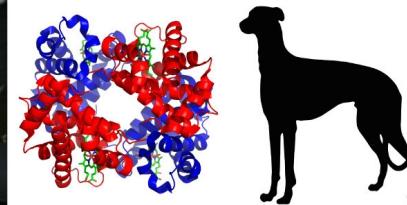
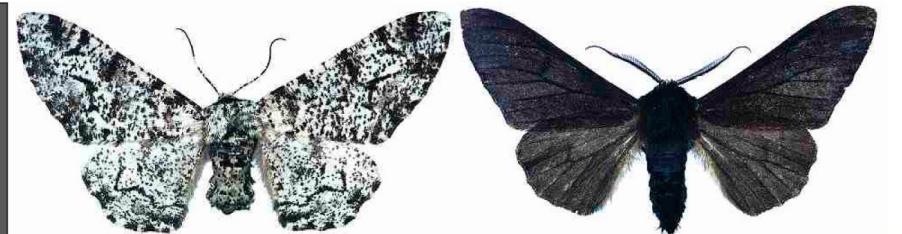


www.gephebase.org

GepheBase

The Database of Evolutionary Genotype-Phenotype Relationships



www.gephebase.org

Includes Natural, Domesticated and Experimental Variation
but **NO LAB MUTANTS** and **NO CLINICAL TRAITS**

>2000 genes and mutations
associated with
natural phenotypic changes
in animals and plants

Ge-phe

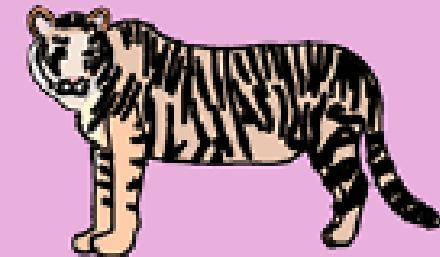
a Genetic VARIATION causing
a Phenotypic VARIATION

TGCGCGGTC
C A V
 ₄₇₇



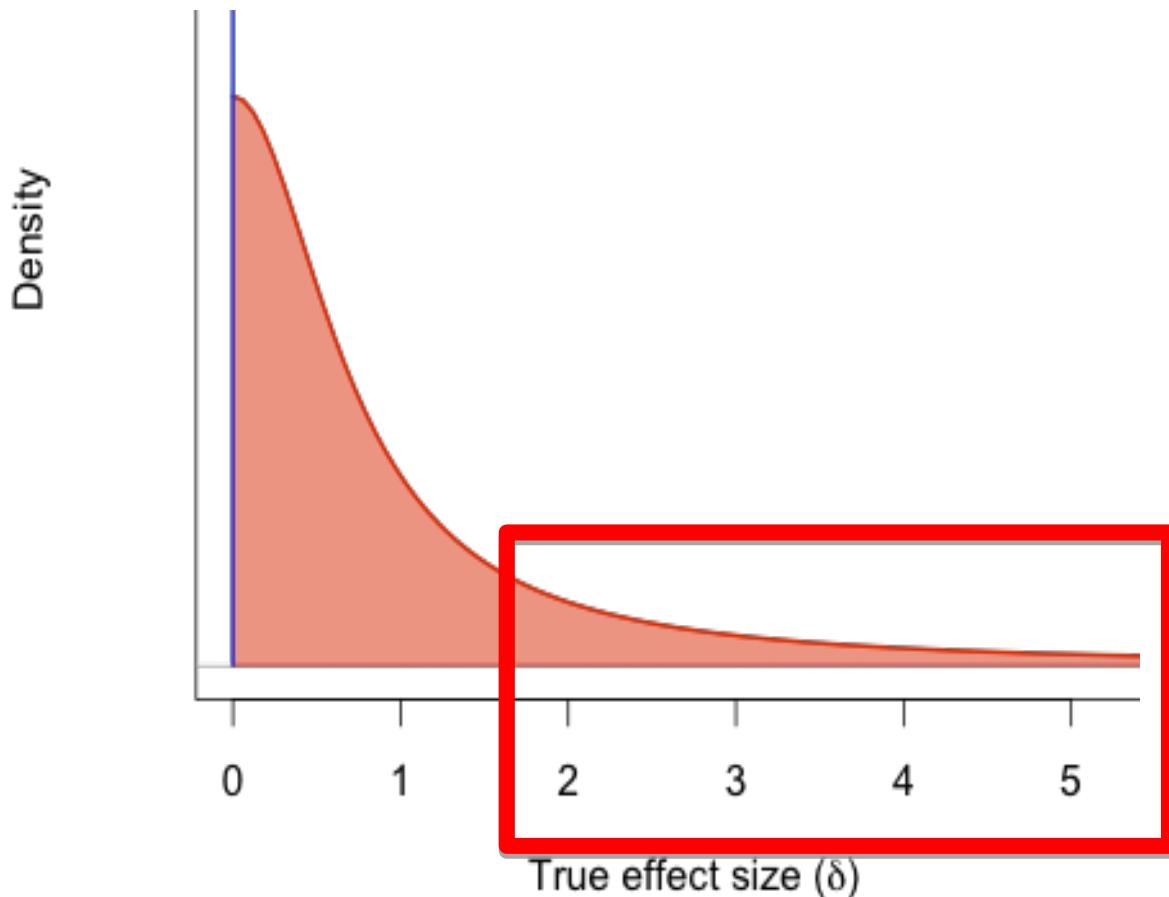
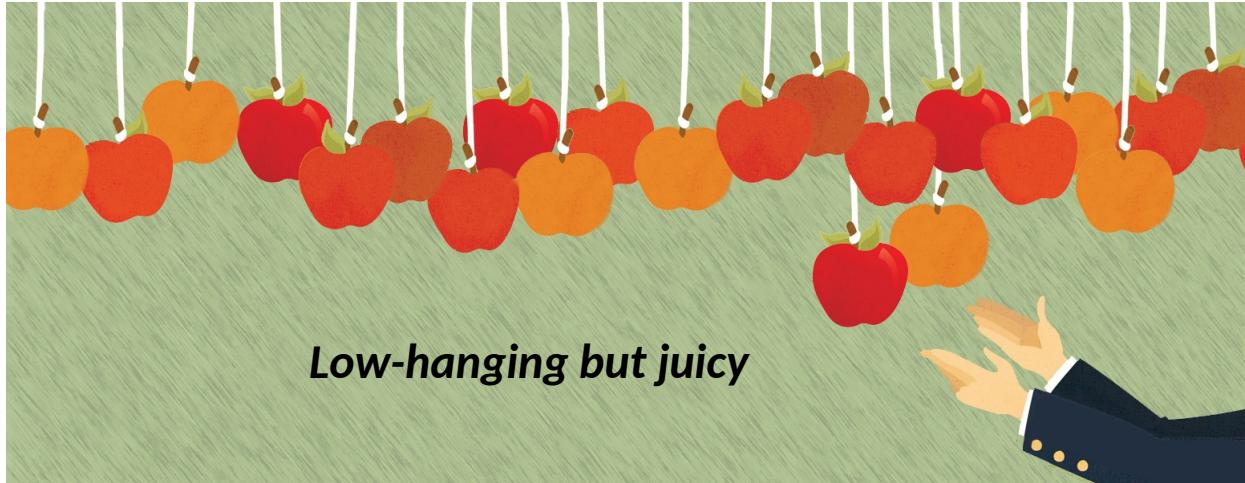
coding region
of *SLC45A2* gene

TGCGVGGTC
C V V
 ₄₇₇



THE QTN PROGRAM AND THE ALLELES THAT MATTER FOR EVOLUTION: ALL THAT'S GOLD DOES NOT GLITTER

Matthew V. Rockman^{1,2}



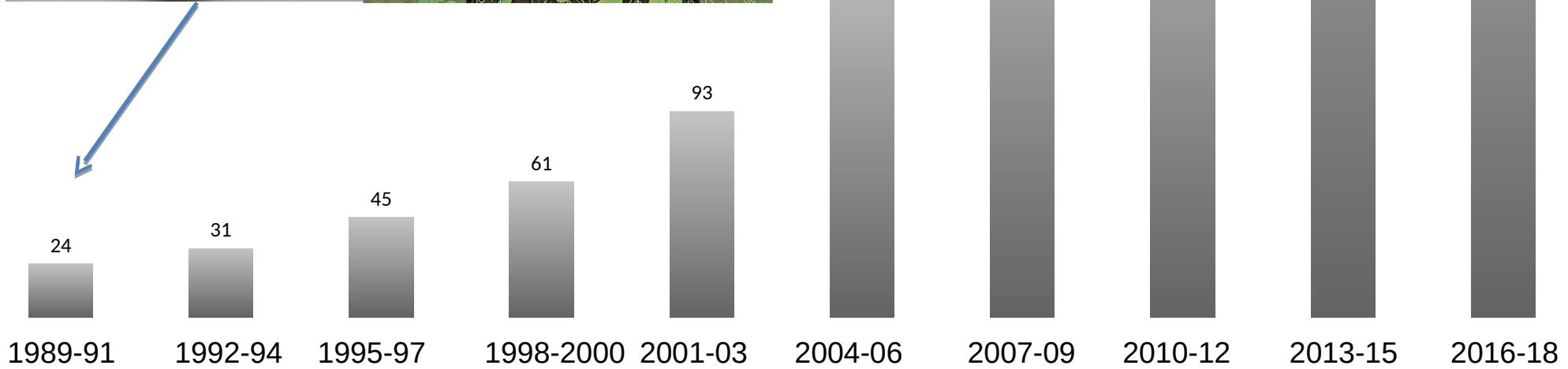
The shiny
“large effect” loci we can document experimentally



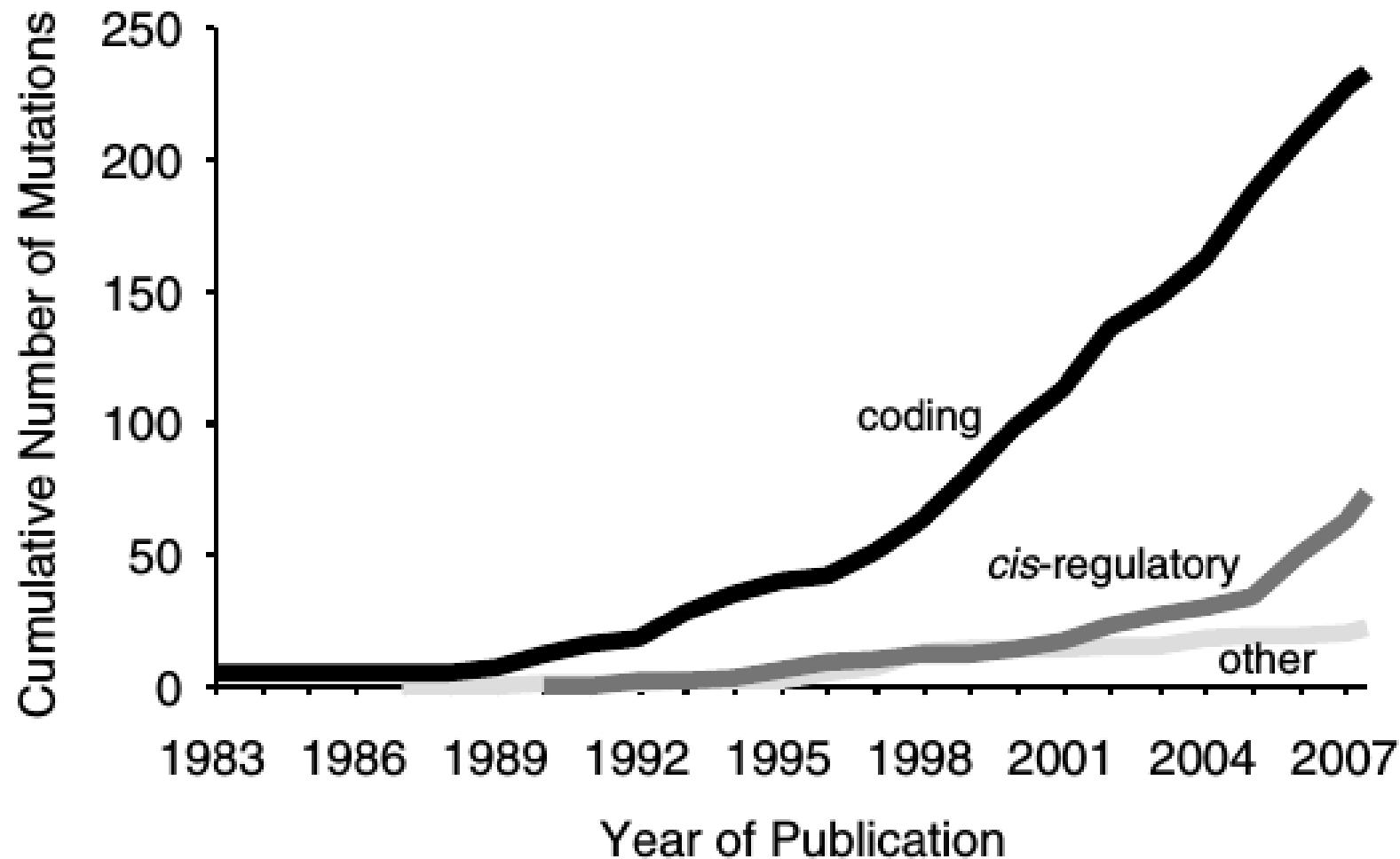
Since 2015:
hard to keep up
with all the
publications...



The Wrinkled-Seed Character of Pea Described by Mendel Is Caused by a Transposon-like Insertion in a Gene Encoding Starch-Branching Enzyme

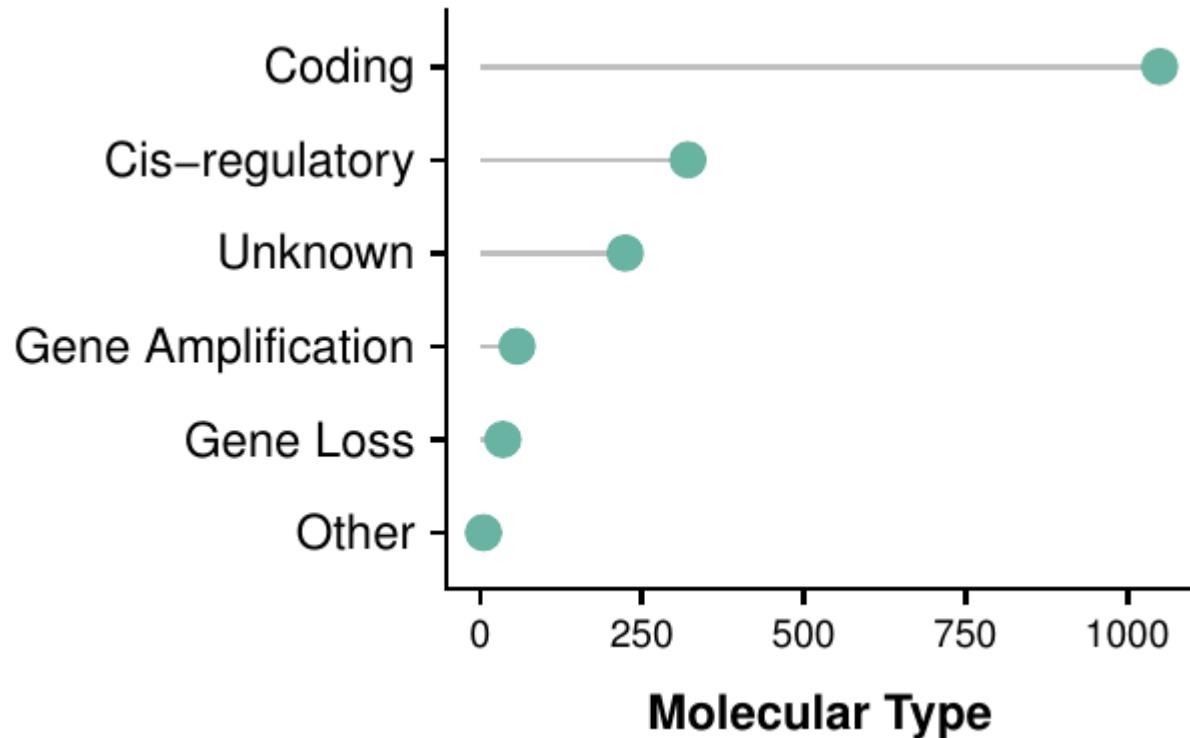


More known cases of coding than cis-regulatory mutations



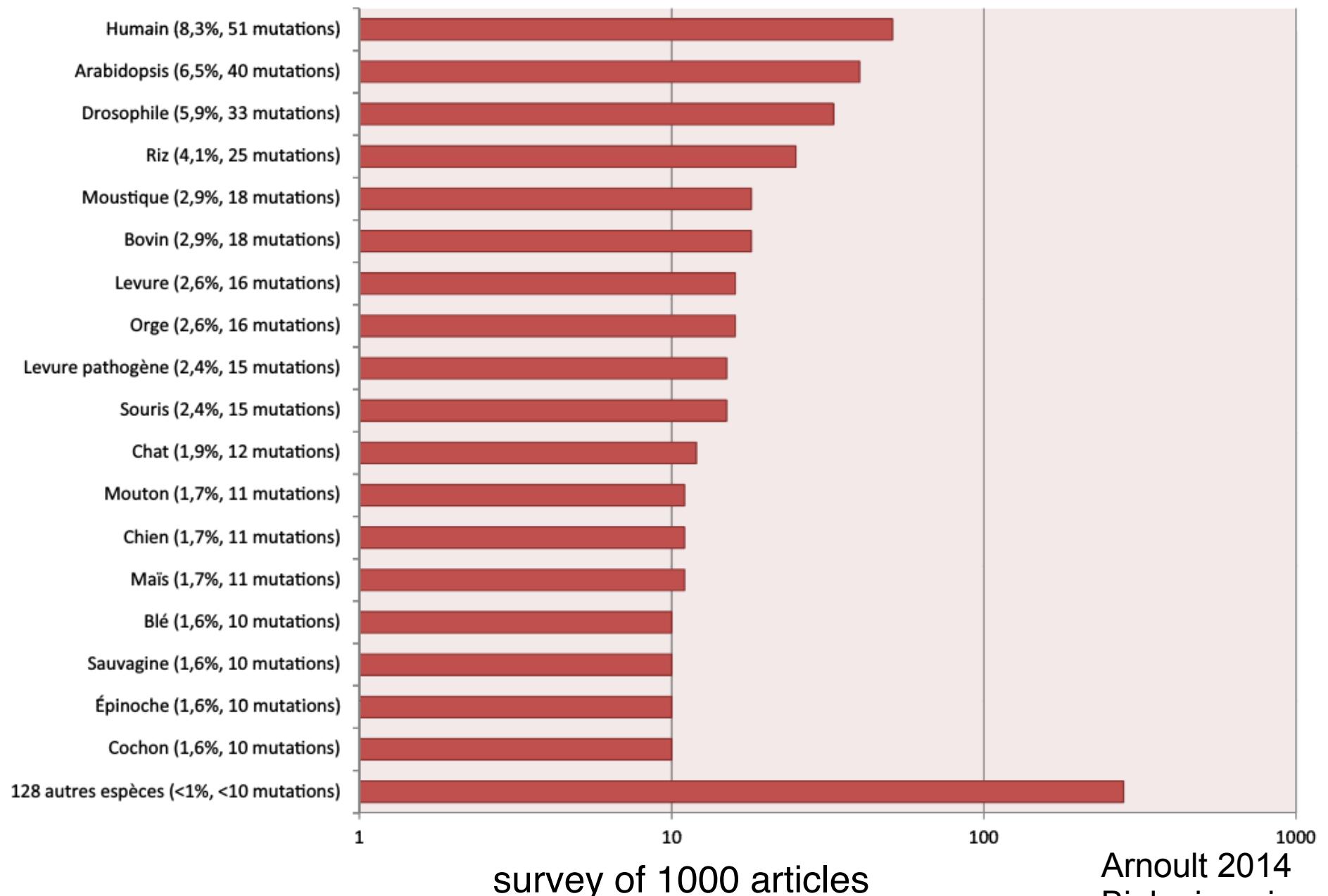
2008: survey of ~300 articles

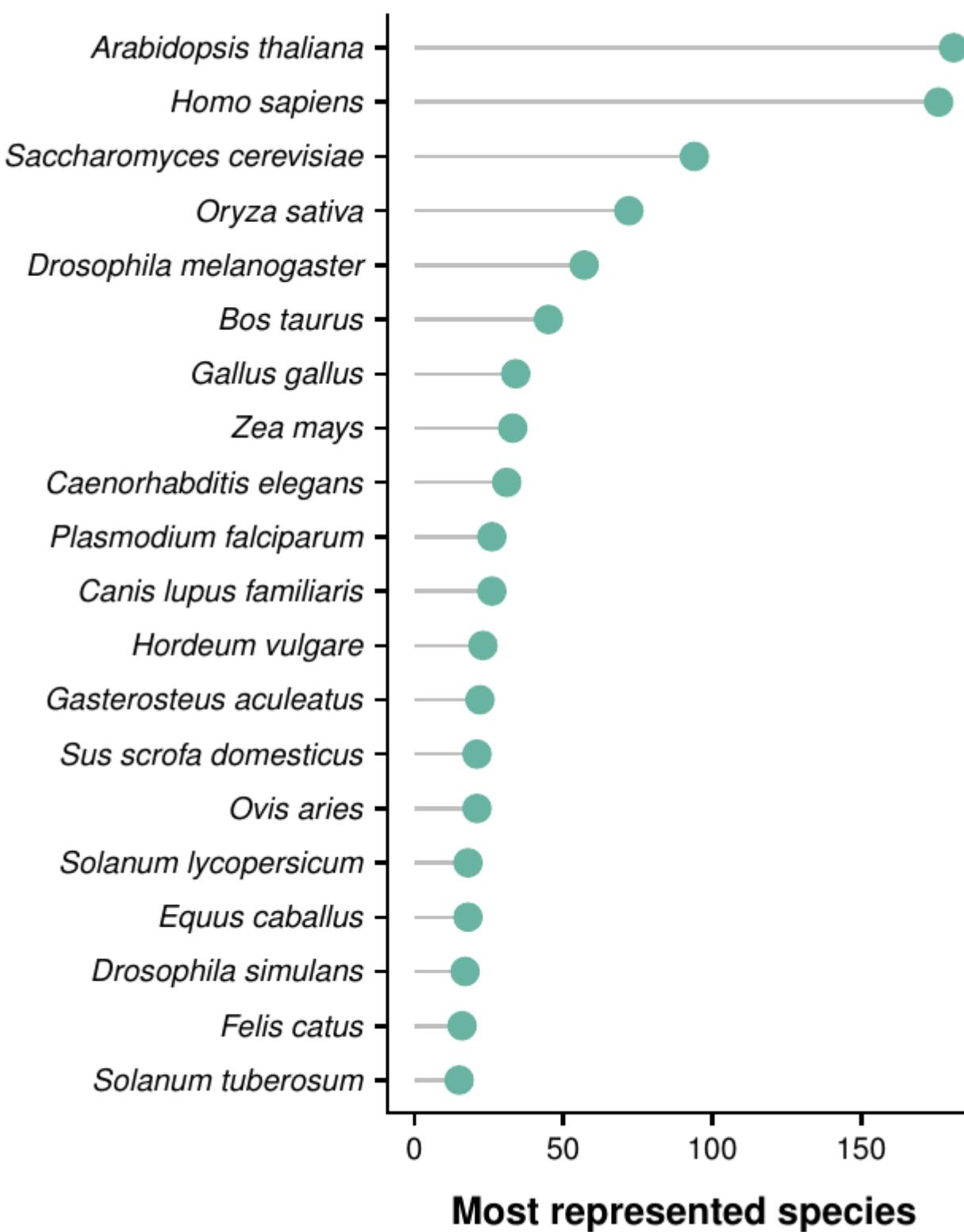
Stern and Orgogozo 2008 Evolution



today's data
Courtier-Orgogozo et al NAR

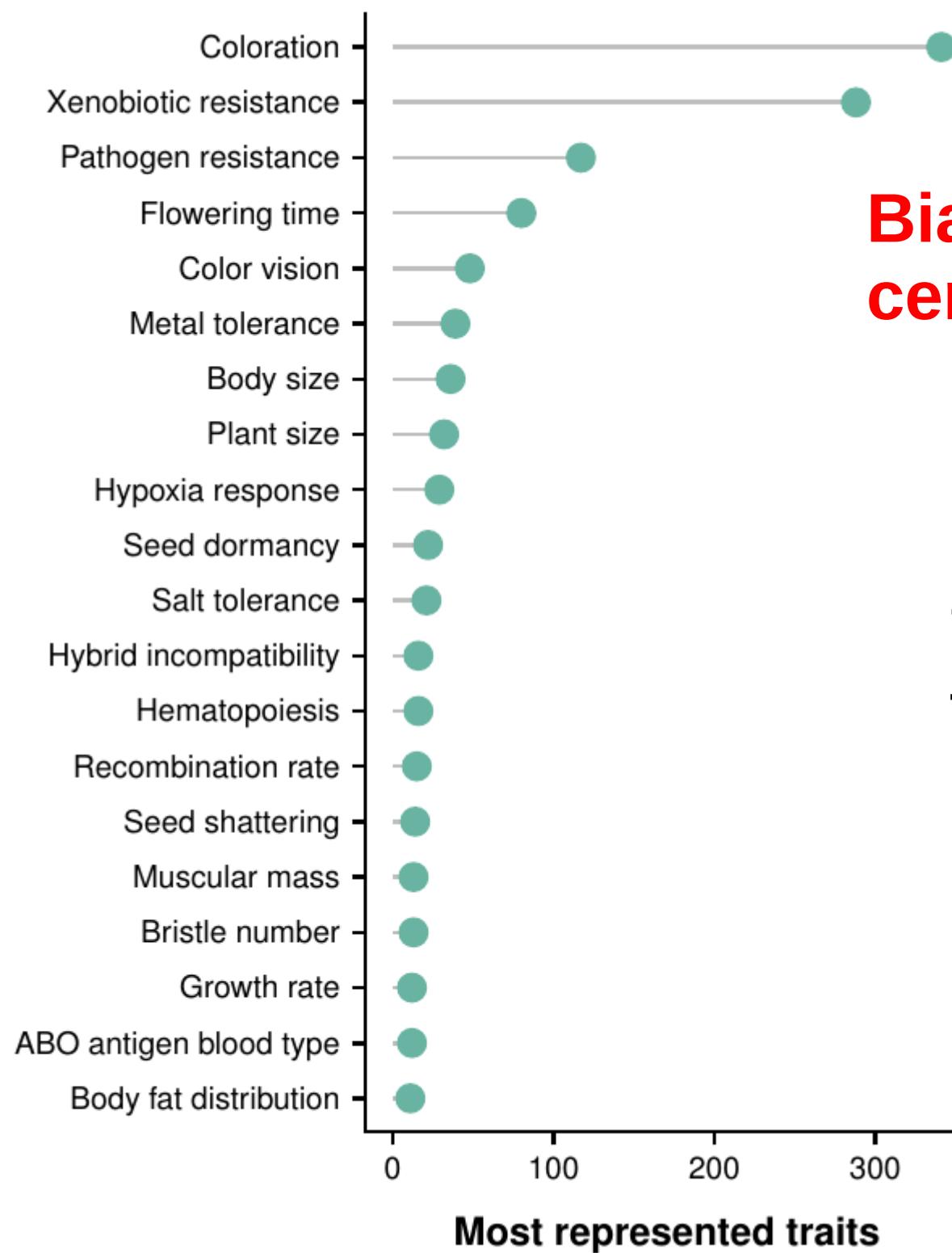
Bias towards certain species





327 species in total

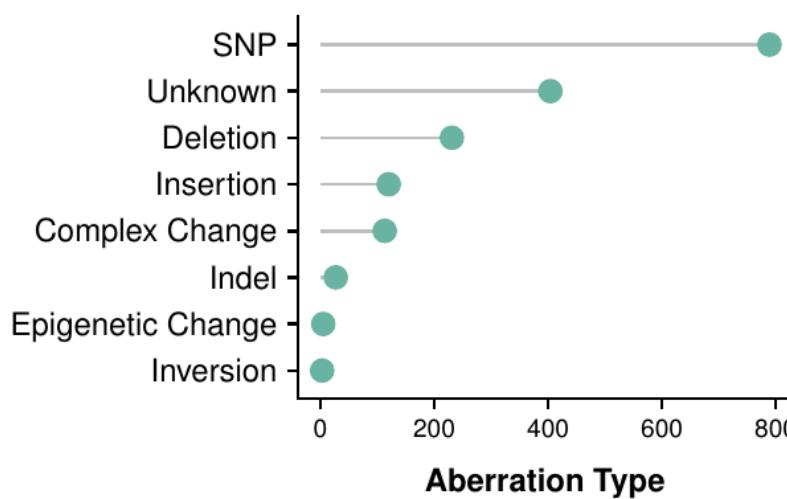
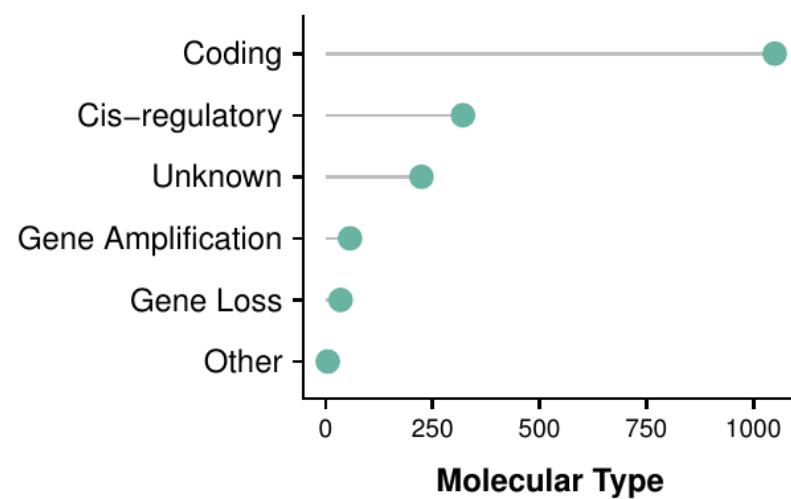
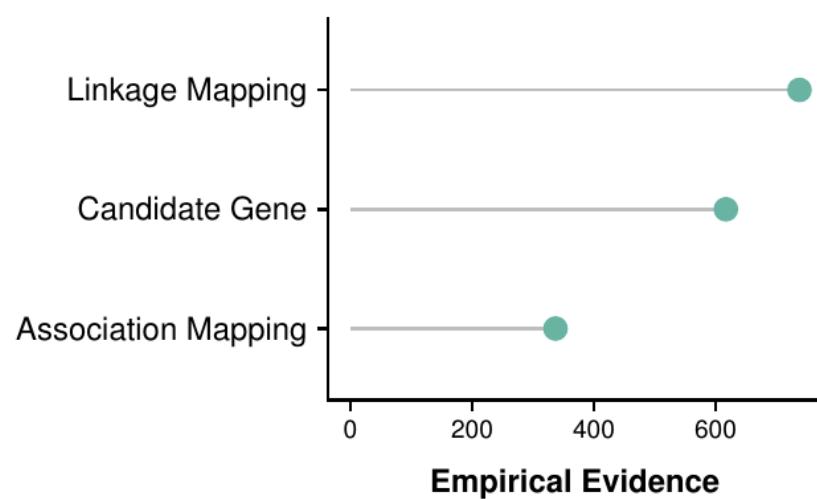
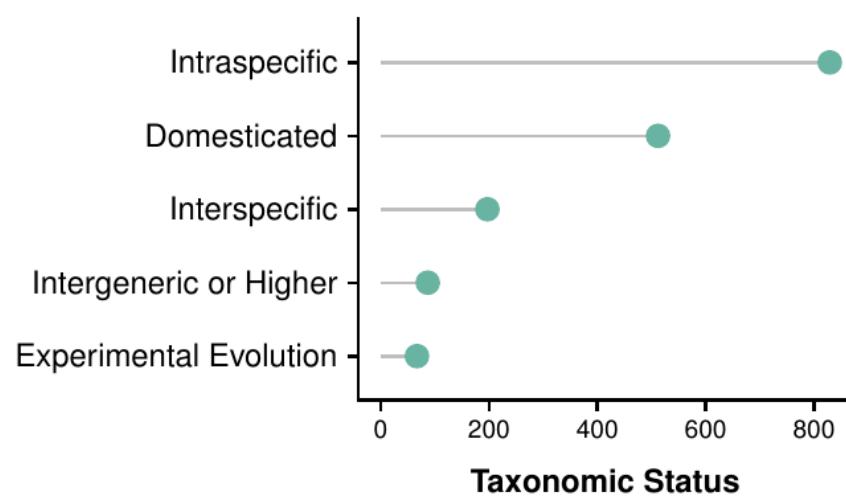
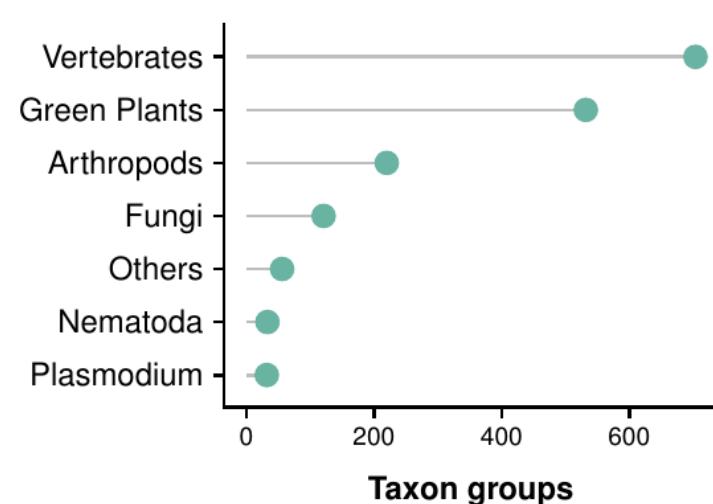
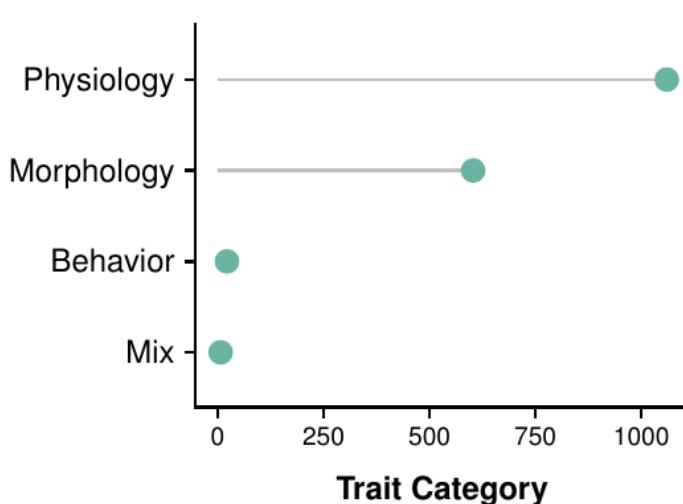
**The other species
represent 752 entries**



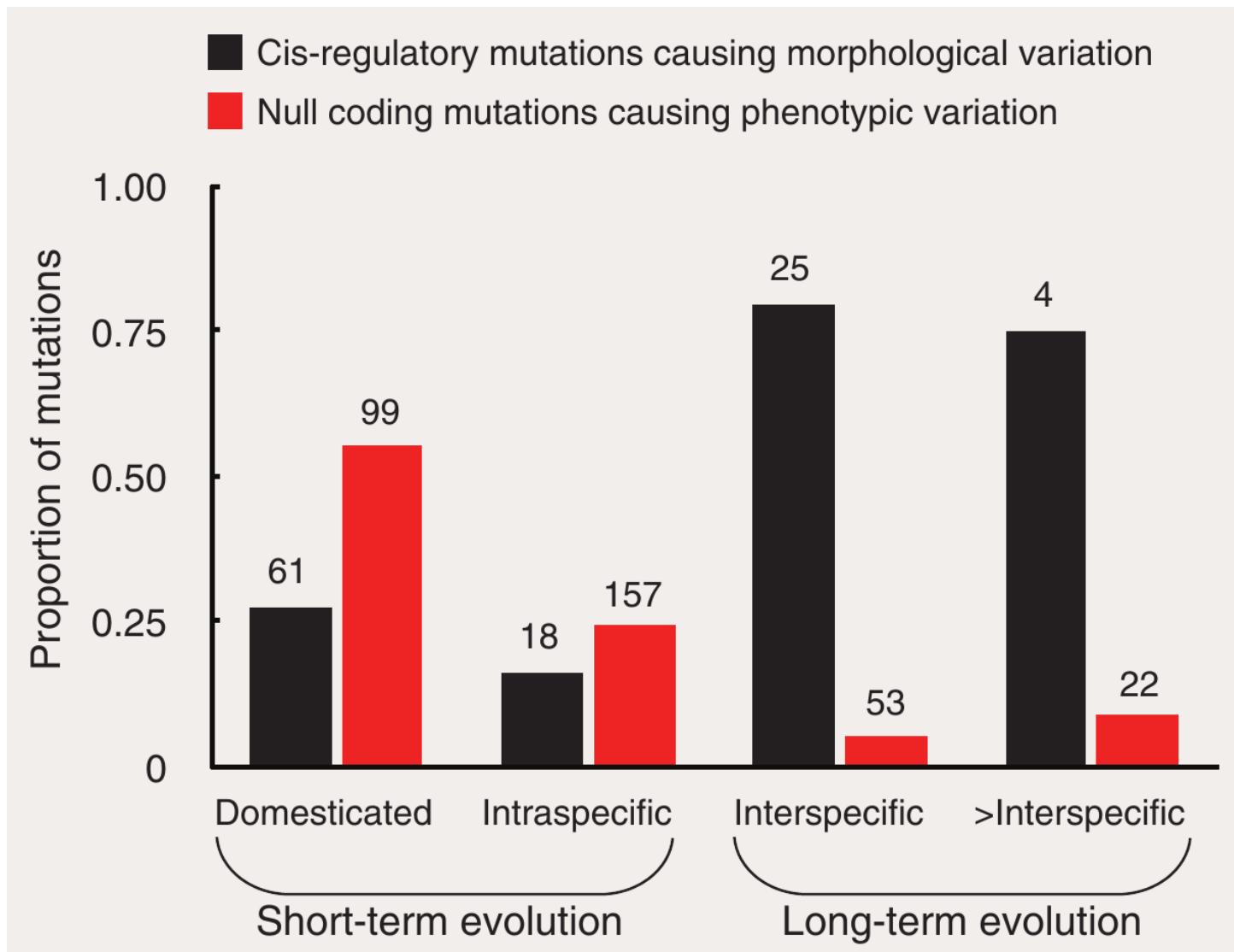
**Bias towards
certain traits**

261 traits in total

**The other traits
represent 517 entries**



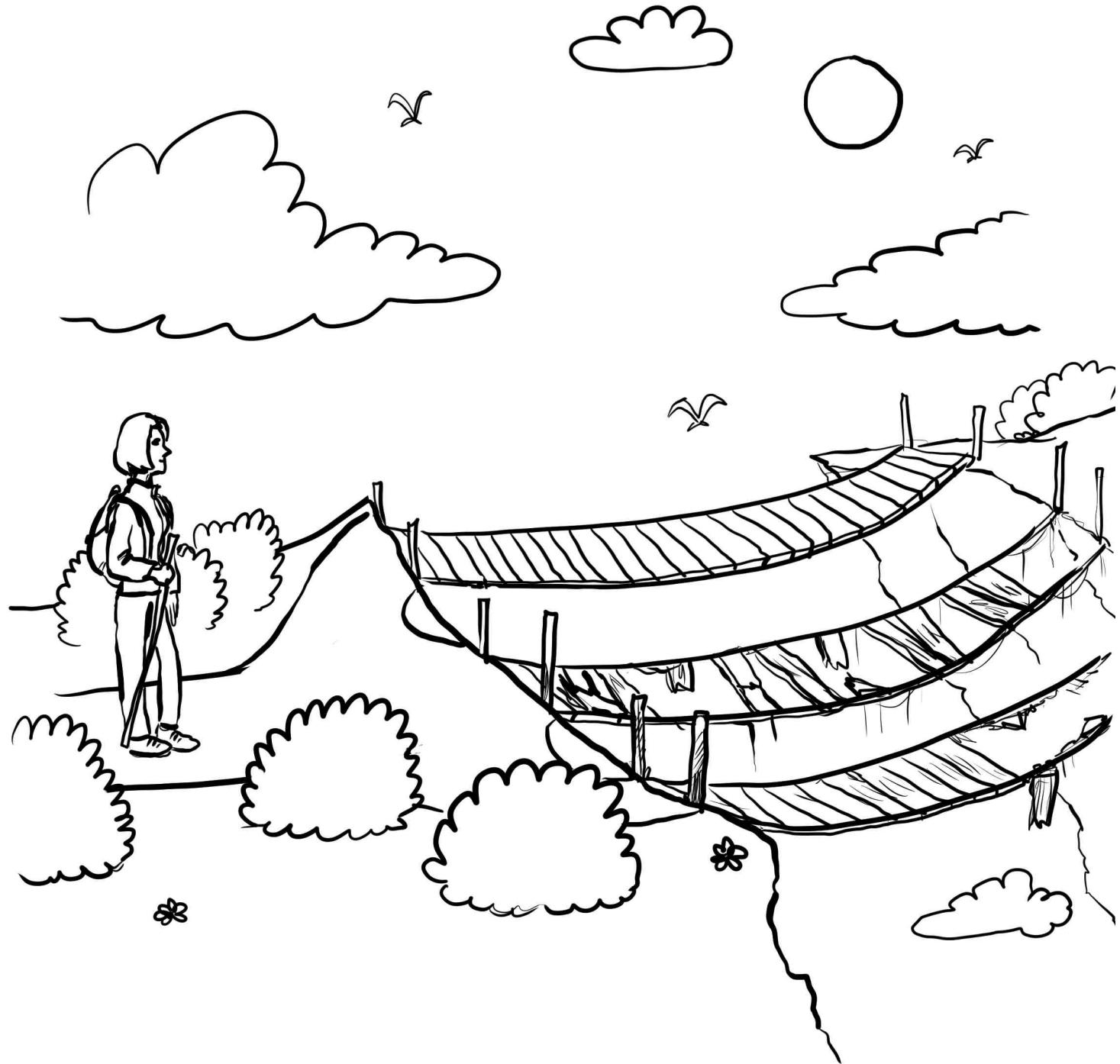
Short-term and long-term evolution involve different types of mutations

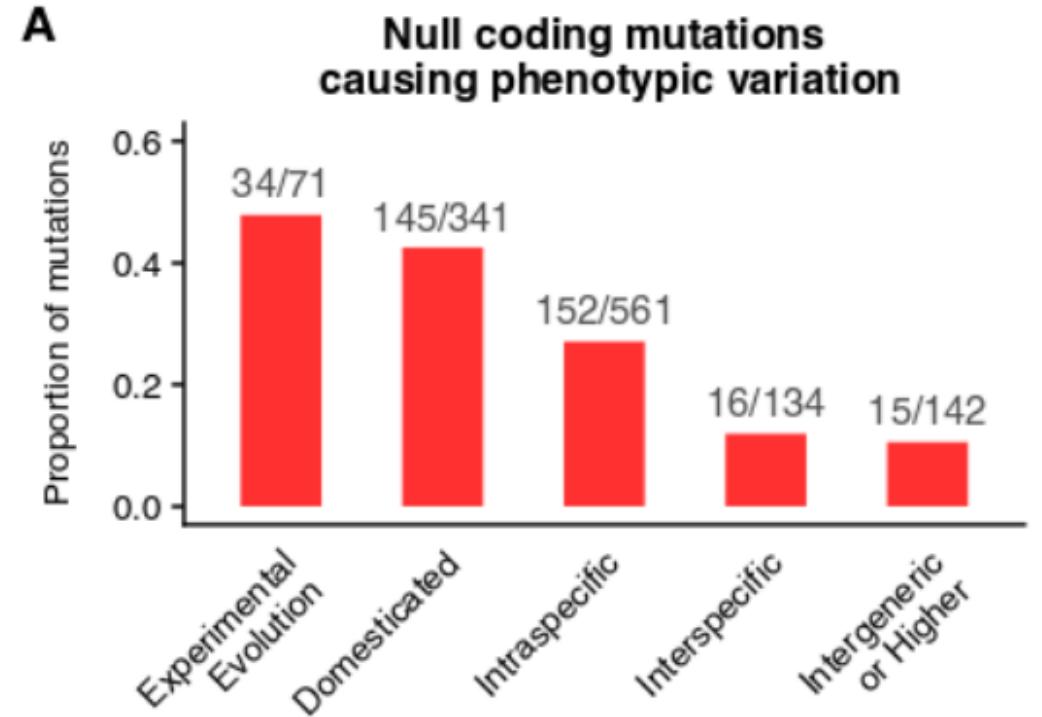


2008: survey of ~300 articles

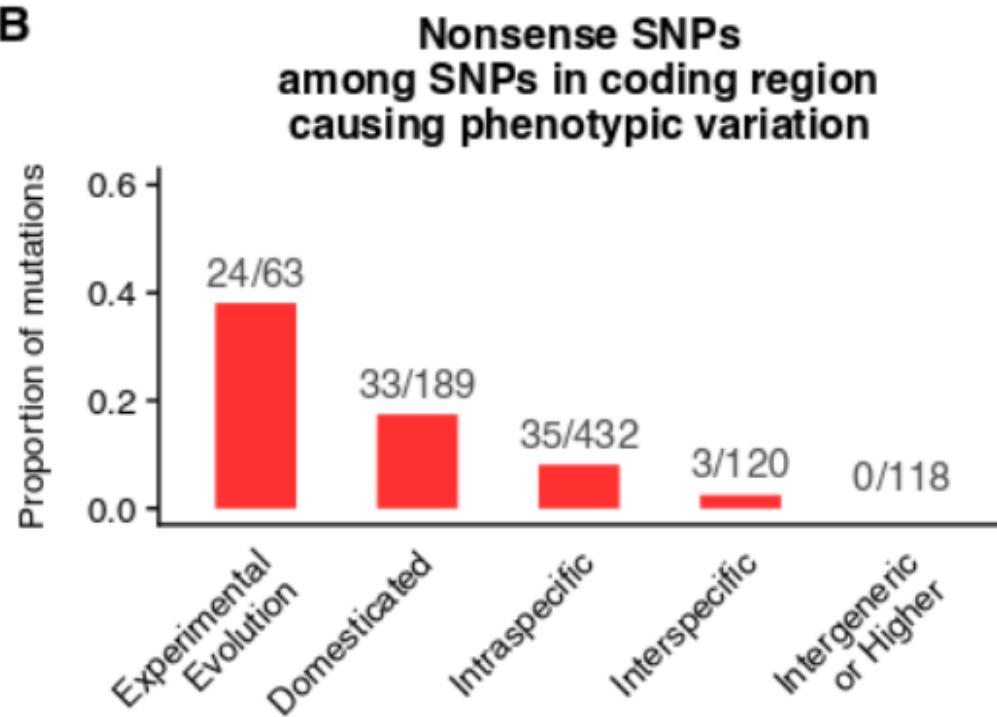
Stern and Orgogozo 2008 Evolution

Stern and Orgogozo 2009 Science

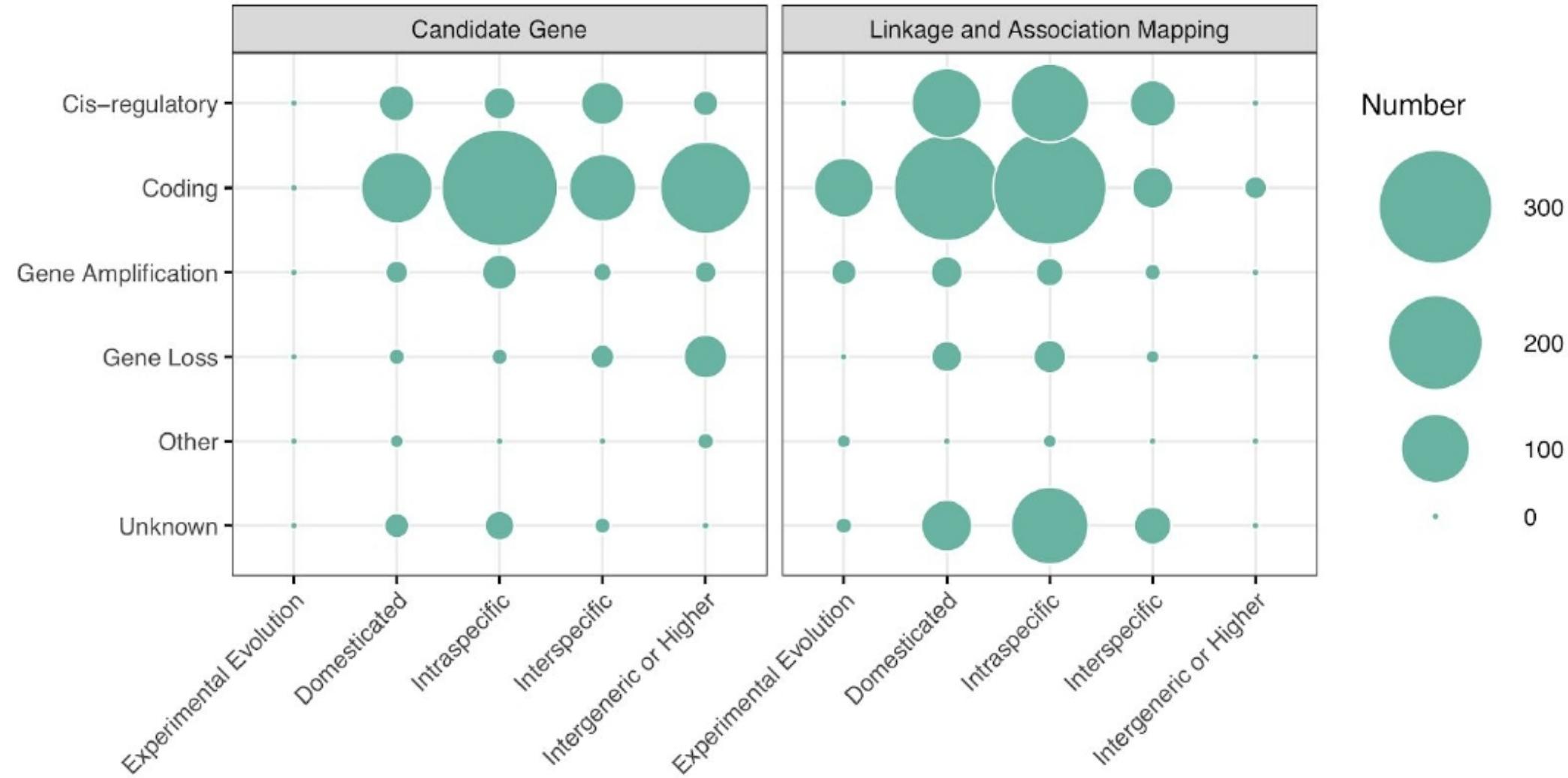


A

All 1281 coding mutations

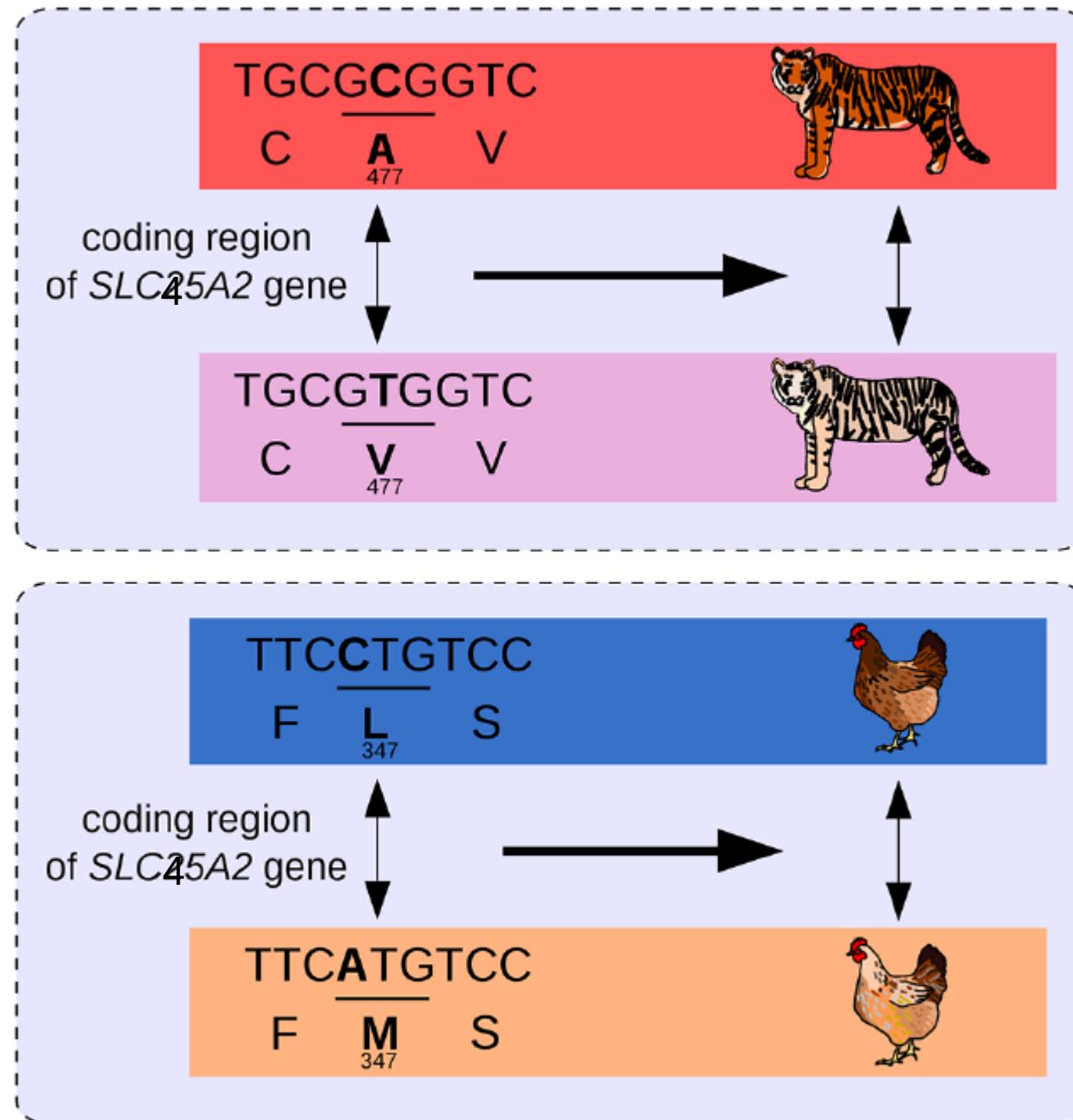
B

today's data
Courtier-Orgogozo et al NAR



today's data
Courtier-Orgogozo et al NAR

Hotspot genes: evolution repeats itself



Repeated evolution via the same amino acid change

clam



↑ Nav1.4
X E945D

Saxitoxin



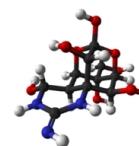
toxic plancton

garter snake



↑ Nav1.4 sodium channel
X E945D

Tetrodotoxin



toxic newt

↑ Nav1.4
E945D



pufferfish (fugu)

Repeats in..



.. the genes responsible for natural evolution

Ex : *hemoglobin* in dogs and humans in Tibet
(Wang et al 2014 GBE)



.. the genes responsible for experimental evolution

Ex : *sulfate transporter SUL1* in yeasts in low sulfate
(Gresham et al 2008 PLoS Genetics)

Specialized loci in the genome

Proteins that interact with external molecules

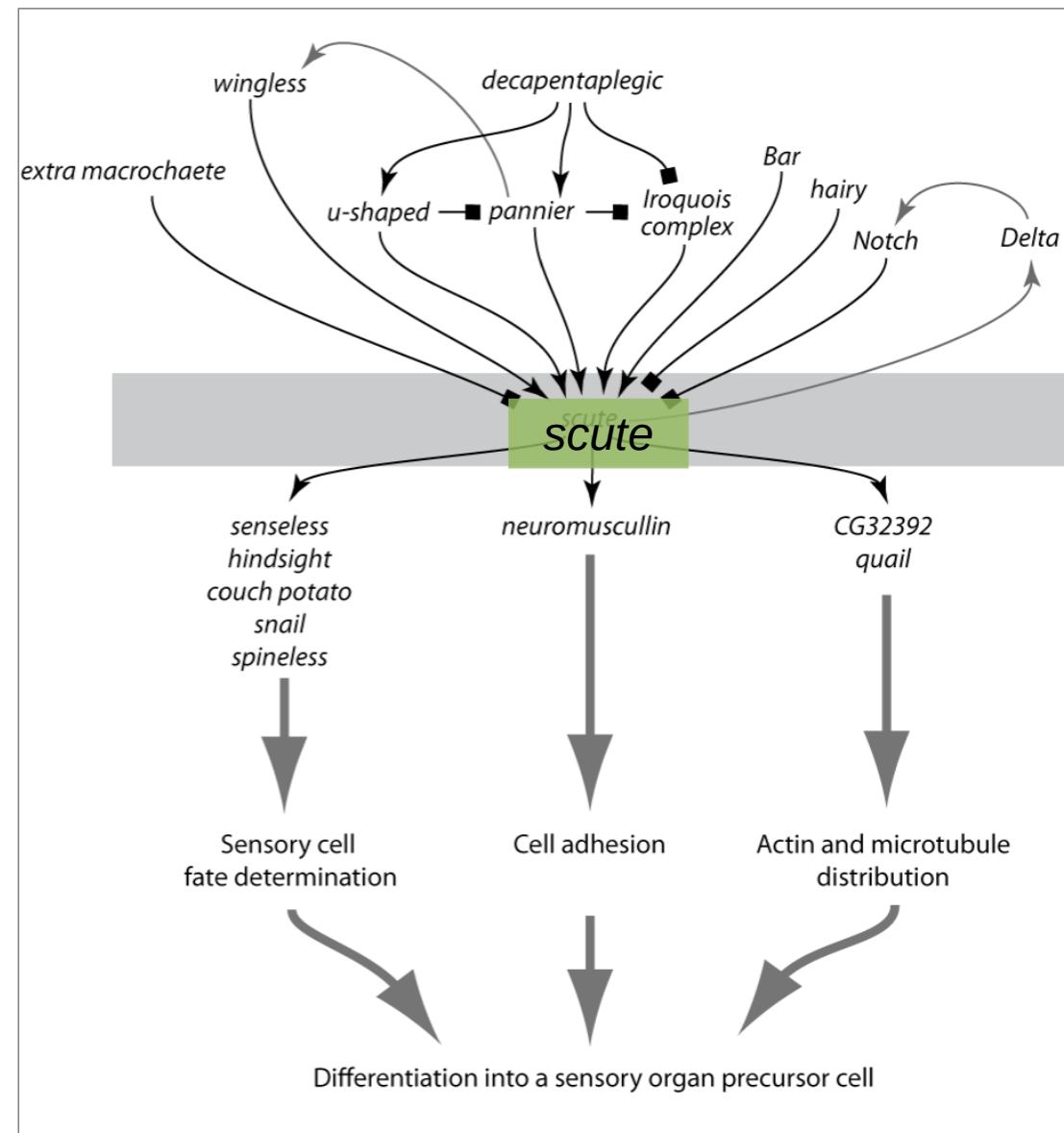
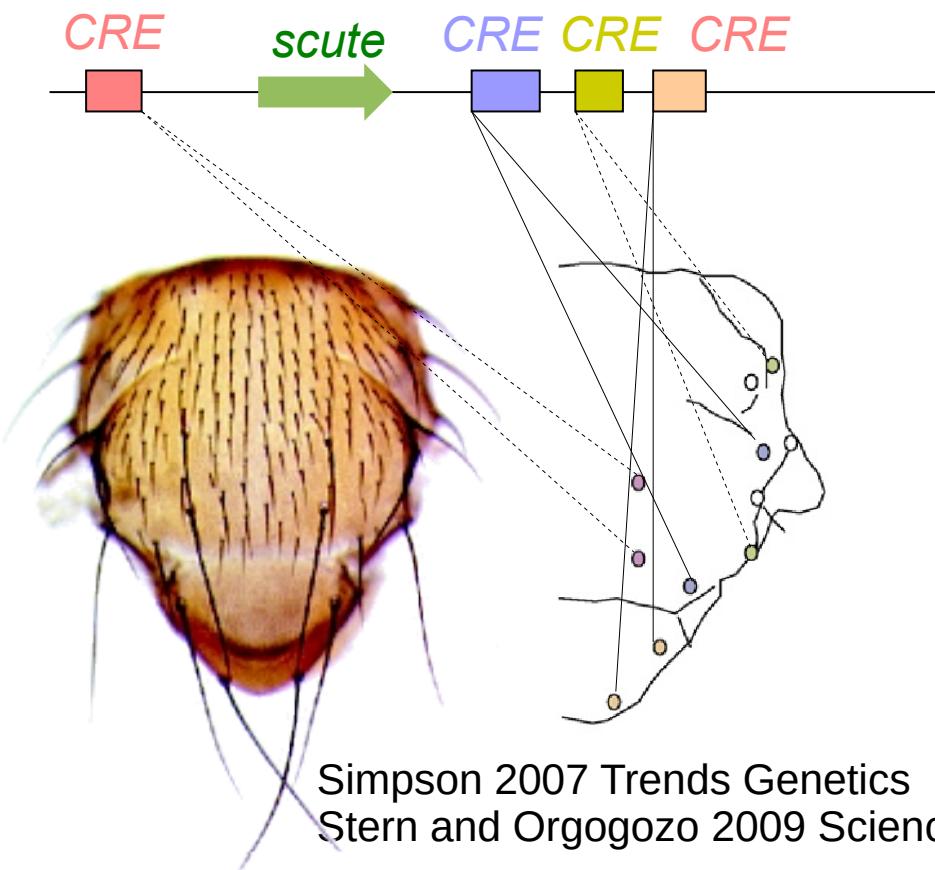
oxygen, photons, insecticide, cholesterol...

Specialized loci in the genome

Proteins that interact with external molecules

oxygen, photons, insecticide, cholesterol...

Cis-regulatory elements of “developmental switch genes”



From random processes can emerge predictability

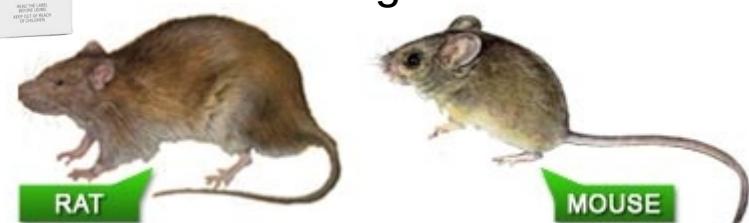
Many unpredictable processes
at a low level



Predictable Evolution
at the genetic level

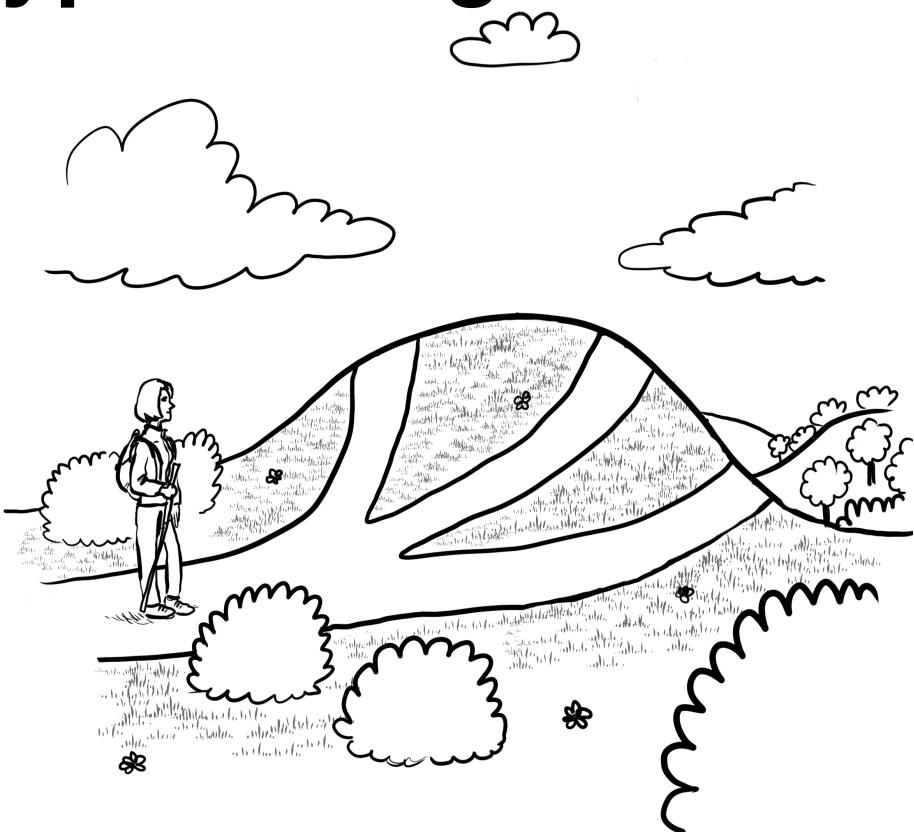
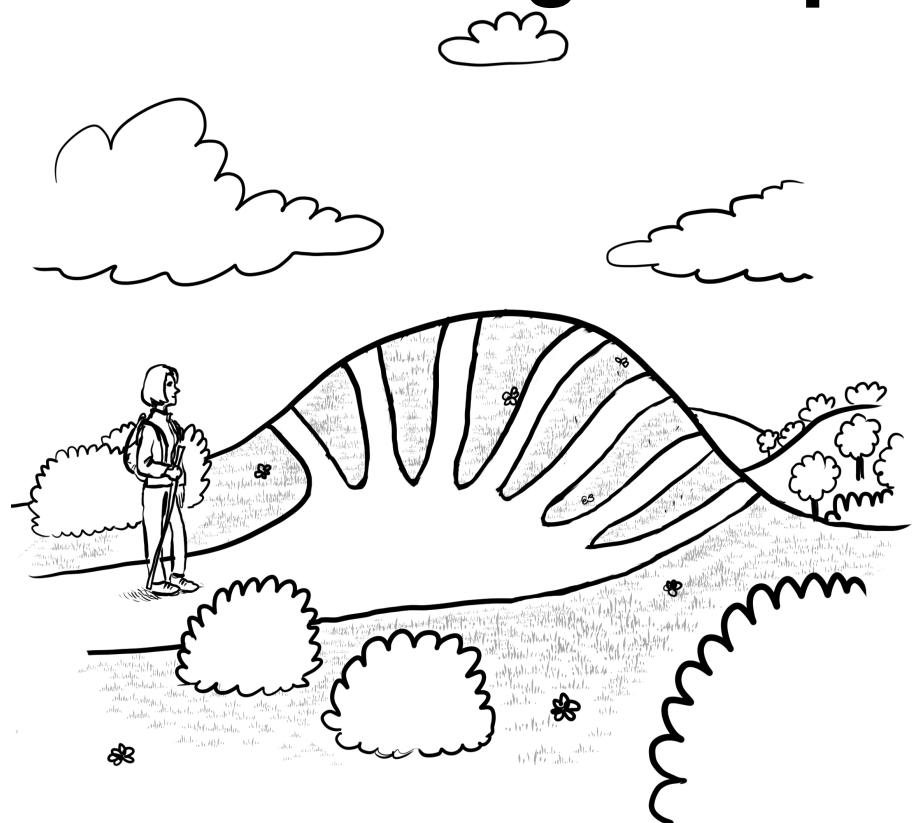
- Mutations in DNA
- Chromosome segregation during meiosis
- Assortative mating
- Gamete competition during fecondation
- Life history traits
- Genetic linkage
- Environmental changes (meteorite, etc.)

...



coding mutation in
VKORC1 gene

A small number of genetic solutions for a given phenotypic change



Diverse conclusions

More known cases of coding than cis-regulatory mutations

Bias towards certain species

Bias towards certain traits

Long-term versus short-term evolution: fewer null mutations, more cis-regulatory mutations

Hotspot genes

What about the role of transposable elements in phenotypic evolution?

