

Inherited = ?

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If parents have it,
offspring more likely to
as well.

**Inherited thru
transmitted genes**

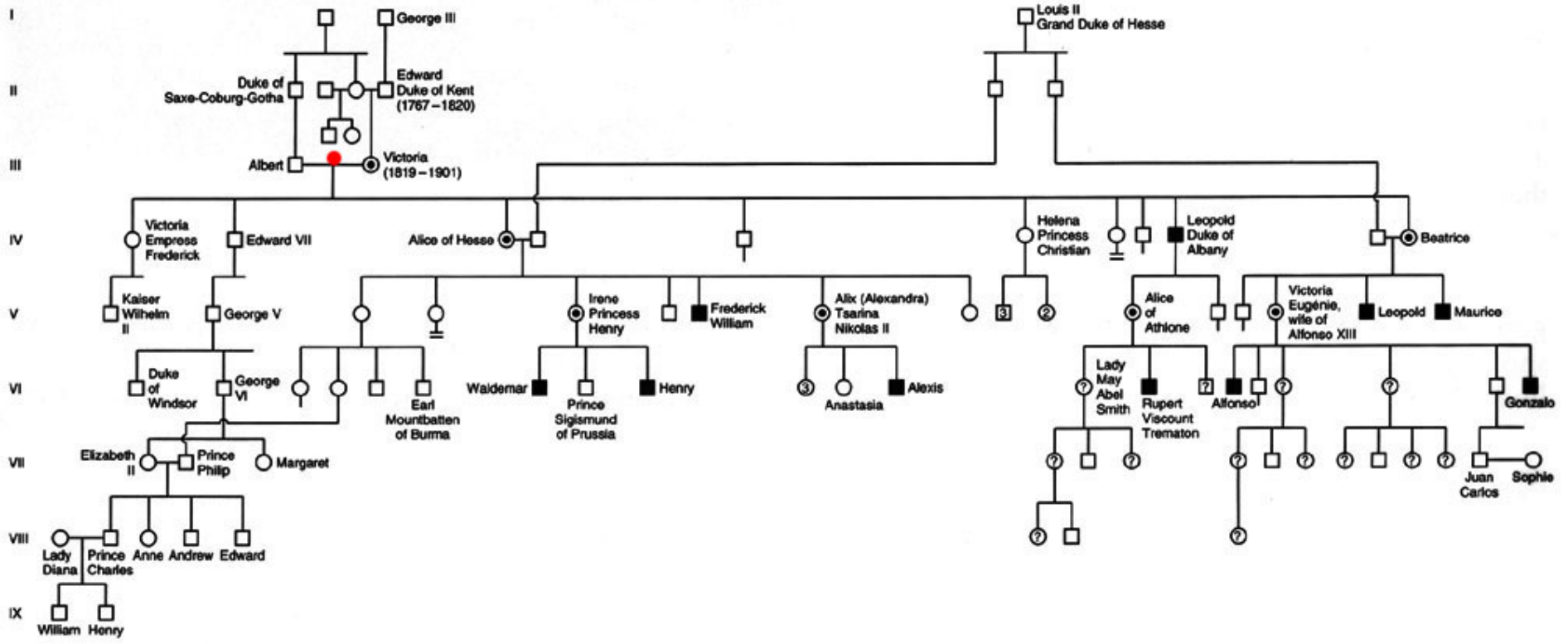
Inherited thru
transmitted genes

evidence = ?

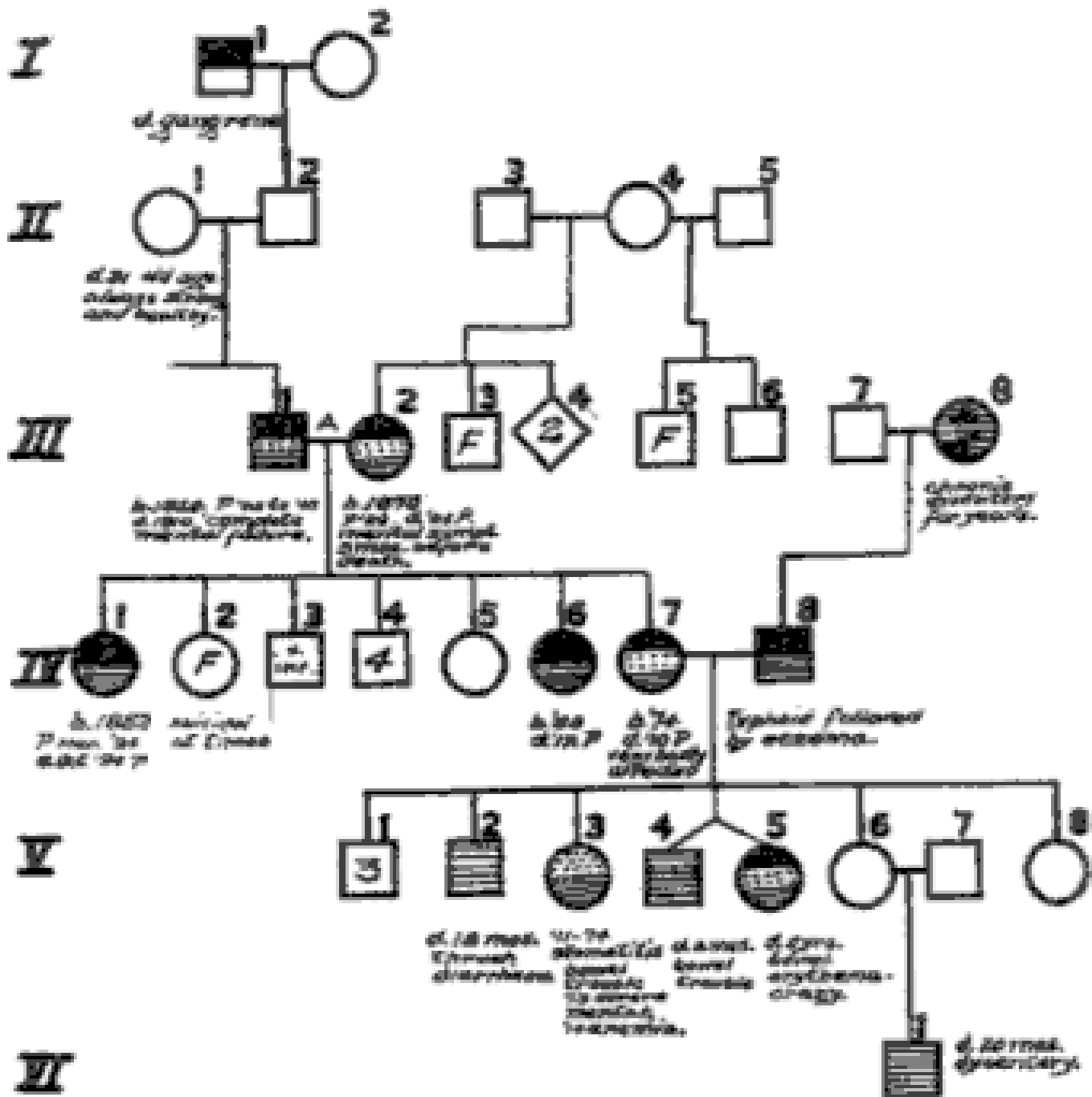
Inherited thru transmitted genes

evidence = ?

1. genealogies



- Carrier female
- Hemophilic male
- ③ Three females
- ② Status uncertain



Inherited thru transmitted genes

evidence = ?

1. genealogies

+ background K re: independence of envtl. factors

Inherited thru transmitted genes

evidence = ?

1. genealogies

+ background K re: independence of envtl. factors

2. single “major” gene

Inherited thru transmitted genes

evidence = ?

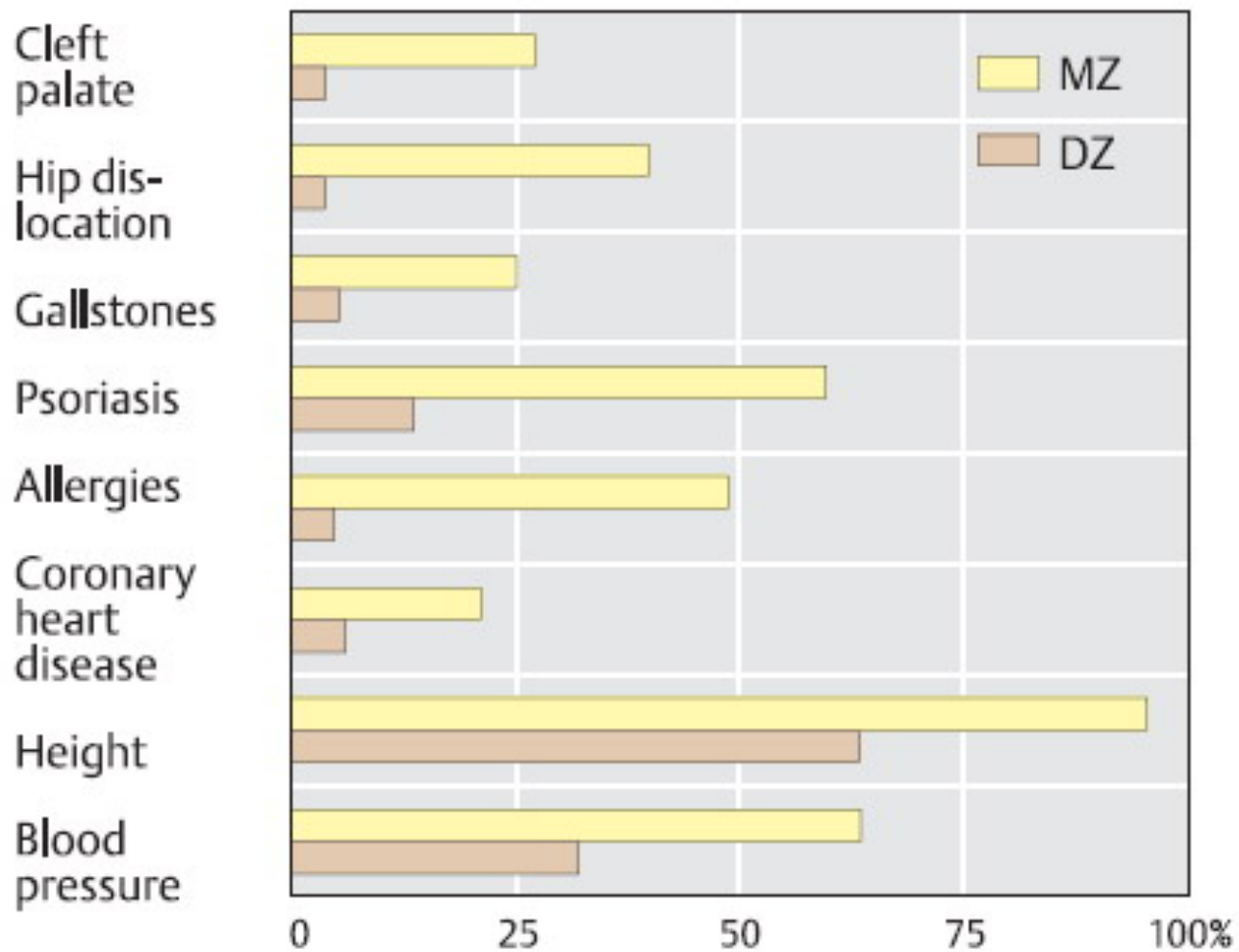
1. genealogies

+ background K re: independence of envtl. factors

2. single “major” gene

3. closer relatives more similar

Category	% chance
General population	0.85
With one parent schizophrenic	13.90
With 2 parents schizophrenic	46.30
With mz twin schizophrenic	47.40
With dz twin schizophrenic	15.00
With sibling schizophrenic	10.20
Parents of schizophrenic children	4.40
With Uncles, Aunts schizophrenic	3.60
With nephews, nieces schizophrenic	2.80
Grandchildren of schizophrenics	3.50
1st cousins of schizophrenics	3.50



(after Connor & Ferguson-Smith, 1991)

C. Concordance of some traits in monozygotic (MZ) and dizygotic (DZ) twins

Inherited thru transmitted genes

evidence = ?

1. genealogies

+ background K re: independence of envtl. factors

2. single “major” gene

3. closer relatives more similar

heritability in twin studies

increases as

similarity of MZ twins exceeds similarity of DZ twins

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$$h^2 = 2 (I_{MZ} - I_{DZ})$$

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good candidate for inquiry into its underlying molecular
genetic basis

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$$h^2 = 2 (I_{MZ} - I_{DZ})$$

good candidate for inquiry into its underlying molecular genetic basis

Q: How to hypothesize what the relevant genes are?

heritability in ag & lab trials

based on analysis of observation of trait,
not underlying genetic or environmental factors

variation among location means



Mean across all varieties & replicates

Location → 1 2 3 4 5 6 7 8

Mean across all locations & replicates

Variety ↓

V_A

A

V_B

B

V_C

C

V_D

D

V_E

E

V_F

F

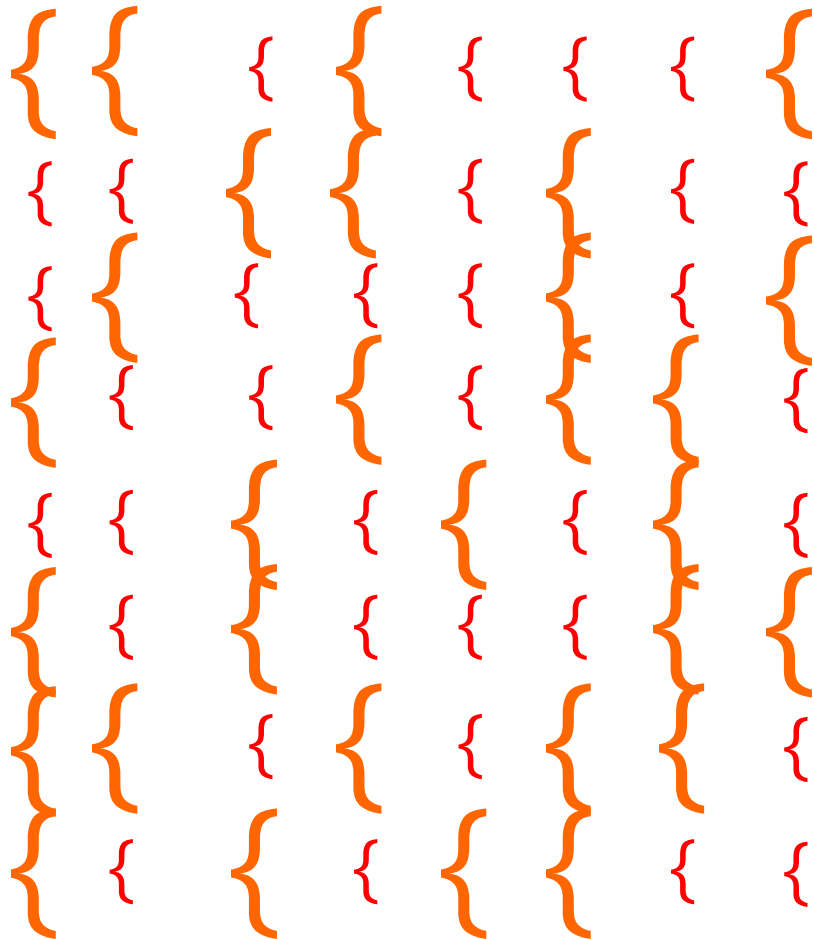
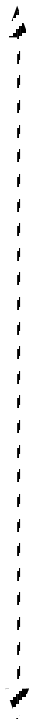
V_G

G

V_H

H

variation among variety means



heritability in ag & lab trials

based on analysis of observation of trait,
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$h^2 = \text{variance of variety ("genetic")} \text{ effects} /$
 total variance

heritability in ag & lab trials

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useful for making predictions in selective breeding

heritability in twin studies

problems

$h^2 = 2 (I_{MZ} - I_{DZ})$ -- not a reliable estimator of true heritability

heritability in twin studies

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$h^2 = 2 (I_{MZ} - I_{DZ})$ -- not a reliable estimator of true heritability

(ignores variety-location interaction
assumes that DZ are half as similar as MZ)

heritability in twin studies

problems

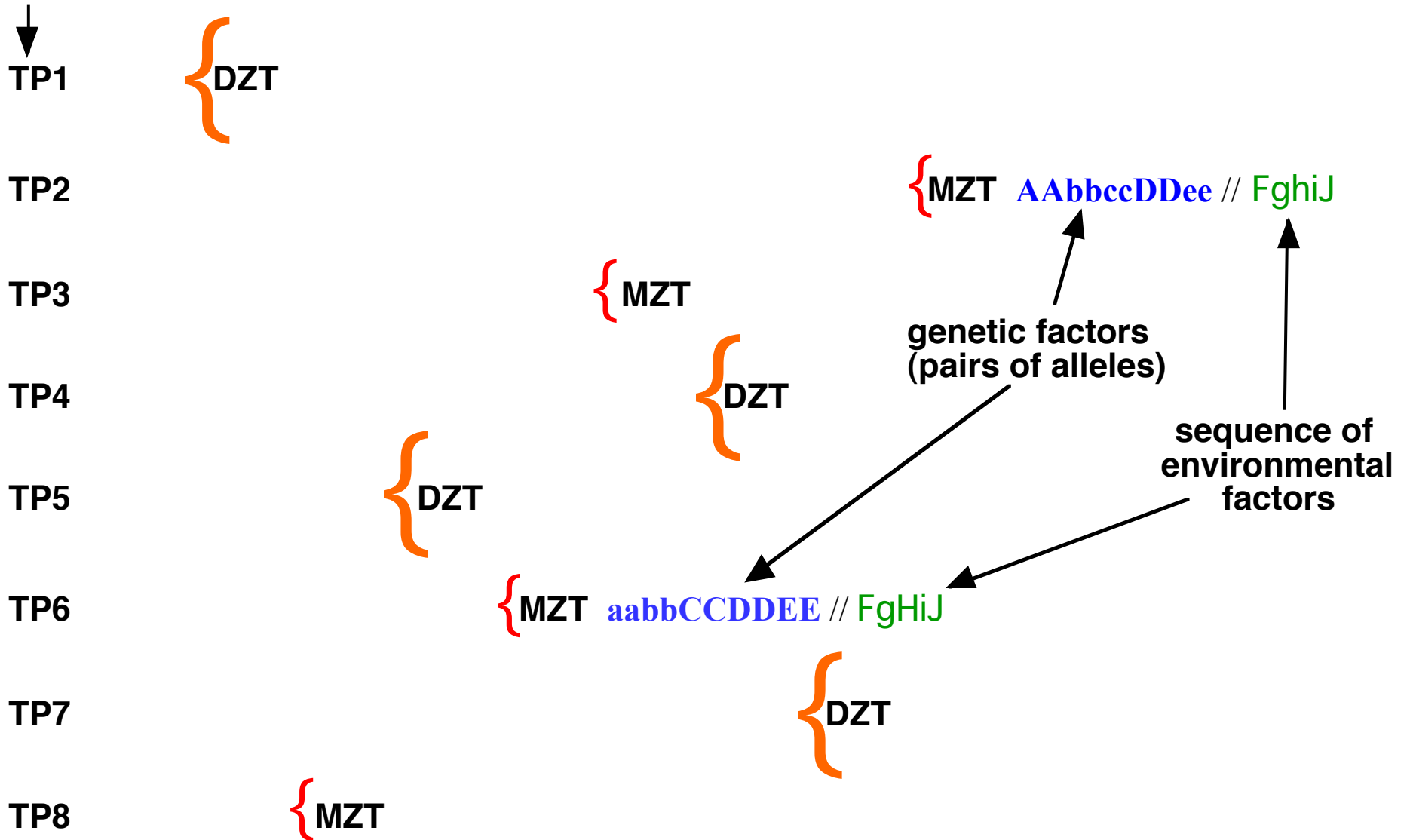
$h^2 = 2 (I_{MZ} - I_{DZ})$ -- not a reliable estimator of true heritability

(ignores variety-location interaction
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possibility of underlying heterogeneity

Situation → S1 S2 S3 S4 S5 S6 S7 S8

Twin Pair



heritability

problems

depends on the sample of varieties & locations

high heritability within one group \neq high within another

heritability

problems

depends on the sample of varieties & locations

high heritability within one group \neq high within another

put heritability to the side

**Q: genetic factors,
changeability,
group differences?**

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genetic factors \neq unchangeable

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genetic factors w/in one group \neq

same genetic factors w/in 2nd group \neq

same genetic factors “explain” difference b/w groups

Q: genetic factors, changeability, group differences?

genetic factors \neq > unchangeable

genetic factors w/in one group \neq >

same genetic factors w/in 2nd group \neq >

same genetic factors “explain” difference b/w group averages

Q: meaning of difference between averages?

**back to heritability
mixed w/ genetic factors,
changeability,
group differences**

Jensen, A. R. (1969)

"How much can we boost IQ and
scholastic achievement?"

Harvard Educational Review 39: 1-123

within group variation

high heritability

gap between group means

within group \nrightarrow between group

social policy \nrightarrow sustained IQ increase

sociological factors can't explain all of gap

plausible: significant genetic component (w/in & b/w)

\Rightarrow do not dismiss innate differences

(e.g., abstract vs. rote) & educate accordingly

25 April 2005

Black-White-East Asian IQ differences at least 50% genetic, scientists conclude in major law journal

A 60-page review of the scientific evidence, some based on state-of-the-art magnetic resonance imaging (MRI) of brain size, has concluded that **race differences in average IQ are largely genetic**. The lead article in the June 2005 issue of *Psychology, Public Policy and Law*... examined **10 categories of research evidence** from around the world to contrast "a **hereditarian model (50% genetic-50% cultural)** and a culture-only model (0% genetic-100% cultural)."

The paper, "Thirty Years of Research on Race Differences in Cognitive Ability," by J. Philippe Rushton of the University of Western Ontario and Arthur R. Jensen of the University of California at Berkeley...

"Neither the existence nor the size of race differences in IQ are a matter of dispute, only their cause," write the authors...

Dickens, W. T. and J. R. Flynn
(2001)

"Heritability estimates versus
large environmental effects:
The IQ paradox resolved."

Psychological Review 108(2):
346-369.

within group variation

high heritability

generational
gap between group means

within group \nrightarrow between group

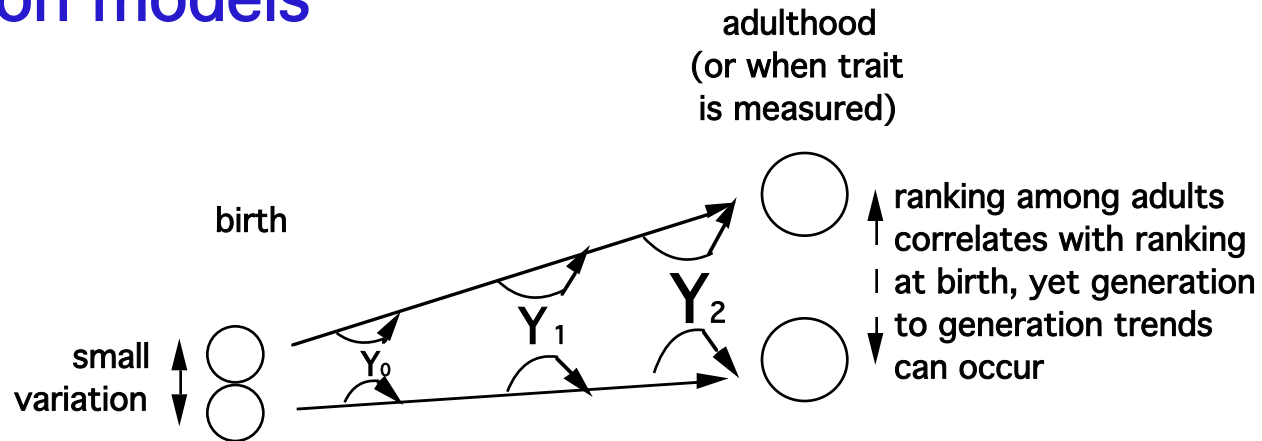
social policy \nrightarrow sustained IQ increase

sociological factors can't explain all of gap

plausible: significant genetic component (w/in & b/w) 

logic must be wrong for racial mean gap as well

reciprocal causation models



Matching and
Reciprocal
causation

growing up in environments whose differences ($Y_0...Y_1...Y_2...$) in part match differences in the trait (or in underlying traits) at each stage of life & in part are given by transient non-matching influences.

In addition, every individual's environment (Y_s) follows society-wide trends that result from average of all individuals' changes.

matching of
environments

+

social
multiplier

Contra Jensen-Rushton & Dickens-Flynn

**Taylor: heritability
should not be mixed w/
genetic factors,
changeability,
group differences**

Unresolved problems

possibility of underlying heterogeneity

heritability \neq genetic factors

how to hypothesize what the relevant genes are?

twins studies heritability

not reliable estimator of true heritability