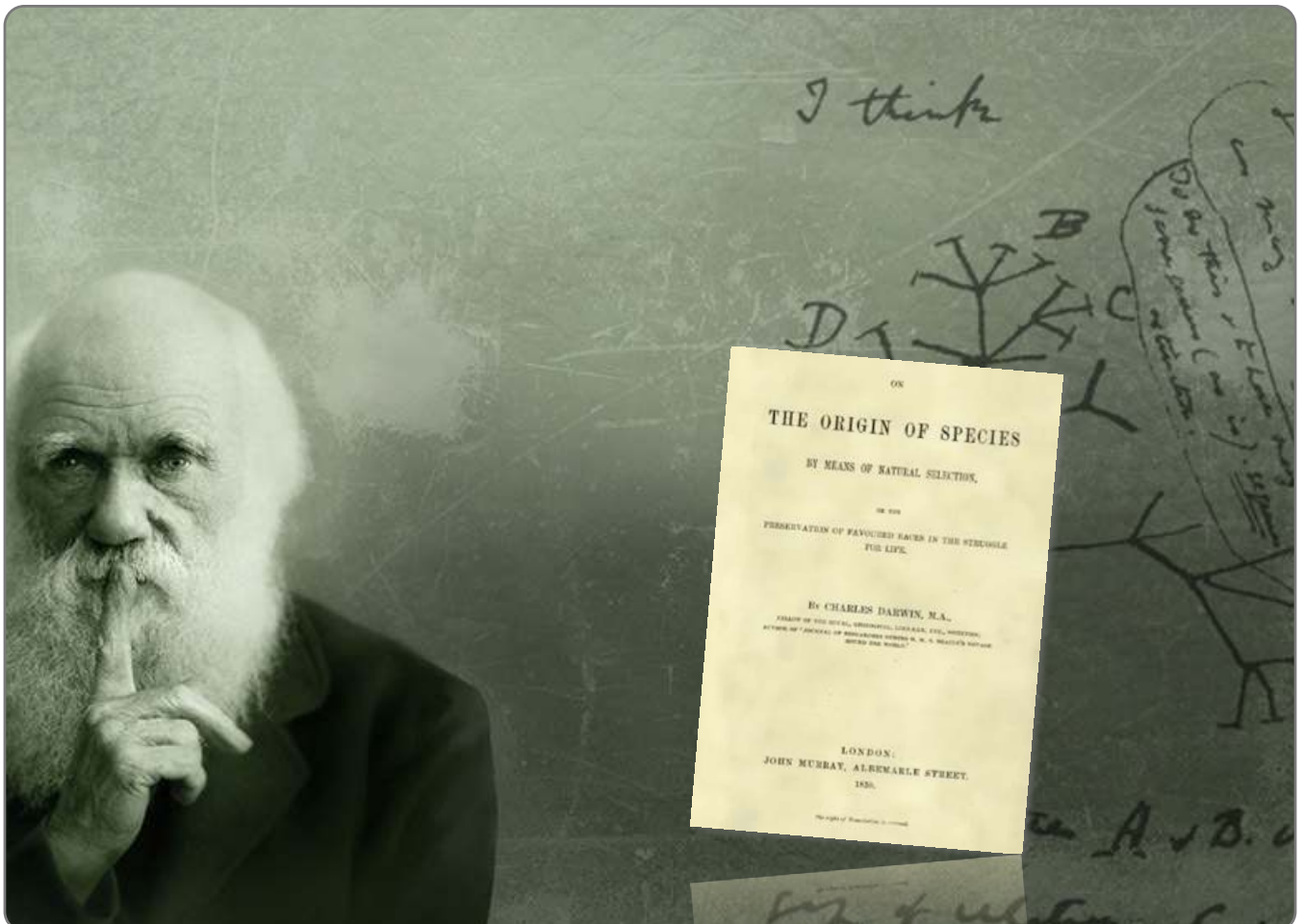




Walter Salzburger

Zoological Institute
University of Basel, Switzerland



ON
THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

PRESERVATION OF FAVOURED RACES IN THE STRUGGLE
FOR LIFE.

By CHARLES DARWIN, M.A.,

FELLOW OF THE ROYAL SOCIETY, LONDON, AND AUTHOR OF "JOURNAL OF RESEARCHES INTO THE NATURAL HISTORY OF THE ZOOLOGICAL MUSEUM, LONDON."

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1859.

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heritable variation



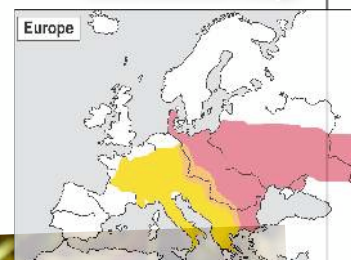
selection



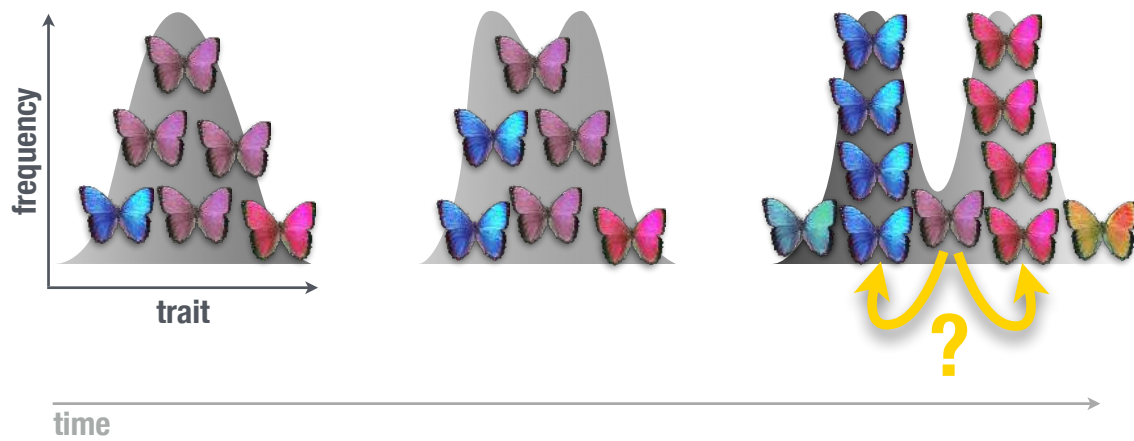
ADAPTATION INNOVATION SPECIATION

- ...are fundamental (real) natural units

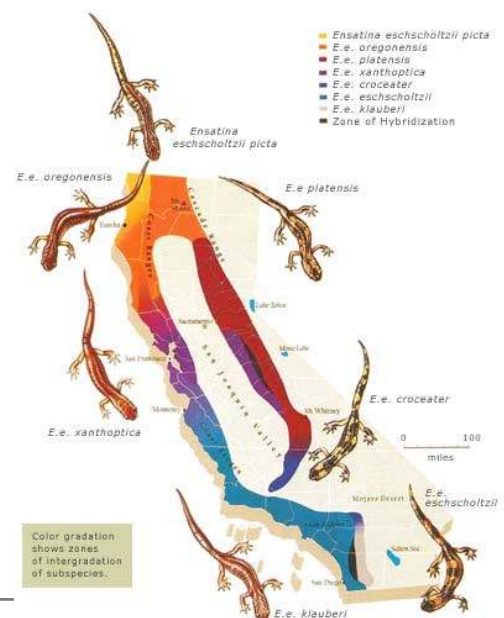
distribution map



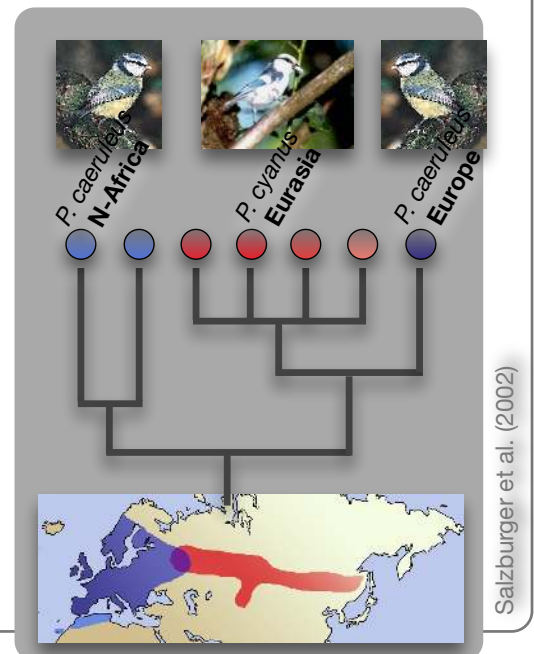
► ...are varied



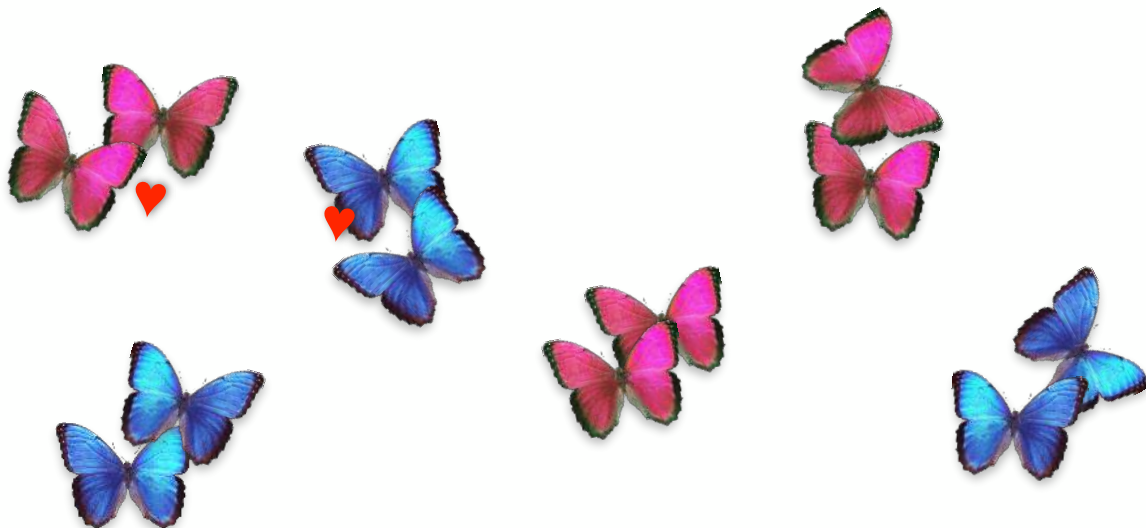
► ...are not (always) easy to define

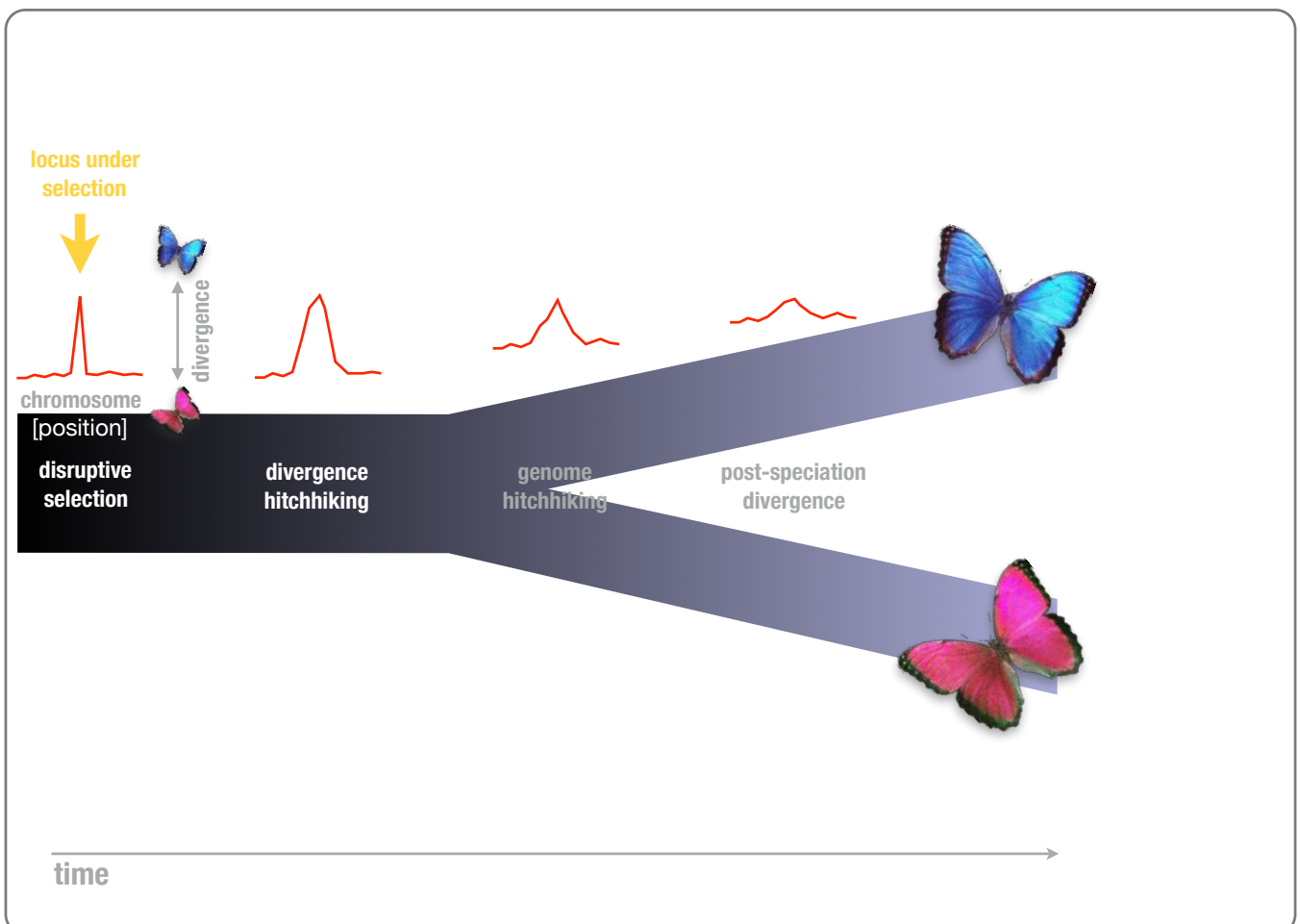
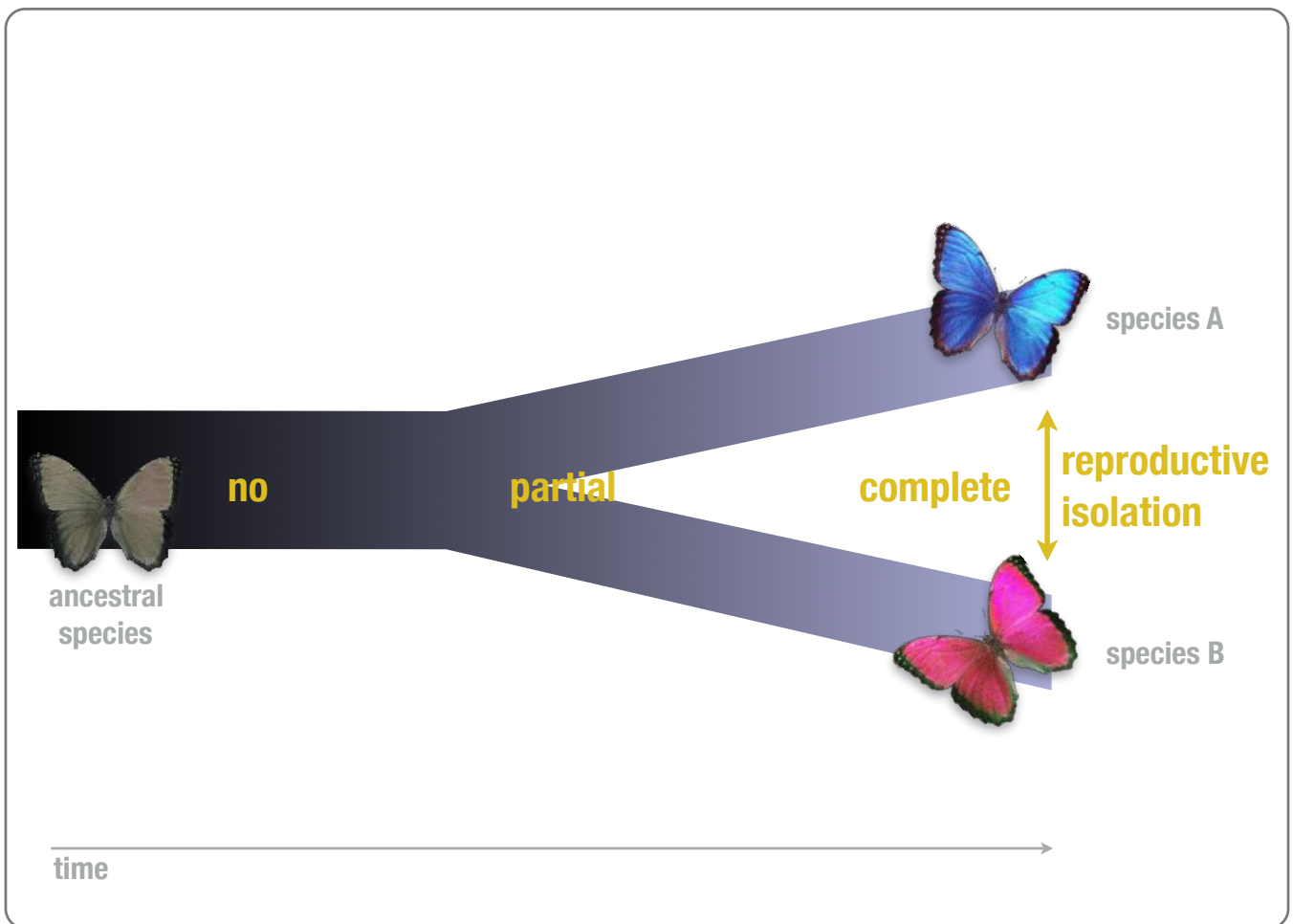


- ...are not (always) easy to define

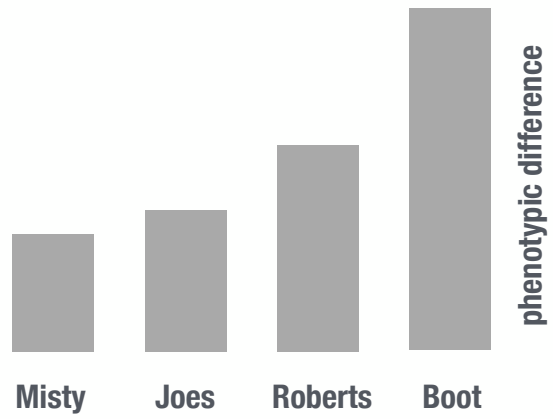
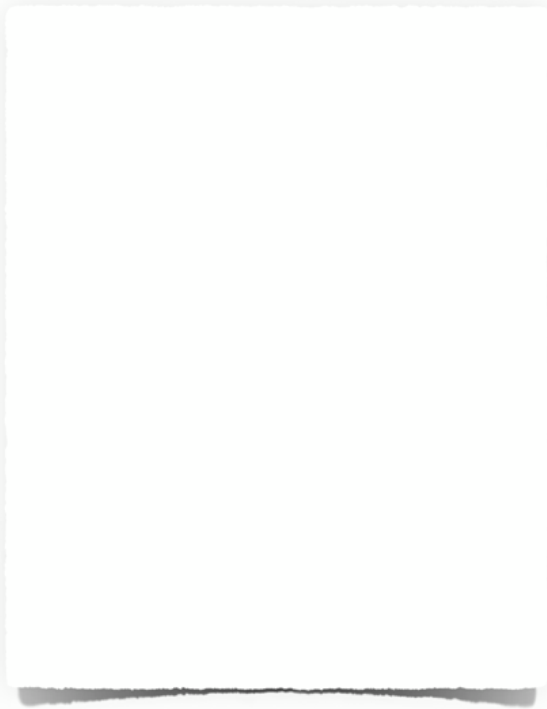


- “Species are groups of interbreeding natural populations that are reproductively isolated from other such groups” (Mayr 1963)





RAD genome scans

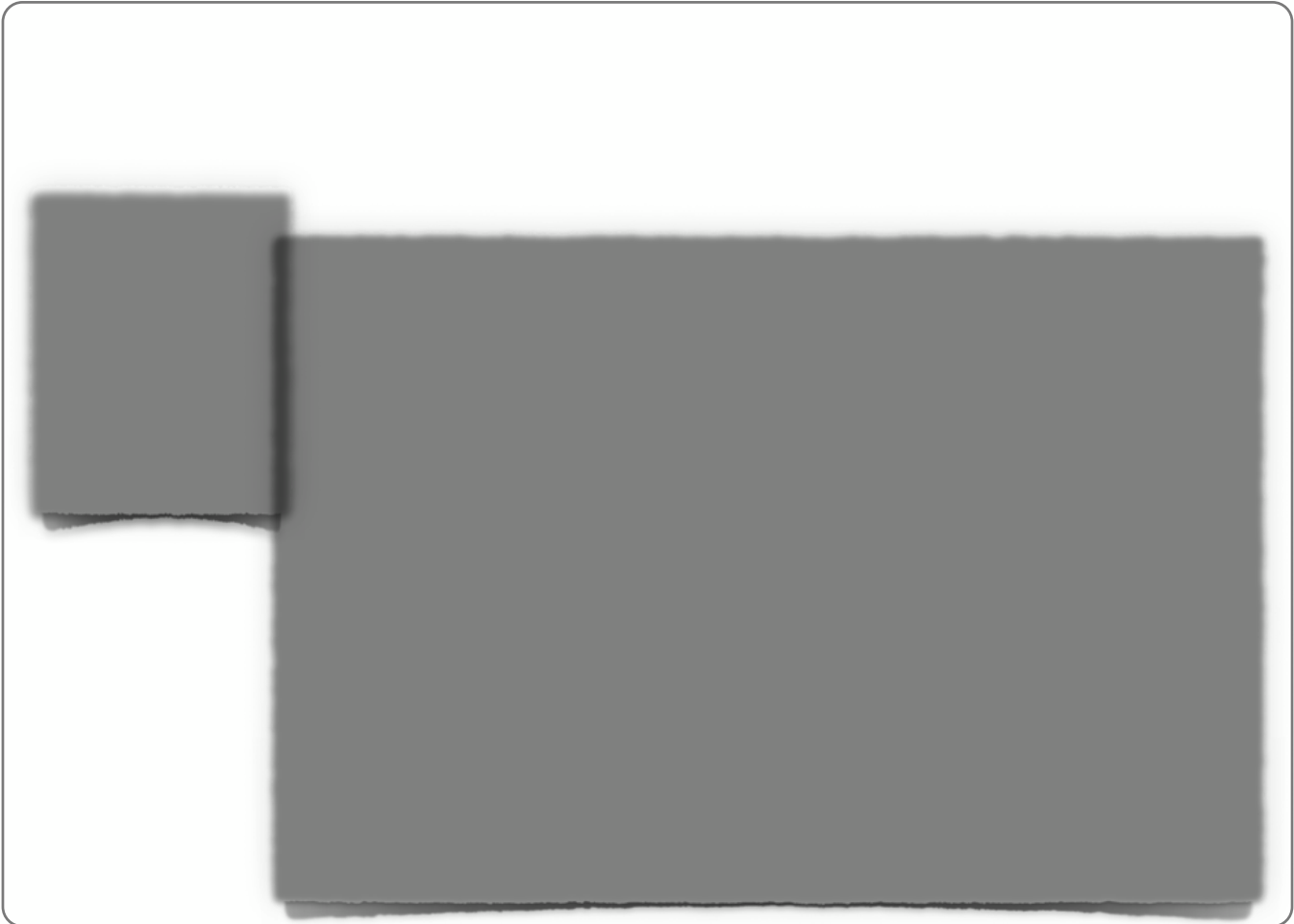


••• M Roesti, A Hendry, W Salzburger & D Berner (2012) Molecular Ecology

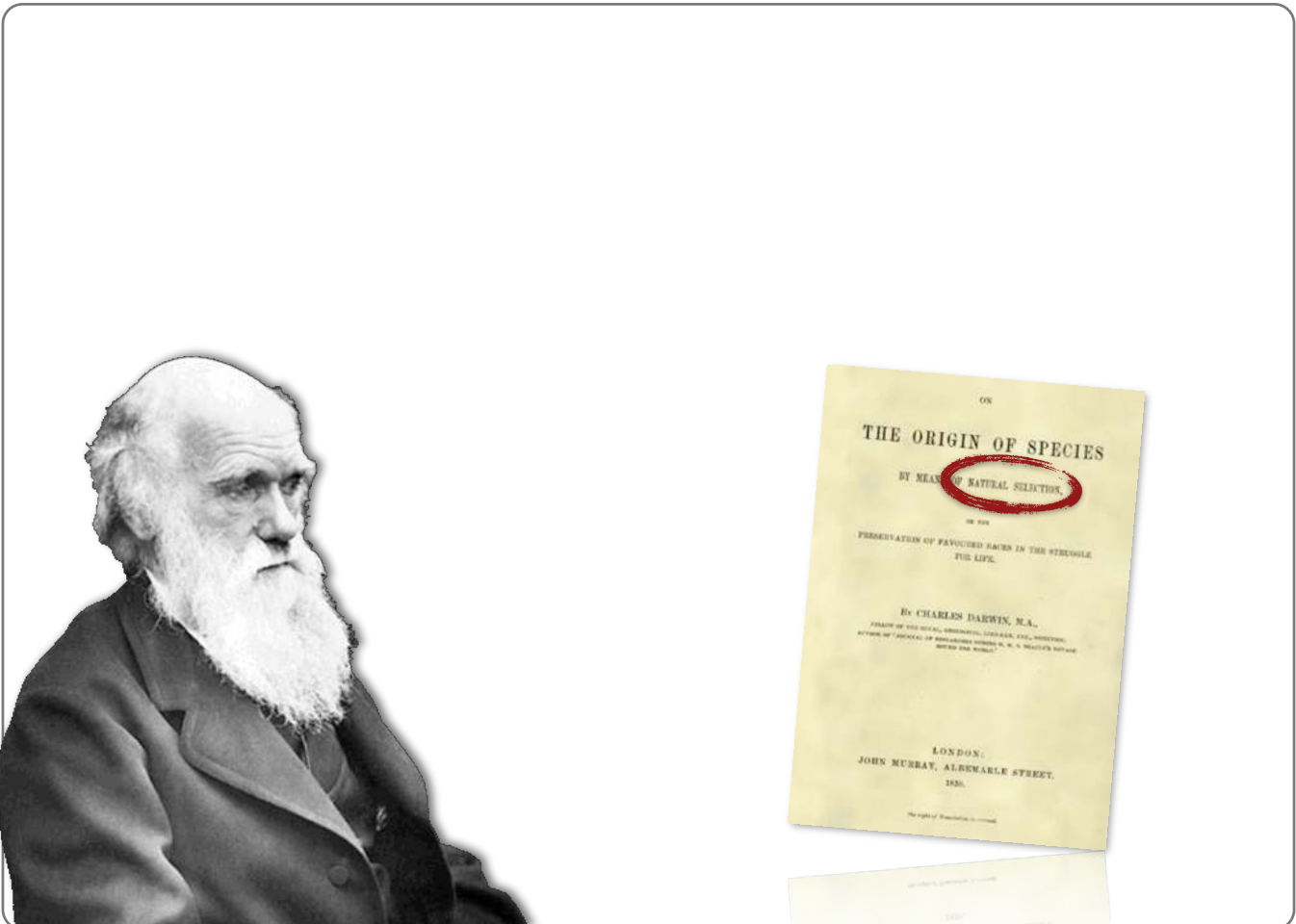


Barrett et al. (2008) Science

••• FC Jones et al. (2012) Nature



••• V Soria-Carrasco et al. (2014) Science



Charles R. Darwin (1809-1882)

- ▶ ... “is the process by which the forms of organisms in a population that are **best adapted** to the environment **increase in frequency** relative to less well-adapted forms over a **number of generations**” (Ridley 1996)



images: www.idscaro.net, www.wikipedia.com

- ▶ ...“is the selection on mating behavior, either through **competition among members of one sex** (usually males) for access to members of the other sex or through **choice by members of one sex** (usually females) for certain members of the other sex” (Ridley 1996)



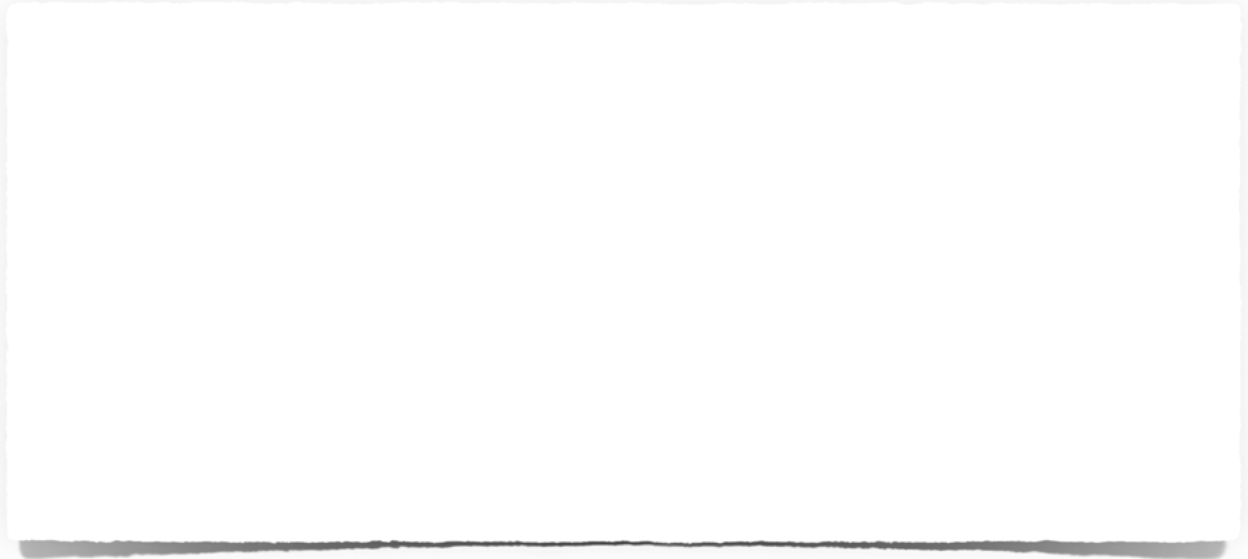
images: www.etsy.com/au, www.shutterstock.com

	fitness	competitors
sexual selection	individual fitness	other members of the same sex
natural selection	fitness of the genotype	other individuals in the same population

► **...operates** if the following **conditions** are met:

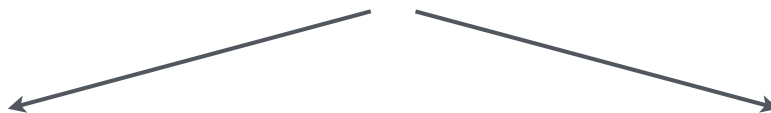
reproduction	organisms must reproduce to form new generations
heredity	offspring resemble parents ("like must produce like")
trait variation	individuals in natural populations vary in (adaptive) traits
variation in fitness	individuals in natural populations vary in the number of their offspring that survive to reproduce ('lifetime reproductive success')

- ▶ **Natural populations** show **variation** at all levels, from gross morphology to DNA sequences. Selection can only operate, if heritable variation exists.



- ▶ **Natural populations** show **variation** at all levels, from gross morphology to DNA sequences. Selection can only operate, if heritable variation exists.

- ▶ Natural variation is generated by two processes:



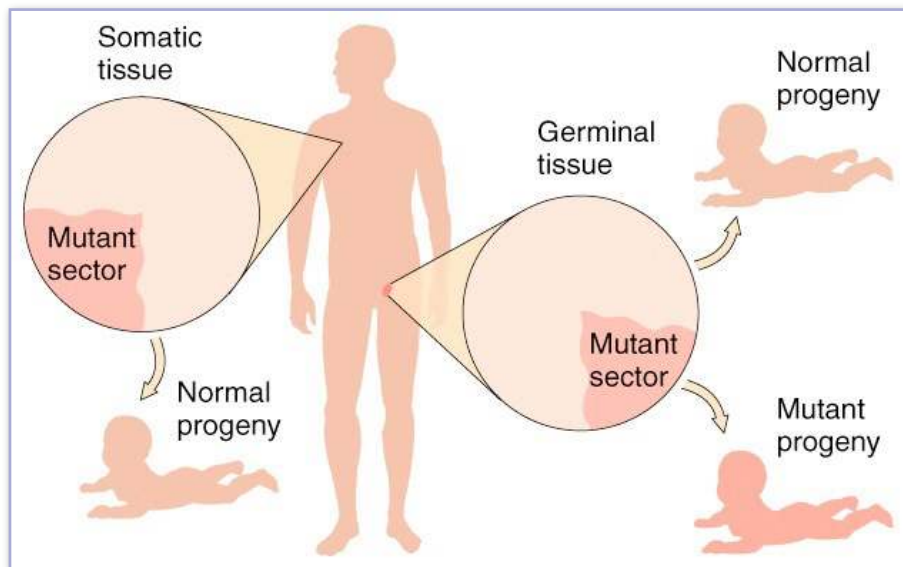
recombination

“reshuffling” of genetic material
by introducing or breaking up
physical linkage

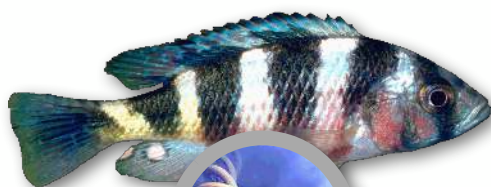
mutation

generation of new genetic
variation by “mistakes” during
the copying of a DNA strand

- New mutations are only transmitted to the next generation, if they occur in **germinal tissue**!



phenome

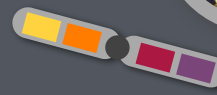


genome



ATG AAC **GTA** TGG AGG...
Met Asn **Val** Trp Arg

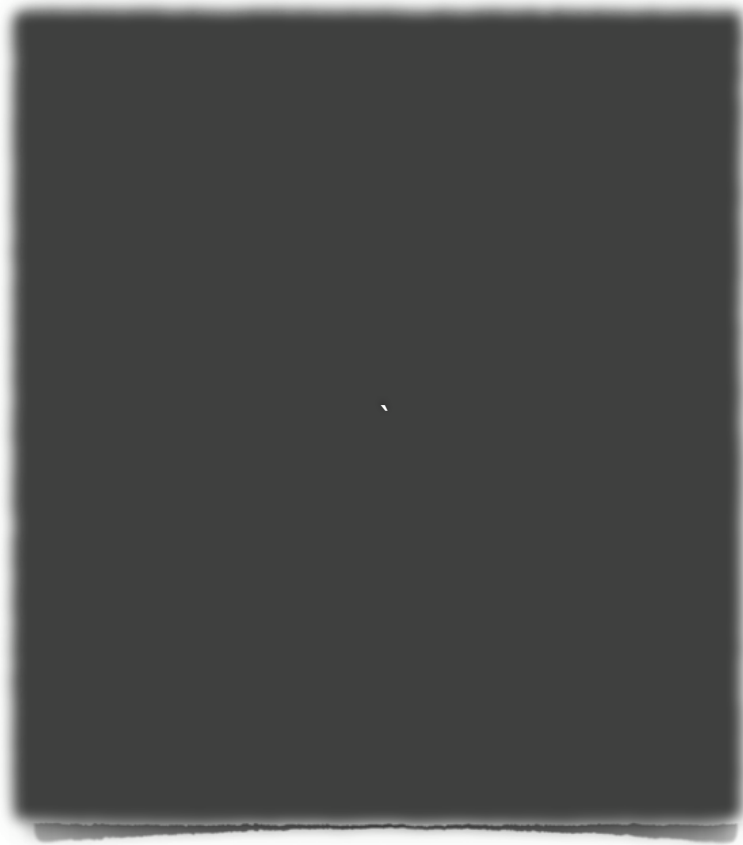
genome
structure
and/or
coding
sequence



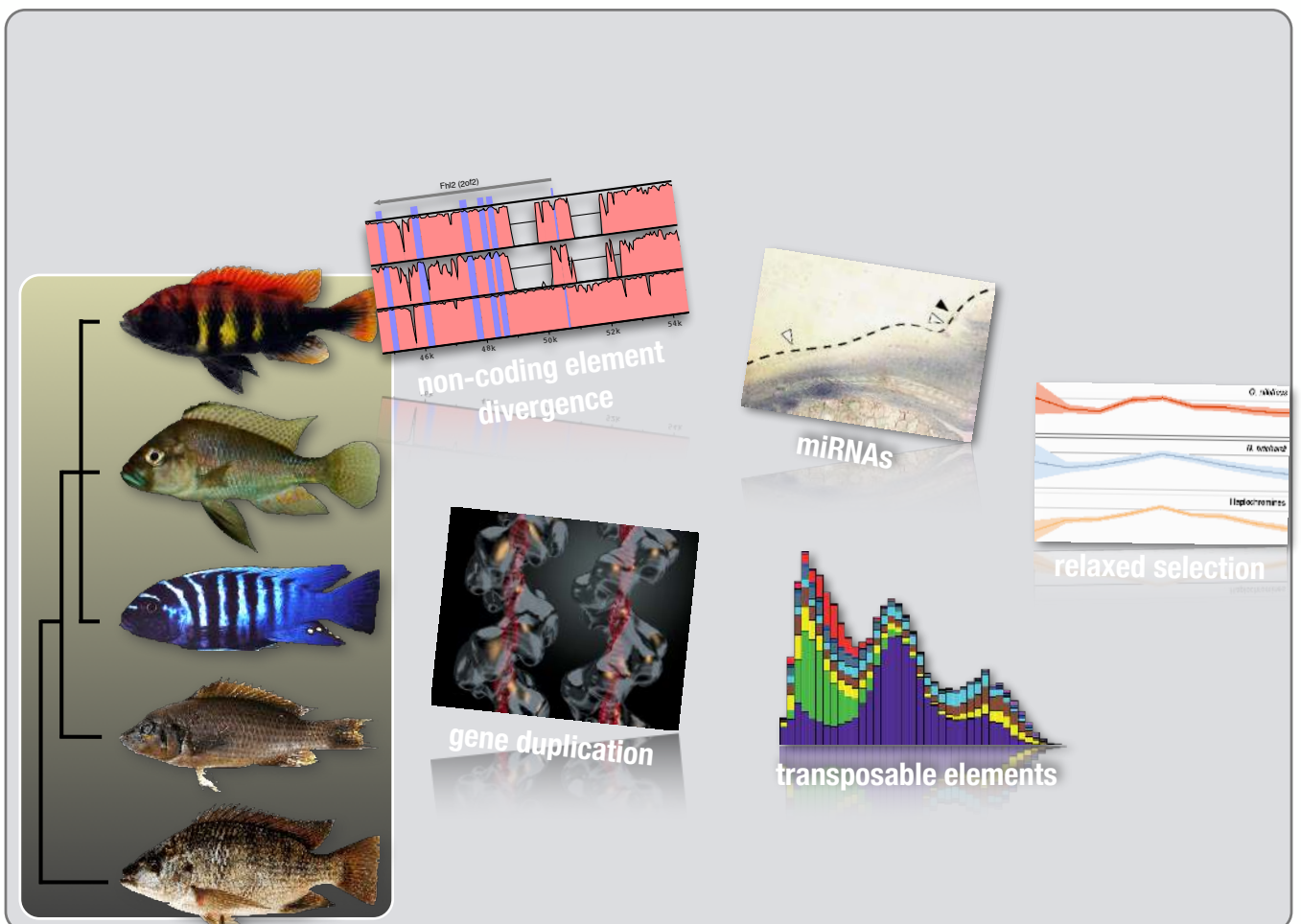
ATG AAC **GCA** TGG AGG...
Met Asn **Ala** Trp Arg

and/or
regulatory
regions





••• The Heliconius Genome Consortium (2012) Nature



••• D Brawand et al. (2014) Nature