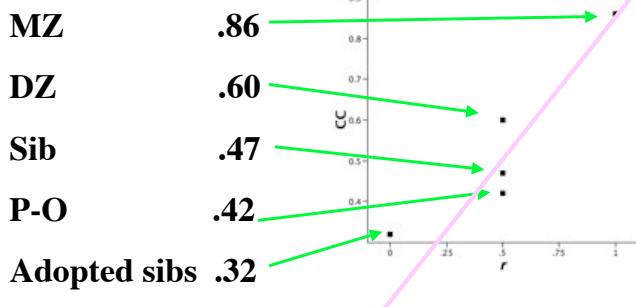
Adopted sibs .32



## Heritability of IQ $\approx .4 - .8$ in USA

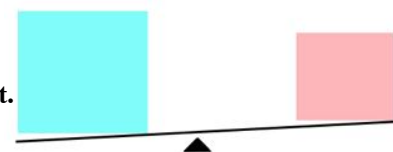
Sibs reared **together** - IQ correlations:

Kinship: Correlation:



What does  $h^2 = .4$  mean?

Which is more important?  
Environment.



Popular interpretation:  
Environmentally determined

What does  $h^2 = .4$  mean?

Which is more important?

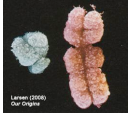


Meaningless question.

Developmental (epigenetic) interpretation:  
Environment explains more variance than genes



What was this lecture about?



- Genes make *products* that do stuff.
- Having a gene  $\neq$  expressing a gene
- Expression can be controlled by chemical stimuli, and those can be triggered by the environment (event  $\rightarrow$  neurochemical response  $\rightarrow$  start/stop expression)
- Expression can be up- or down-regulated by the action of other genes



What was this lecture about?



- By duplicating genes (mutation + selection) can have capacity to make more.
- Genes contribute to [some] complex “traits” like intelligence (d’oh; brain is *made* of something), as well as to the *variation* seen.
- Because of pleiotropy and polygenic traits, even simple on/off controls on single genes can generate immense variation in product[s]; add varying levels of activation and ... complicated.



What was this lecture about?



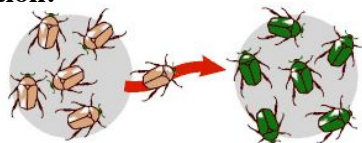
- The result is *potential* genetic contribution to most conceivable phenotypes; heritability.
- The question is not whether genes *could* influence a phenotype - it is whether in that particular case they *do*.



## Mechanisms of evolution

Two sources of genetic variation in a population:

Migration from outside



Mutation



[http://evolution.berkeley.edu/evolibrary/article/0\\_0\\_0/evo\\_01](http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_01)

## Mechanisms of evolution

Two ways for frequency of genes to change:

Neutral (drift, founder)



Natural selection



[http://evolution.berkeley.edu/evolibrary/article/0\\_0\\_0/evo\\_01](http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_01)