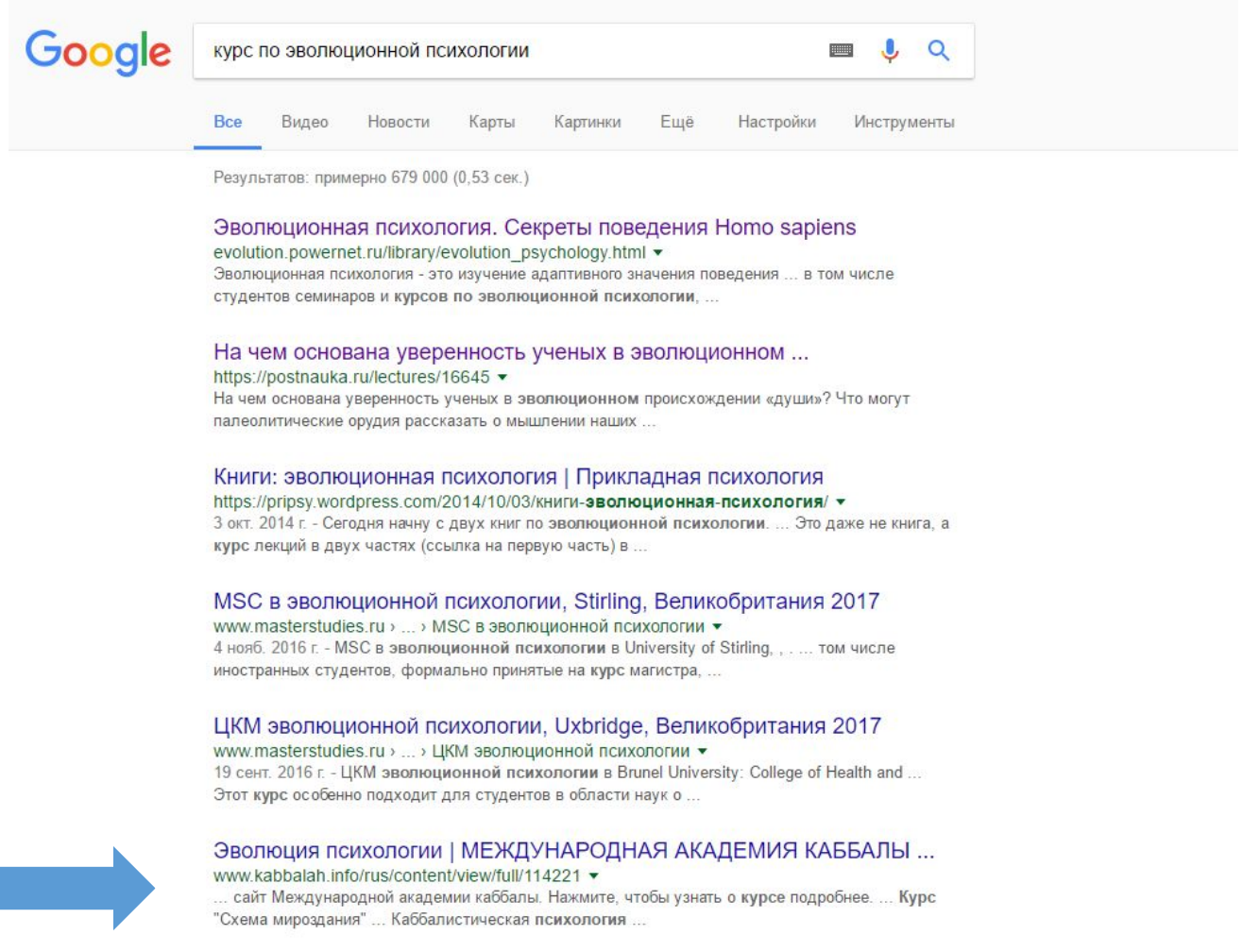
Evolutionary psychology

brought to you by
Ilya Zakharov
&
Alexander Fenin

Evolutionary psychology in Russia in one picture



Лаборатория
Когнитивных Исследований и Психогенетики

TEDS
TWINS EARLY DEVELOPMENT STUDY

Goldsmiths
UNIVERSITY OF LONDON

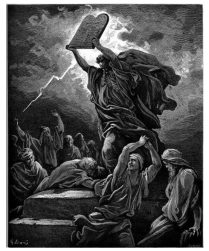
RBBG LAB
Russian British Behavioural
Genetics Laboratory

InLAB

ПРОГРЕСС
Российский Школьный
Близнецовый Регистр

What we thought we were

What we actually are



МЕМАСИКИ

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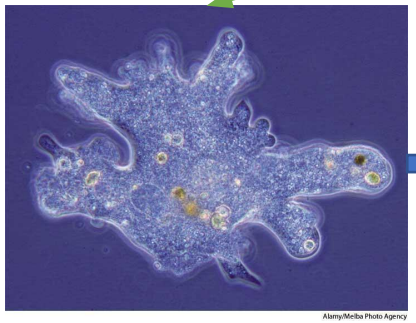
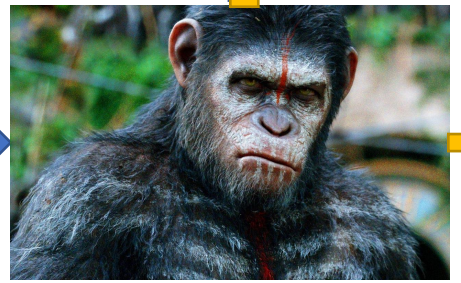
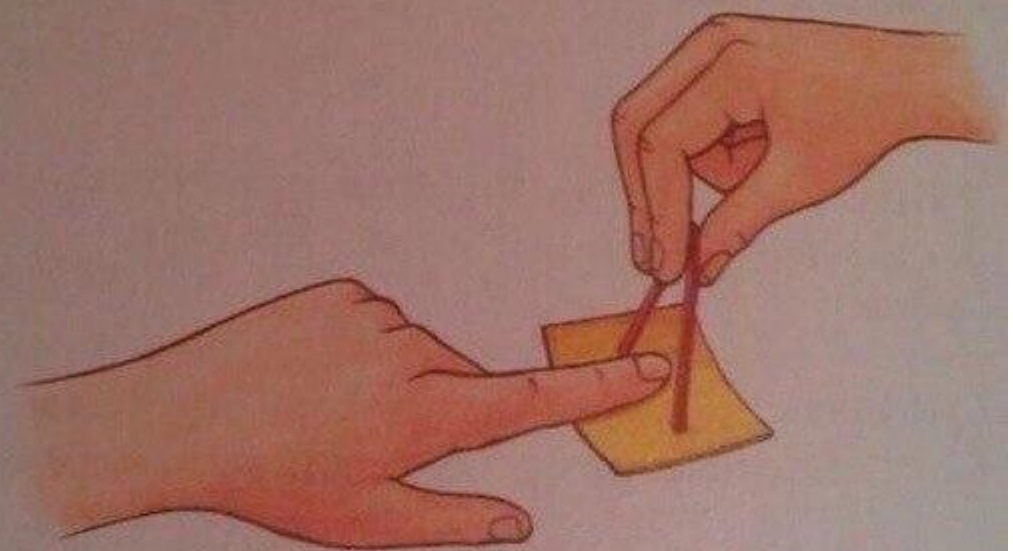
1UP!


Alamy/Melba Photo Agency



EP is about how evolution shaped our behavior. Functionally speaking.

3 Просунь палец под первую резинку. Другой рукой оттяни ее и отпусти.



Результат

Ты почувствуешь боль.

Pure cognitive psychology is working this way too!

N+1

Наука | Космос | Гаджеты | Технологии

Роботы и дроны | Обучение машин | Физики смогли | Медиц

Нейроновости | «Альцгеймер» и фибриллы

Наука

15:18 | 29 Нояб. 2016

Сложность | 3.1

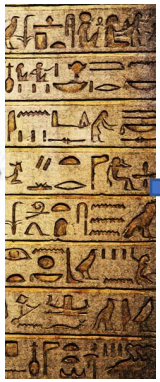
Найден ген любви к алкоголю

Свеж

14 январ
первог
сентяб

14 январ
необхо
полету

Генетика расплющила мою морду,



Behavioral genetics Nature Vs. Nurture

The Telegraph

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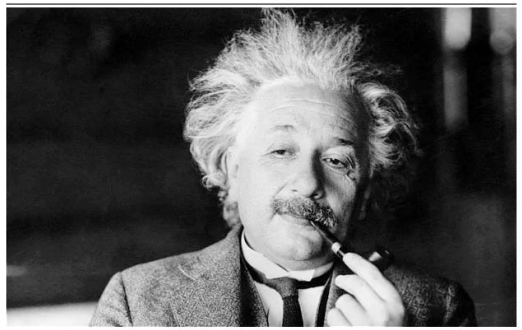
Intelligence genes discovered by scientists

Imperial College London has found that two networks of genes determine whether people are intelligent or not so bright.

11K | 0 | 0 | 11K | Email



National Puzzle Day: Albert Einstein would be a fan Photo: AP

By Sarah Knapton, Science Editor

4:00PM GMT 21 Dec 2015

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Но общество “расплющило” мою душу.

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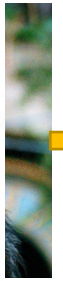
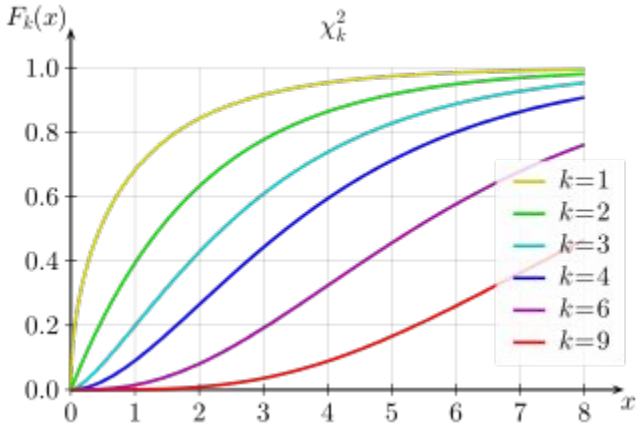
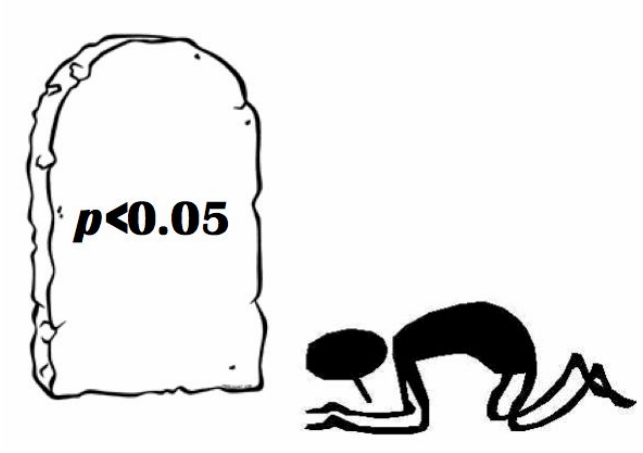
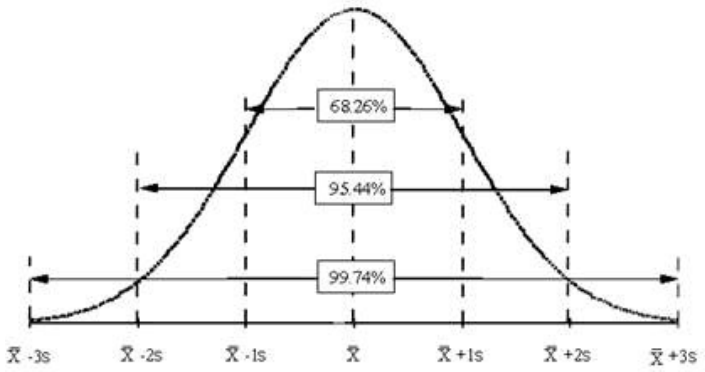
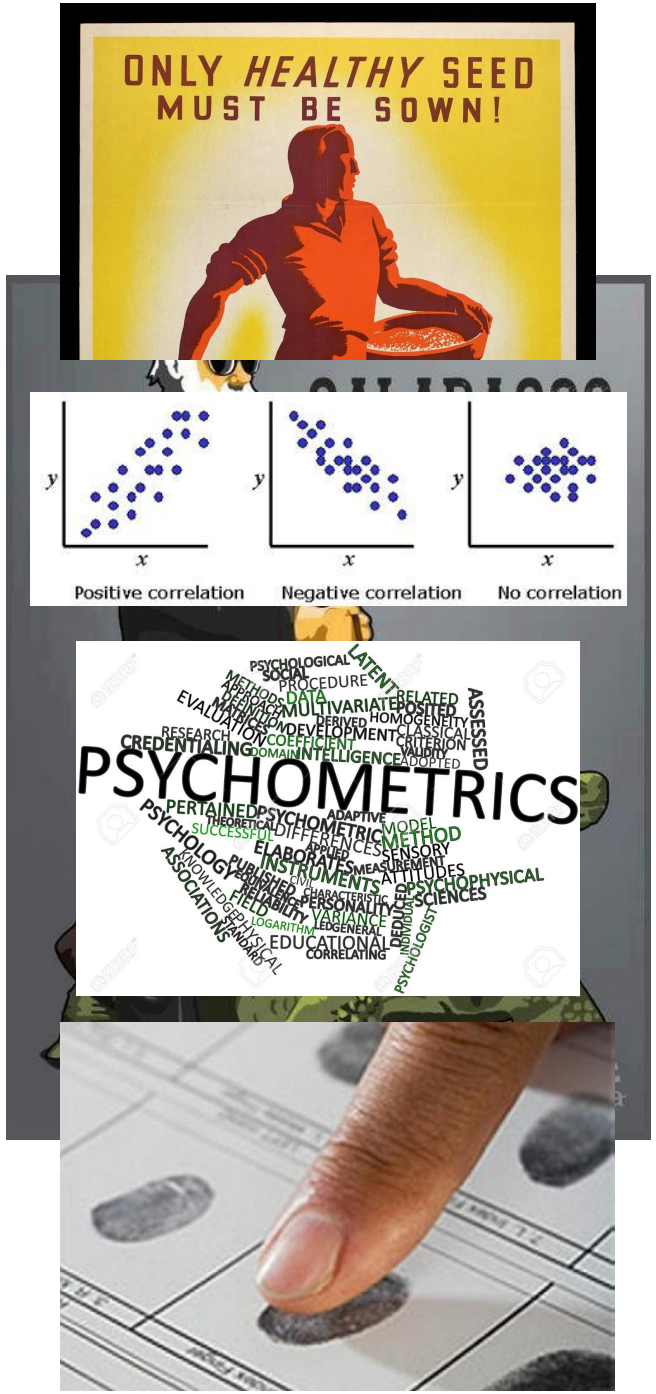


So how do genetics and environment form us?


$F_k(x)$
χ^2_k
1.0
0.8
0.6
0.4
0.2
0.0
0 1 2 3 4 5 6 7 8
x
$k=1$
$k=2$
$k=3$
$k=4$
$k=6$
$k=9$


$p<0.05$


68.26%
95.44%
99.74%
$\bar{X}$ -3s
$\bar{X}$ -2s
$\bar{X}$ -1s
$\bar{X}$
$\bar{X}$ +1s
$\bar{X}$ +2s
$\bar{X}$ +3s

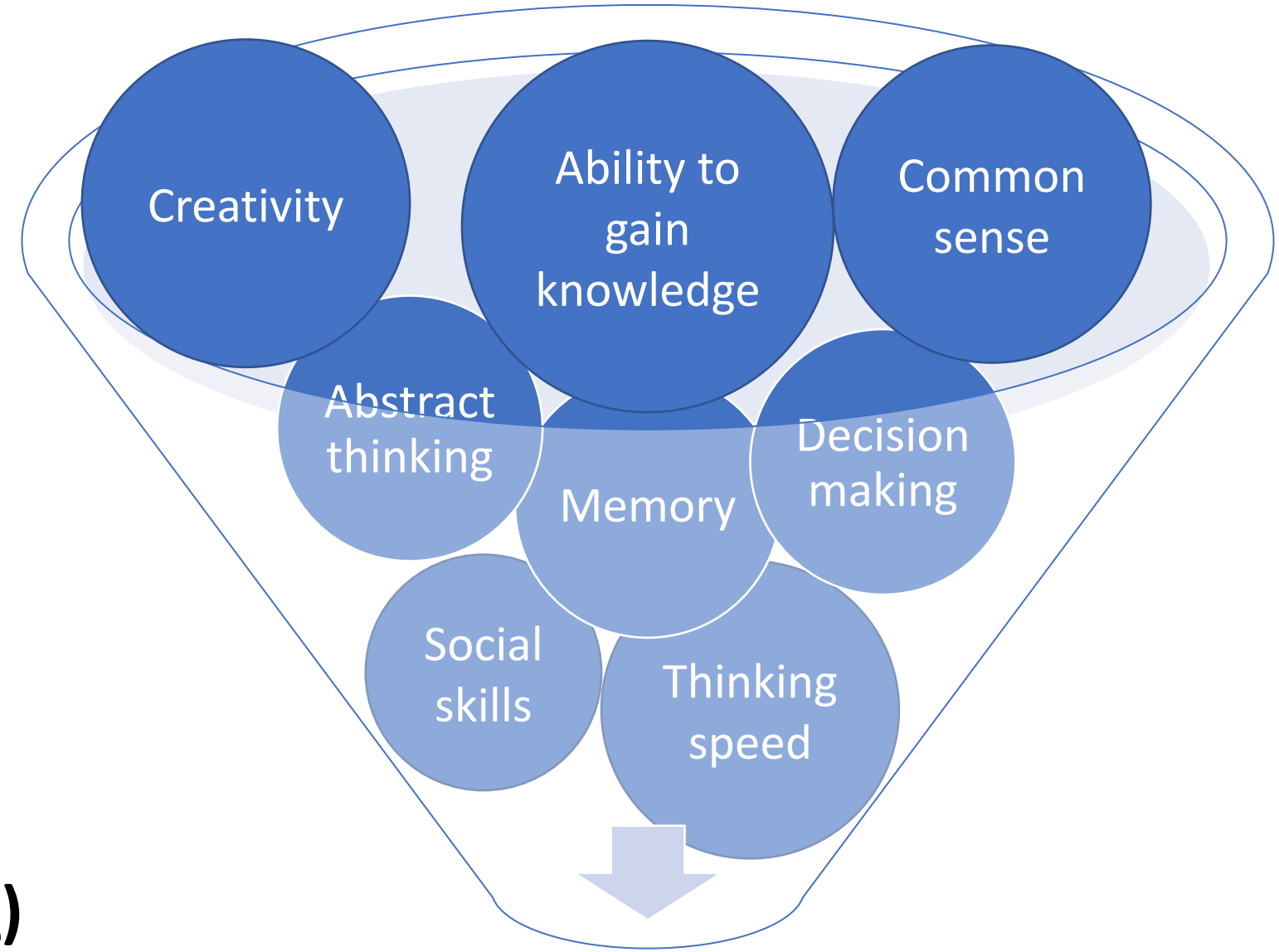

ONLY HEALTHY SEED
MUST BE SOWN!
Positive correlation
Negative correlation
No correlation
PSYCHOMETRICS

Quantitative genetics

To proceed, we will need several terms from behavioral genetics

- Every phenotype (and that could be any trait) in any population has a dispersion rate
- We may suggest that this dispersion consists of:
  - h – heritability. The difference in genes.
  - c – common environment. The difference in family environment.
  - e – individual environment + the measurement error.

Let’s take a look at how it works.



Analytical (IQ)
Practical
Creative

G

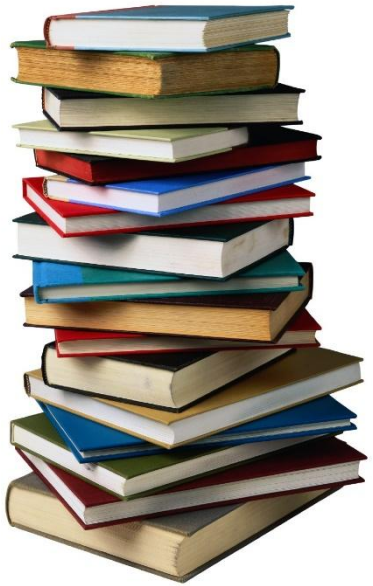
Fluid
Crystallized

Suppose we have an infinite amount of identical twins couples

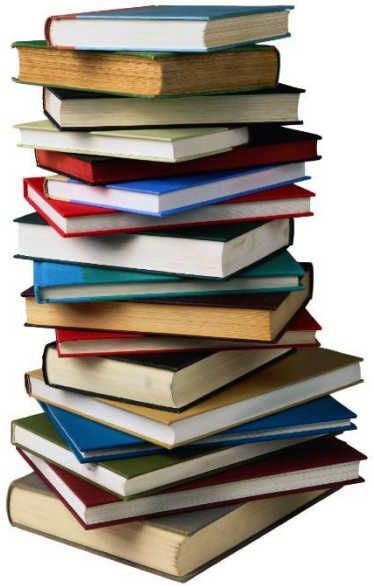
Let’s put them apart

Now let’s place them in different conditions

h = 0; c = ?; e = ?

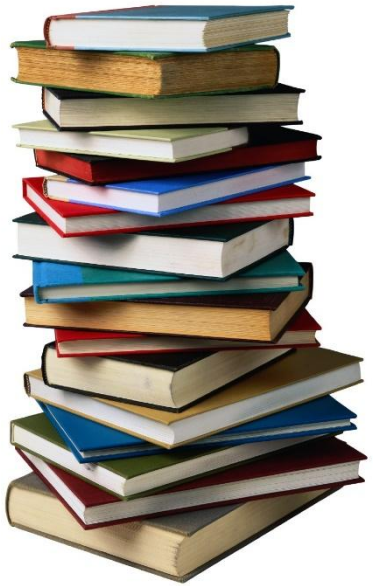


Okay, what if we place them into the same conditions?

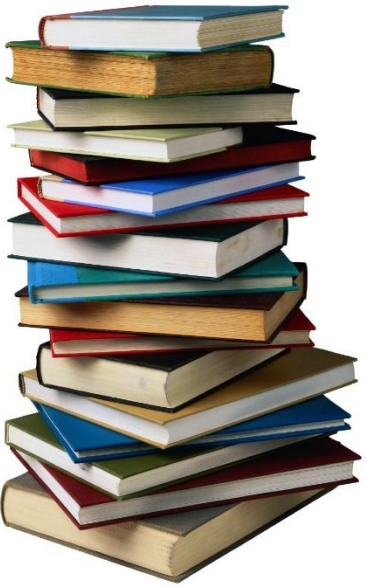


h = 0; c = 0; e = ?

CONSIDERING THAT

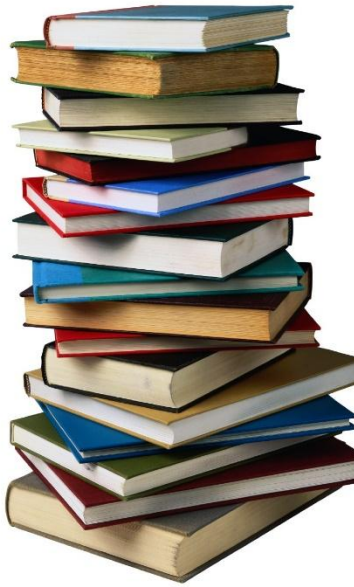


Now what if we take fraternal twins?

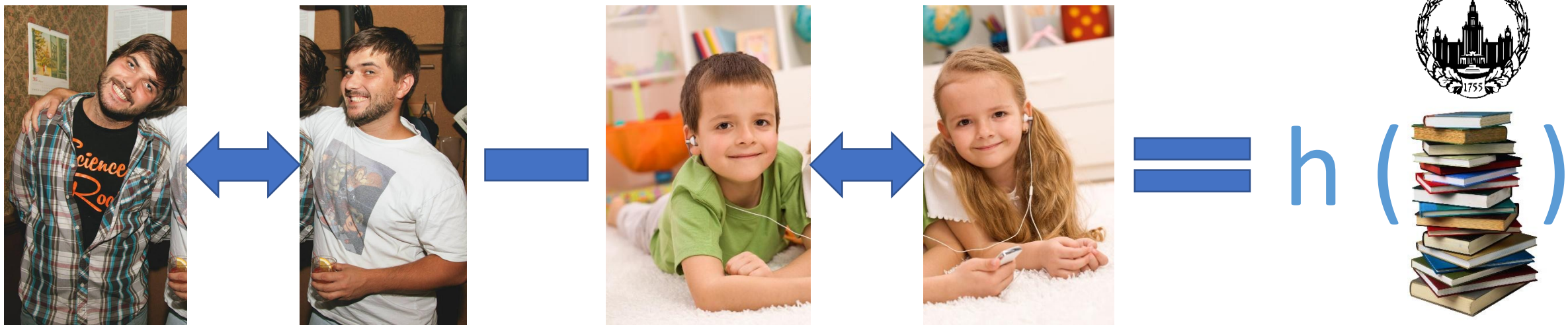


h = ?; c = const; e = const

IF SES AND THE OTHER ENVIRONMENTAL FACTORS ARE ACCOUNTED FOR

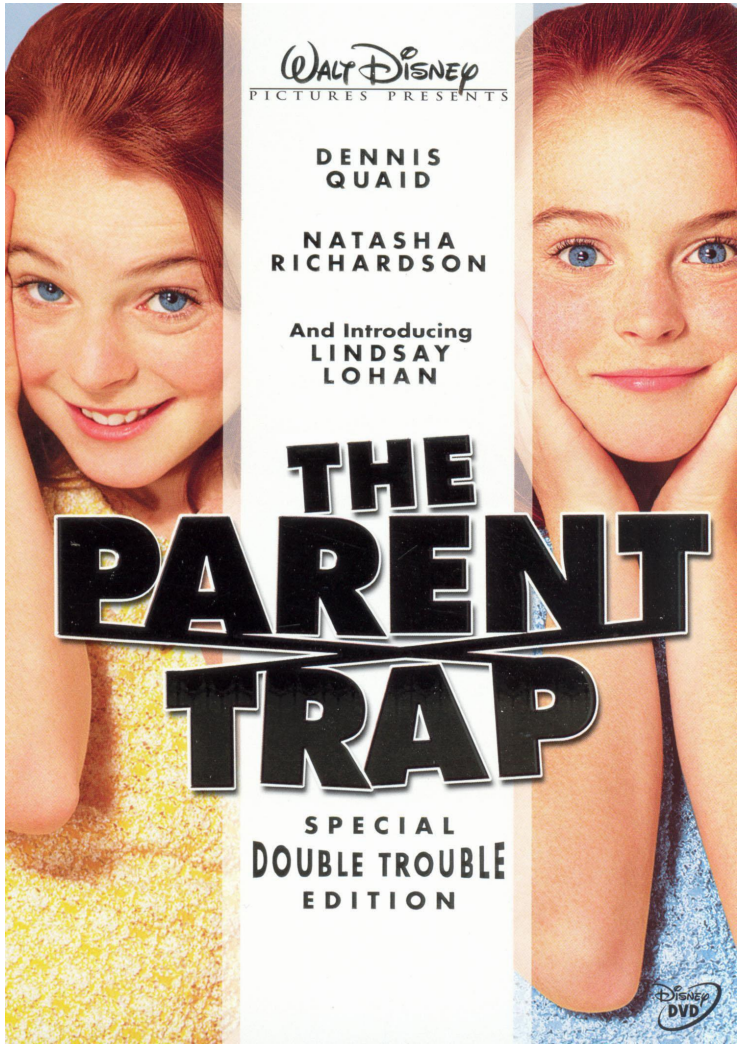


And here is how twin method works



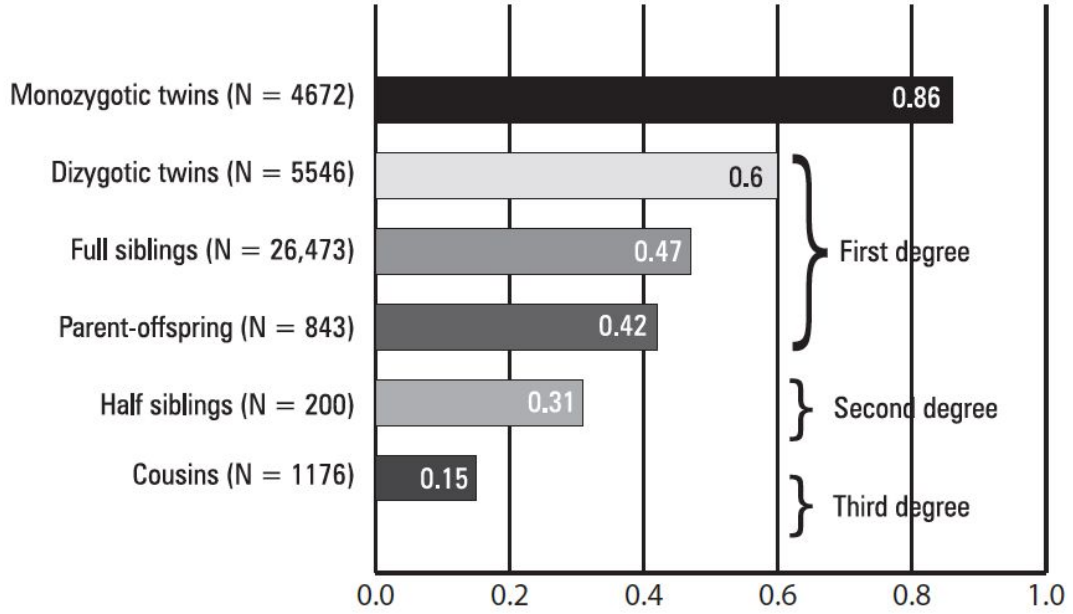
Biographical method and reared-aparts

Сын	Ты	Отец	Дед	Прадед
50%	Гений	30%	15%	3%



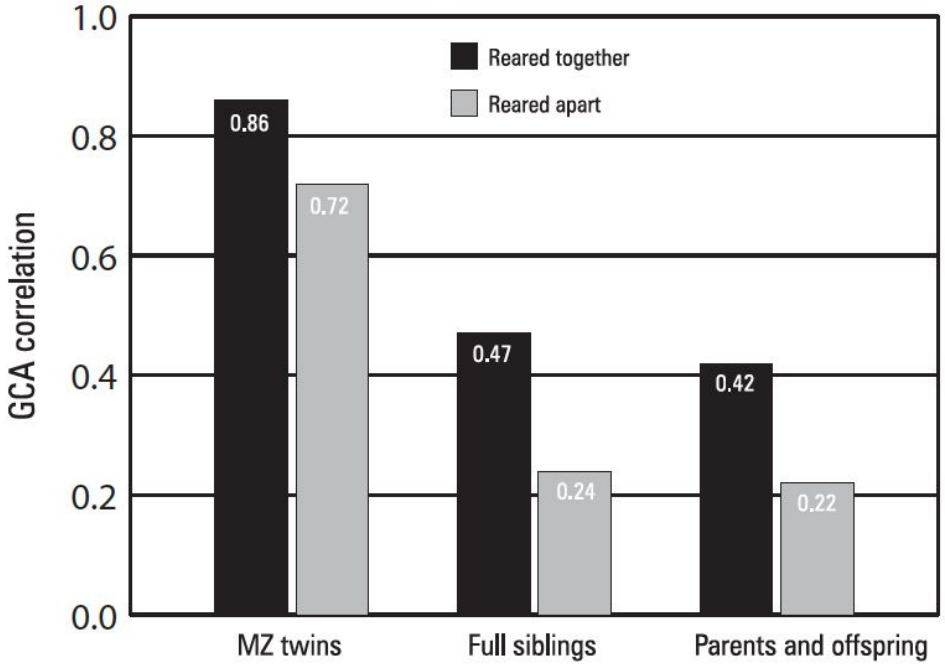
By this moment we already can say much

Figure 2.
Average correlation for general cognitive ability among reared-together relatives as a function of degree of genetic relatedness



(T. Bouchard and M. McGue, "Familial Studies of Intelligence: A Review," *Science* 212 [1981]: 1055-59).

Average correlation for general cognitive ability among reared-together versus reared-apart relatives

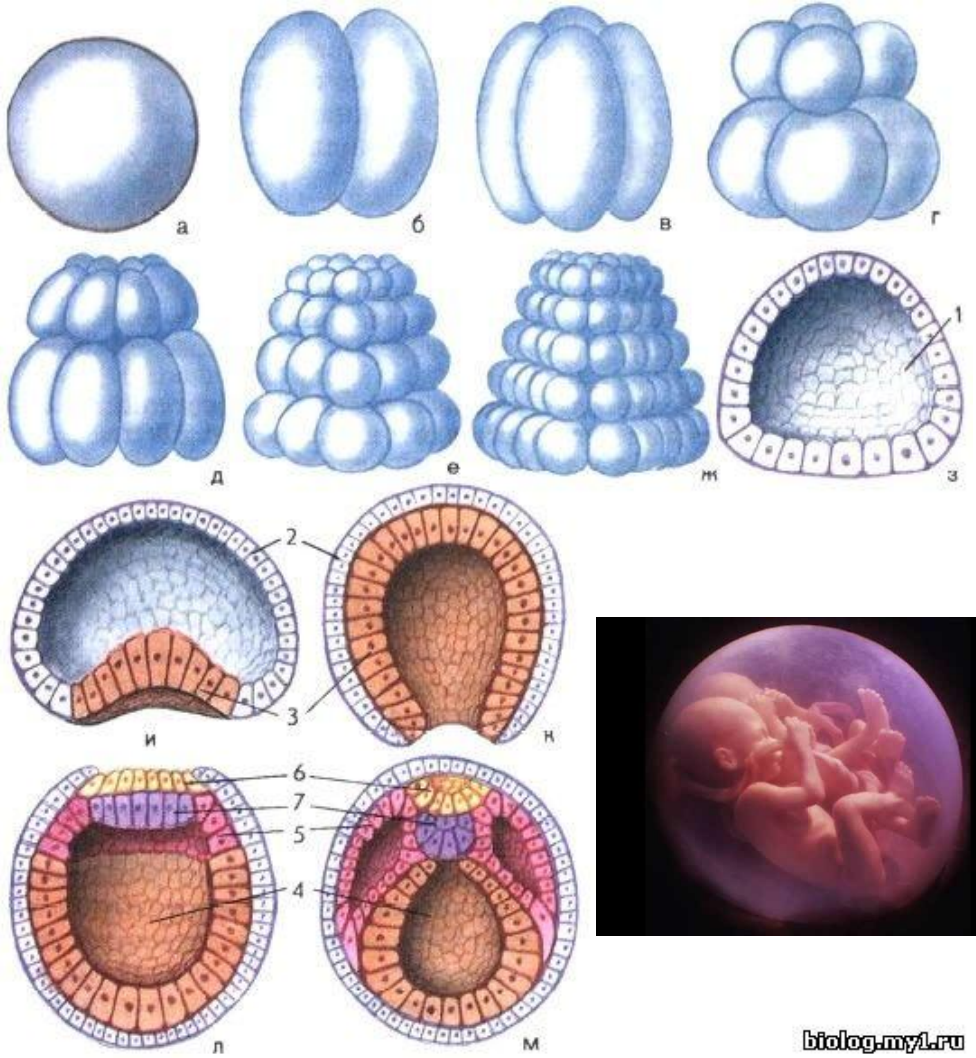


(T. Bouchard and M. McGue, "Familial Studies of Intelligence: A Review," *Science* 212 [1981]: 1055-59).

Problems, officer?

- MZ twins are supposed to be equal in many ways, but they are actually not
- Genotypic-environmental covariation makes it hard to distinguish genetic influences from the environmental

Prenatal influence



Perinatal influence

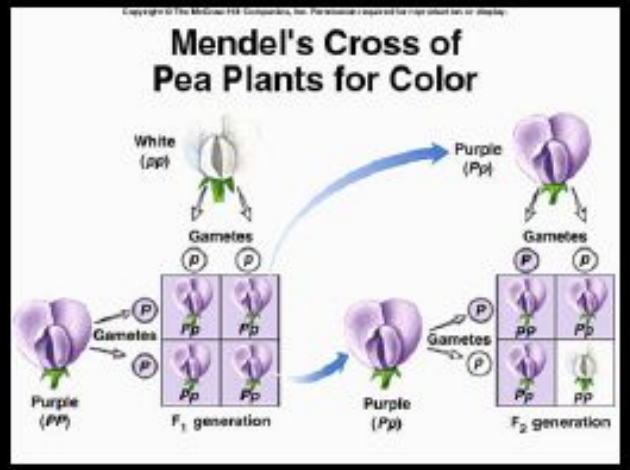
Covariation

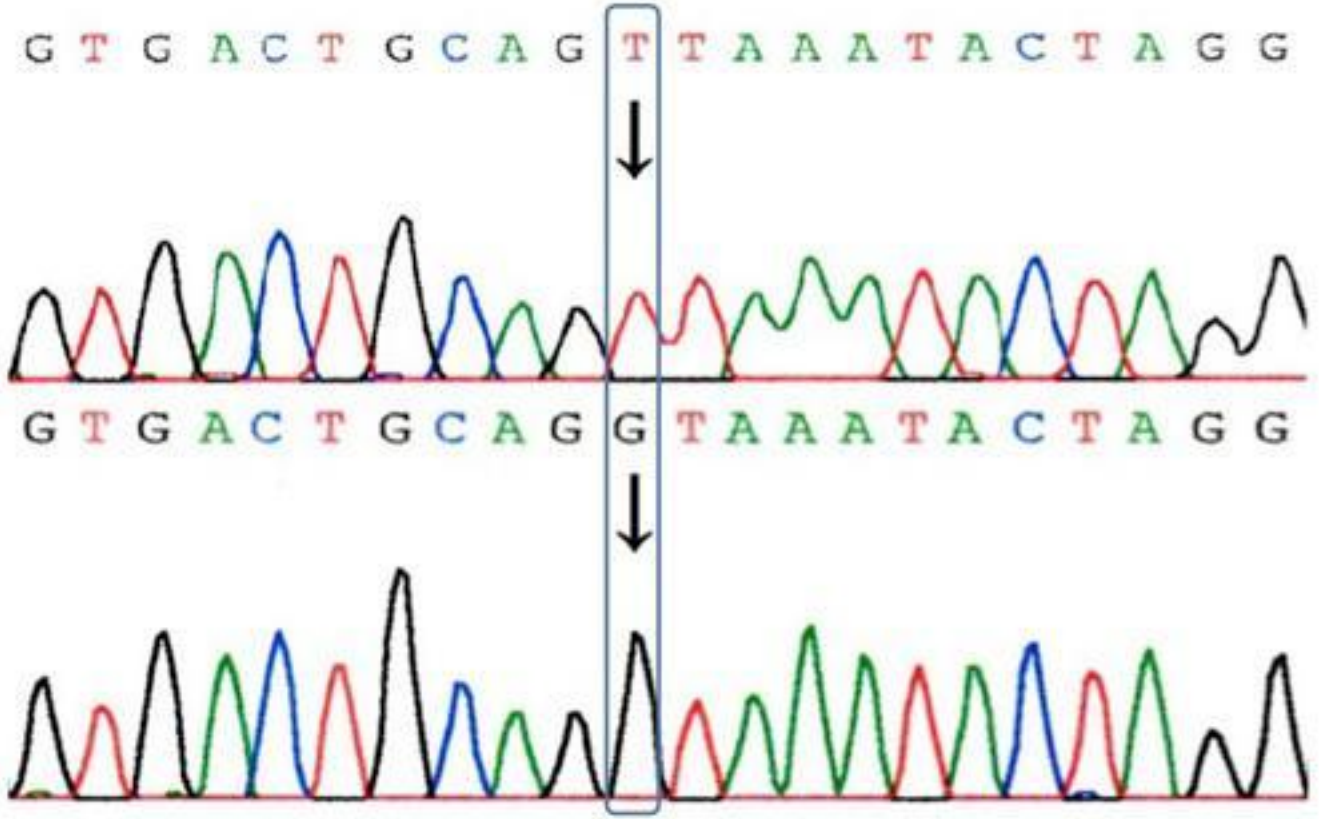
+

=

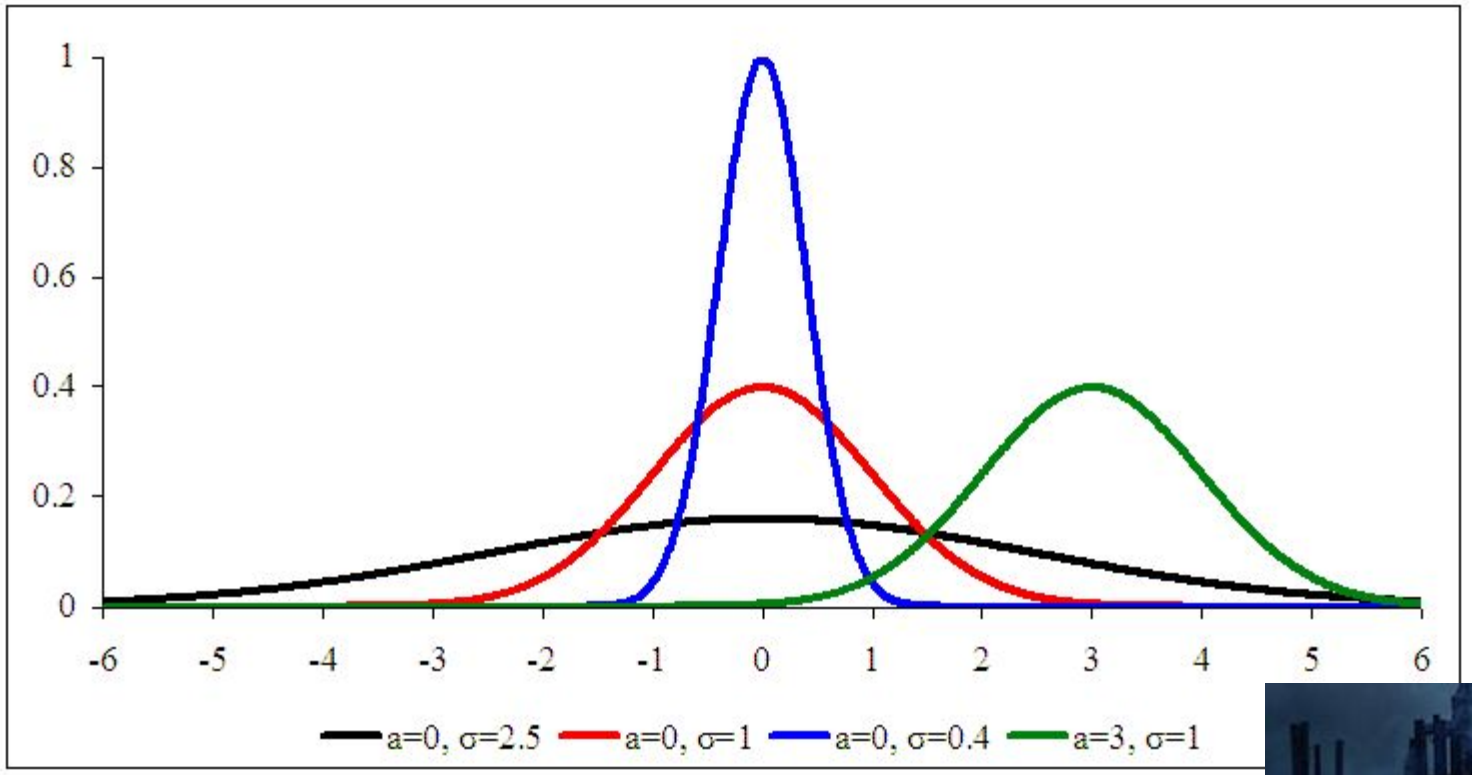
Ok, that’s good enough, but where were the genes?

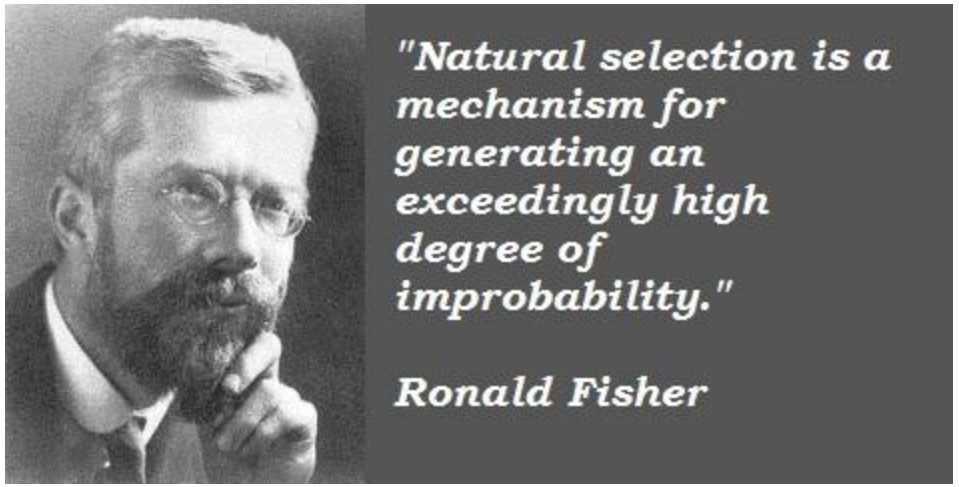
Грегор Мендель и большая удача

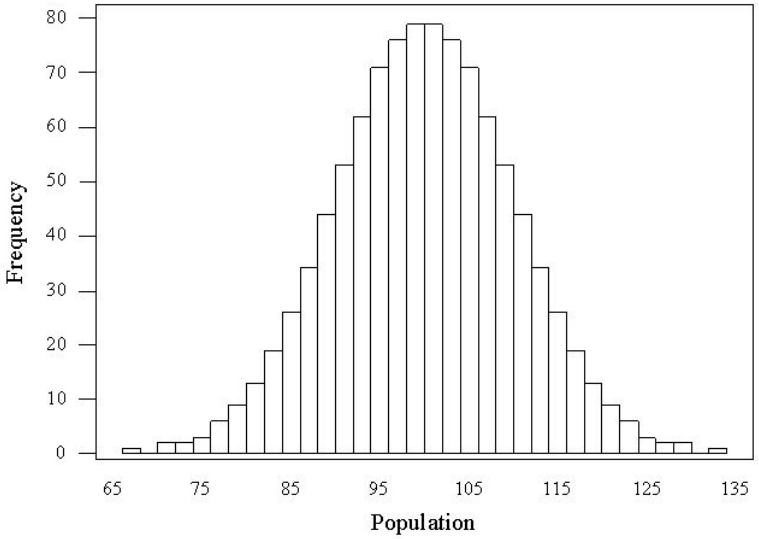




3 billion nucleotides, 3 million meaningful changes, 0.4% diseases

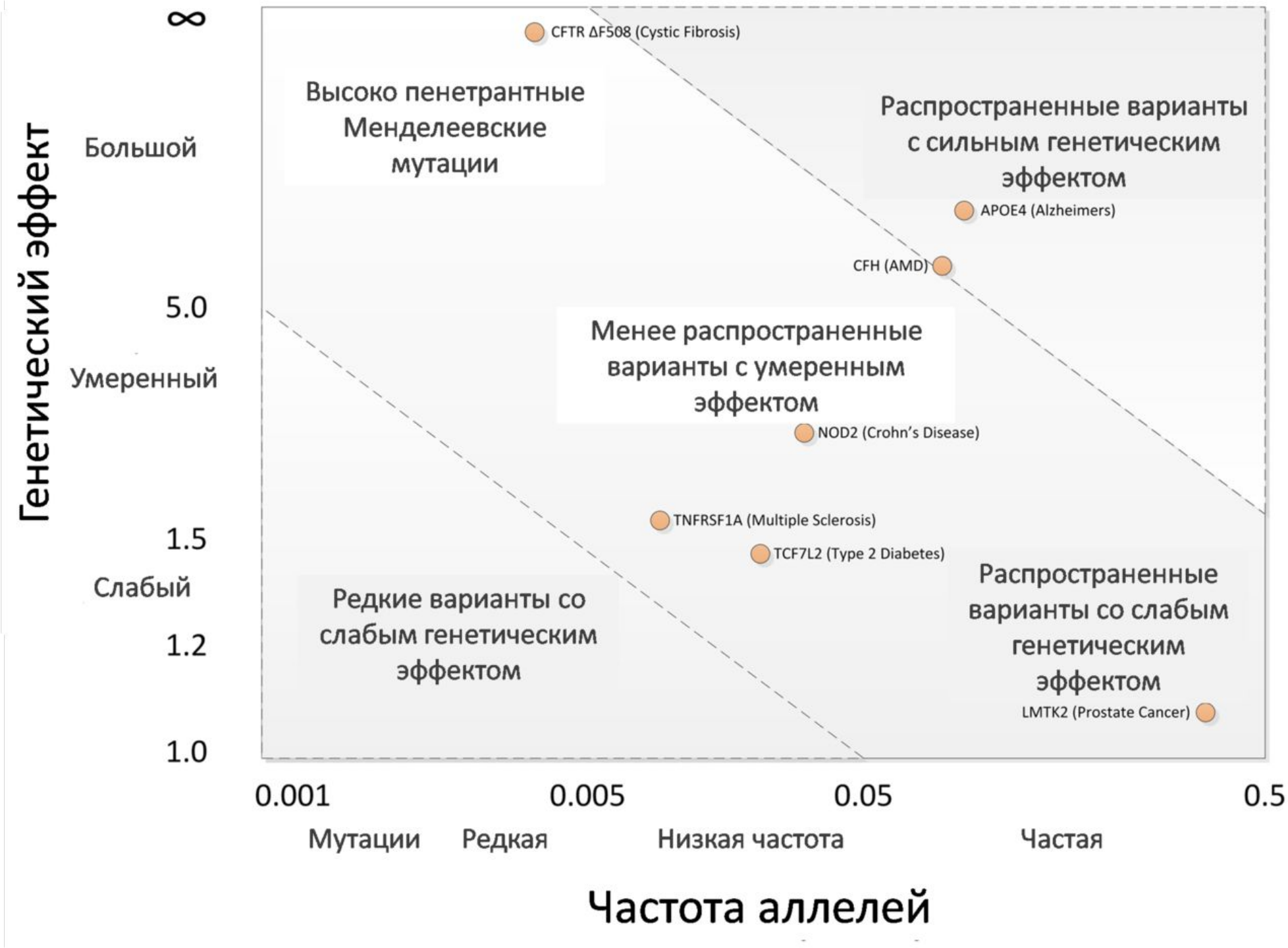

1
0.8
0.6
0.4
0.2
0
-6
-5
-4
-3
-2
-1
0
1
2
3
4
5
6
a=0, σ=2.5
a=0, σ=1
a=0, σ=0.4
a=3, σ=1


"Natural selection is a mechanism for generating an exceedingly high degree of improbability."
Ronald Fisher

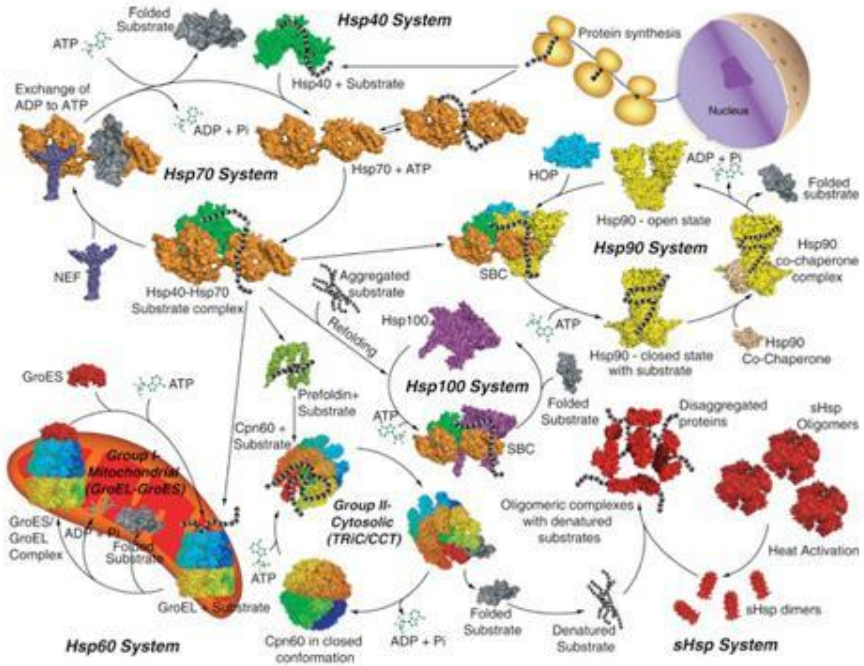

Frequency
80
70
60
50
40
30
20
10
0
65
75
85
95
105
115
125
135
Population

Молекулярные исследования

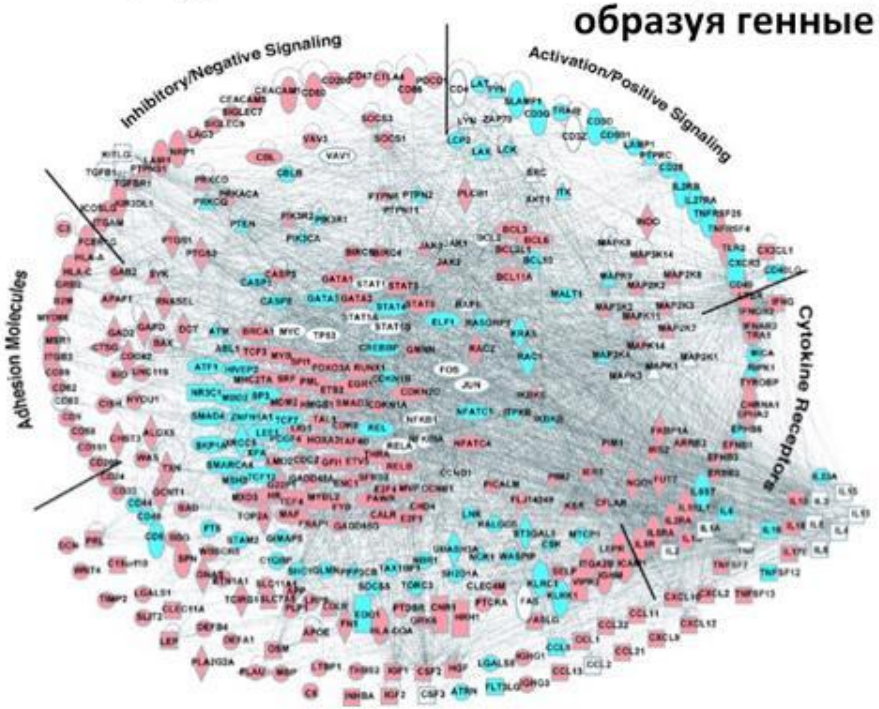
Looking at genes – ~95% of heritability is missing


Генетический эффект
∞
Большой
5.0
Умеренный
1.5
Слабый
1.2
1.0
CFTR ΔF508 (Cystic Fibrosis)
Высоко пенетрантные Менделеевские мутации
Распространенные варианты с сильным генетическим эффектом
APOE4 (Alzheimers)
CFH (AMD)
Менее распространенные варианты с умеренным эффектом
NOD2 (Crohn's Disease)
TNFRSF1A (Multiple Sclerosis)
TCF7L2 (Type 2 Diabetes)
Редкие варианты со слабым генетическим эффектом
Распространенные варианты со слабым генетическим эффектом
LMTK2 (Prostate Cancer)
0.001
0.005
0.05
0.5
Мутации
Редкая
Низкая частота
Частая
Частота аллелей

Белков очень много и они очень разные



Они определяют миллионы взаимодействий, образуя генные сети…



Polygenic scores

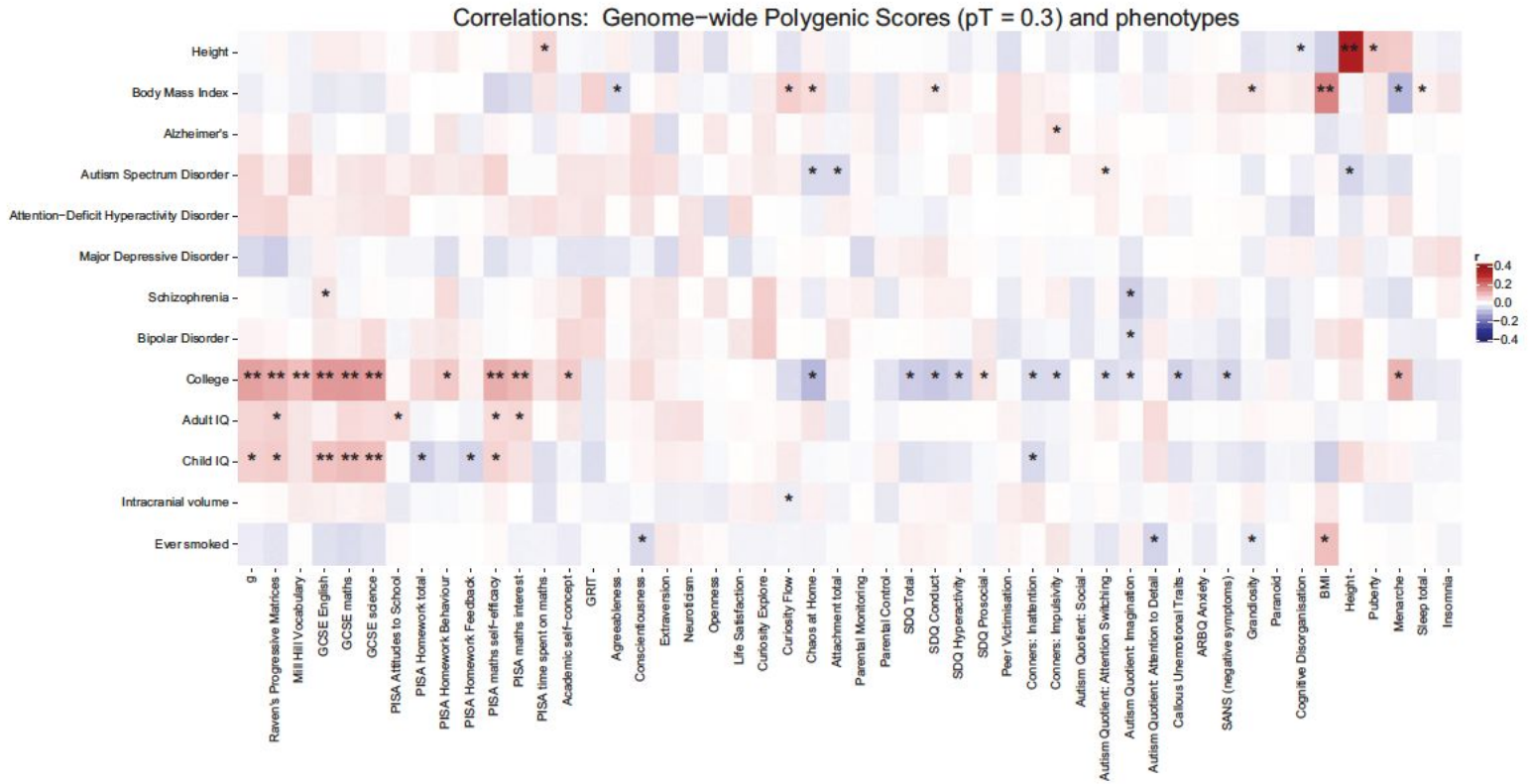


Figure 1. Correlations between 13 genome-wide polygenic scores and 50 traits from the behavioral phenome. These results are based on GPS constructed using a GWAS *P*-value threshold (P_T) = 0.30; results for P_T = 0.10 and 0.05 (Supplementary Figures 1a and b and Supplementary Table 3). *P*-values that pass Nyholt–Sidak correction (see Supplementary Methods 1) are indicated with two asterisks, whereas those reaching nominal significance (thus suggestive evidence) are shown with a single asterisk.

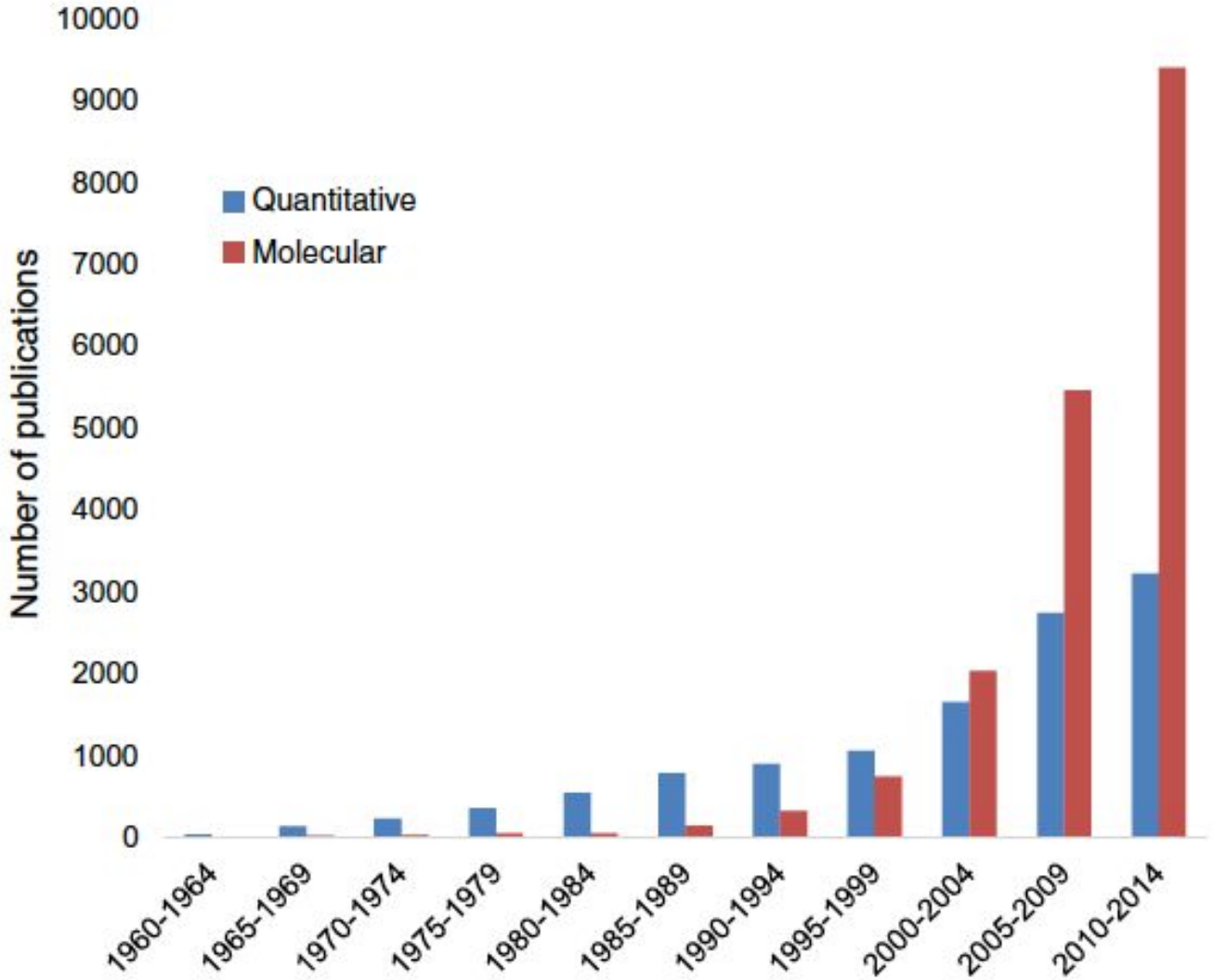
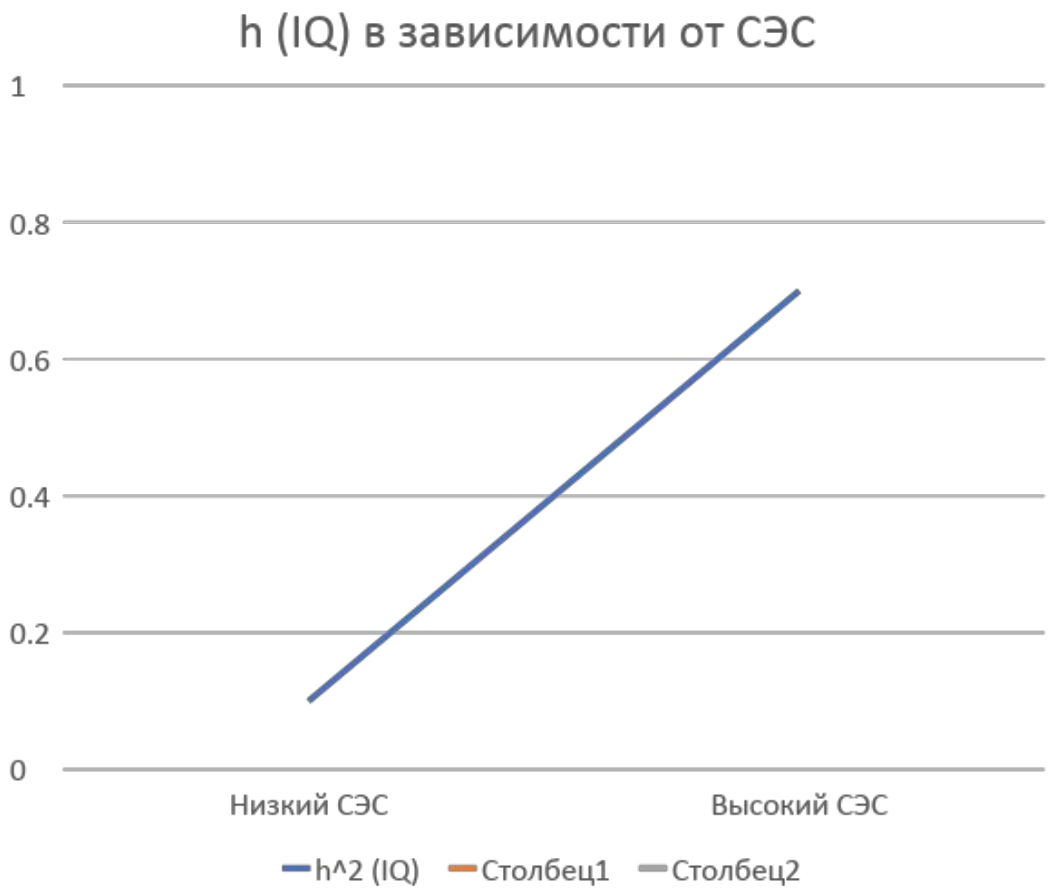


Fig. 2 Number of human behavioral genetic papers by lustrum since 1960, comparing quantitative and molecular genetic research

Why does it all matter?

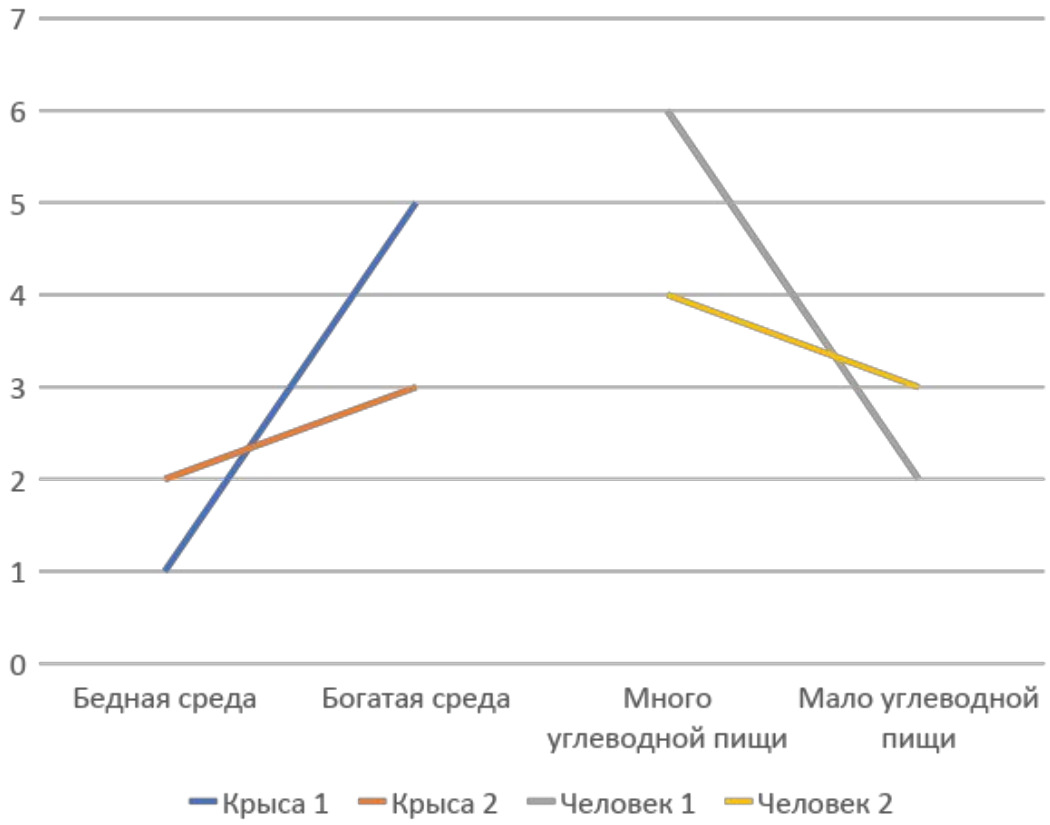
Every unhappy family is unhappy in its own way

- Вариабельность факторов среды, влияющих на IQ в семьях с низким СЭС, примерно в 5 раз выше, чем в семьях с высоким СЭС.
- Иначе говоря, семьи с низким СЭС отличаются между собой в 5 раз больше, чем семьи с высоким.

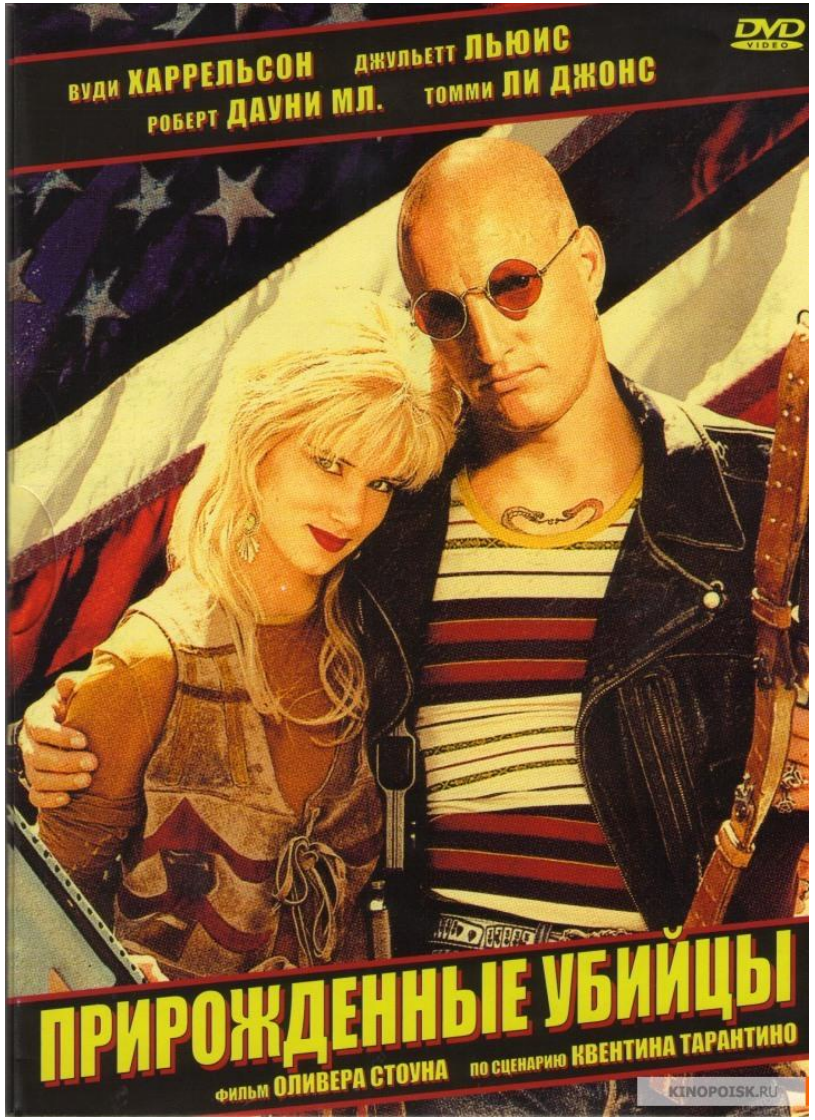


Why?

- Because it is not the trait itself that is inherited, but rather the borders defining it’s maximum variation
- Rats’ intelligence
- Fatness



- Genes make some things easier (see Rutter & autism, neurojurisprudence, gay rights),
- Yet genes do not determine our destiny or what we are. They rather install the borders and filters,
- In the end, it is you who determine the environment that determines how the genes determine who you are.
- And that is the point of the third factor.



Enough for today.
Questions?