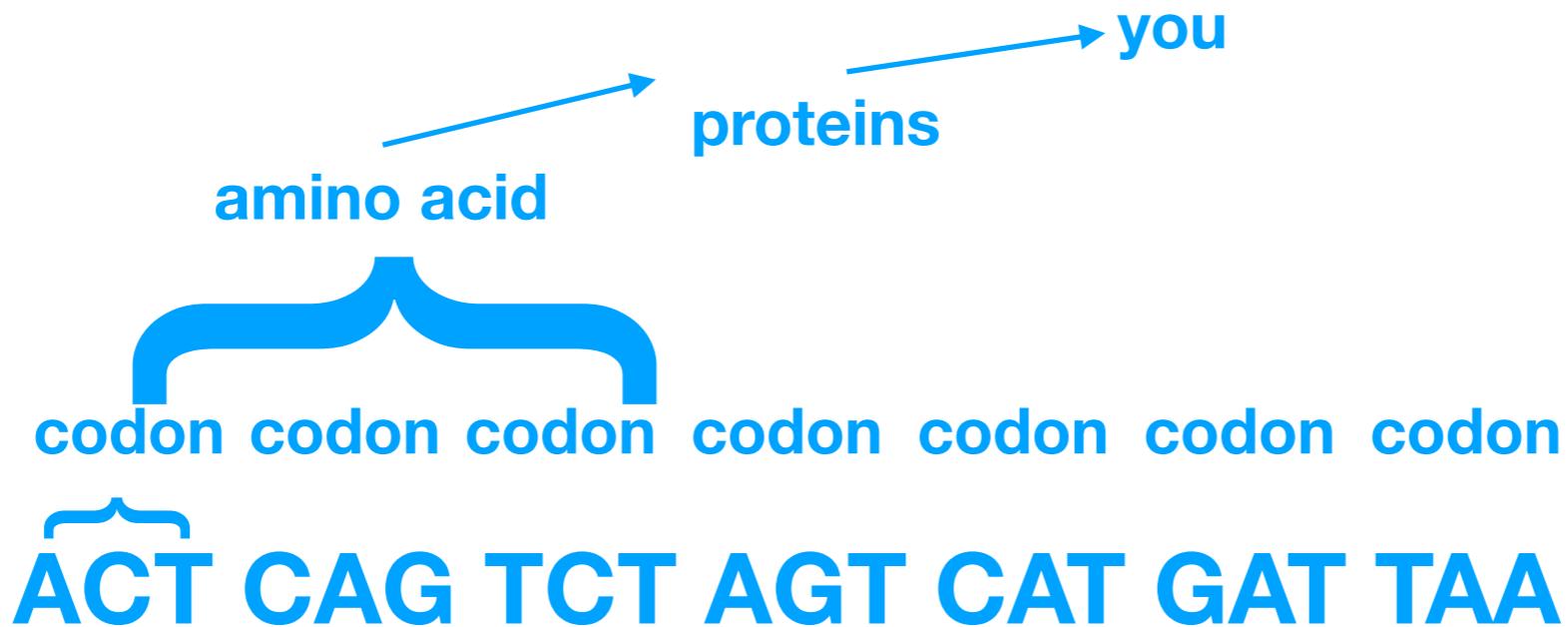


mutations

before we start

- phenotype (that is the set of observable characteristics or traits of an organism)
- genotype (that is an organism's complete set of genetic material)
- In a gene there could be different alleles.



mutations usually

- not good
- lethal
- harmful
- neutral
- sometimes good
- not random

mutations are

- **common** only when the creatures is under stress -> when it needs mutation to change
stress could be: infection, lack of food, new environment, poison, DNA-injury
bacterias SOS mechanism
- but usually **rare** (correcting mechanism)

types of mutation

or at least some of them

Point mutation

- one nucleotide is deleted/ inserted/changed
- usually does nothing
- sickle cell disease: A -> T mutation in the hemoglobin beta part that causes glutamin -> valin

Sequence for normal hemoglobin

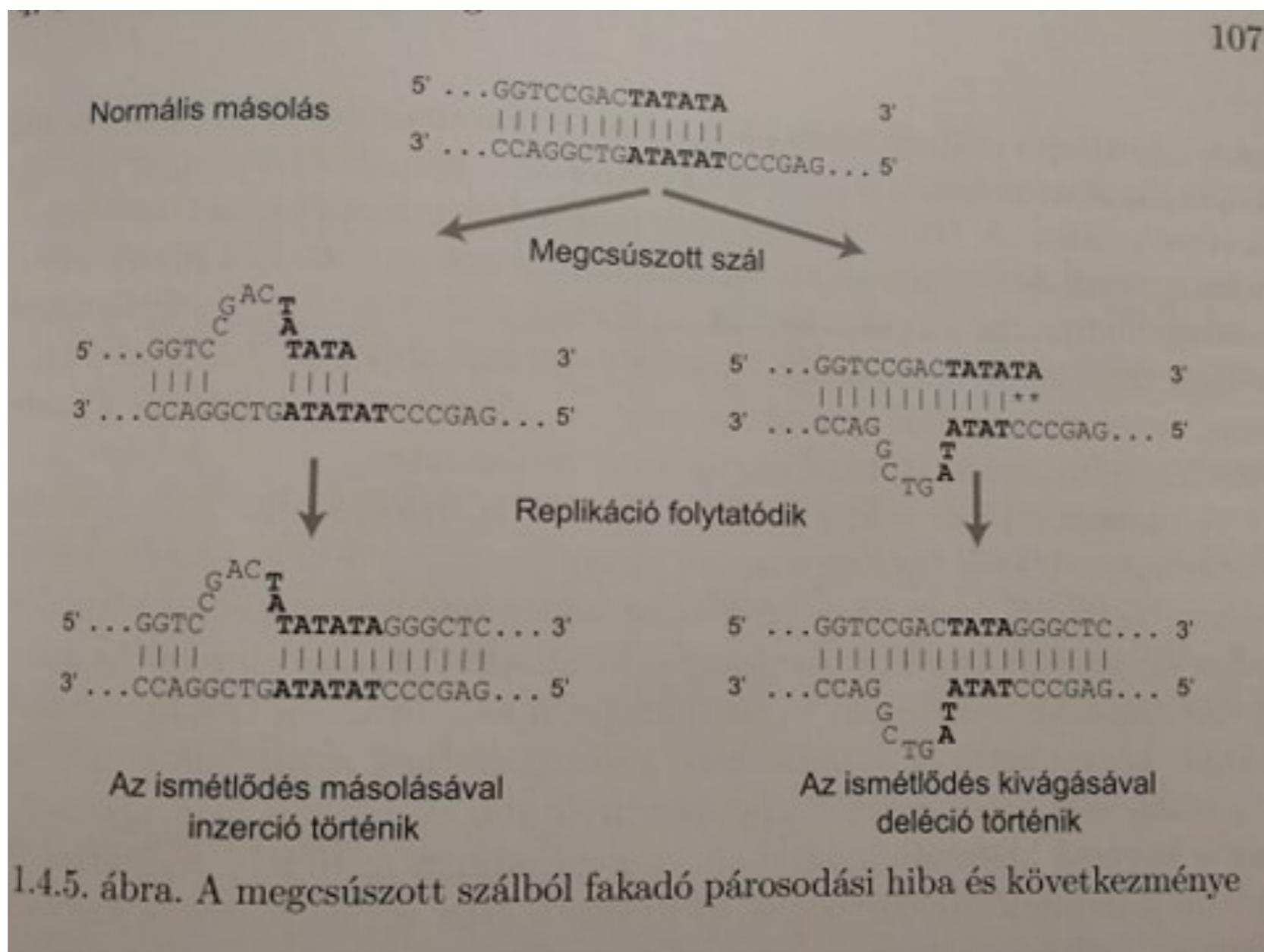
AUG	GUG	CAC	CUG	ACU	CCU	GAG	GAG	AAG	UCU	GCC	GUU	ACU
START	Val	His	Leu	Thr	Pro	Glu	Glu	Lys	Ser	Ala	Val	Thr

Sequence for sickle-cell hemoglobin

AUG	GUG	CAC	CUG	ACU	CCU	GUG	GAG	AAG	UCU	GCC	GUU	ACU
START	Val	His	Leu	Thr	Pro	Val	Glu	Lys	Ser	Ala	Val	Thr

indel

- insertion + deletion = indel



transposons

- Barbara McClintock and the corns in 1940s
- transposons will not take over your body
- fruit fly *P* transposonon the gene *mth* causes 35% longer life
- peppered moths: a transposon in gene cortex makes the moth dark



recombination

- adaptive immune system: B cells
- fruit flies after an infection makes more recombinant offspring

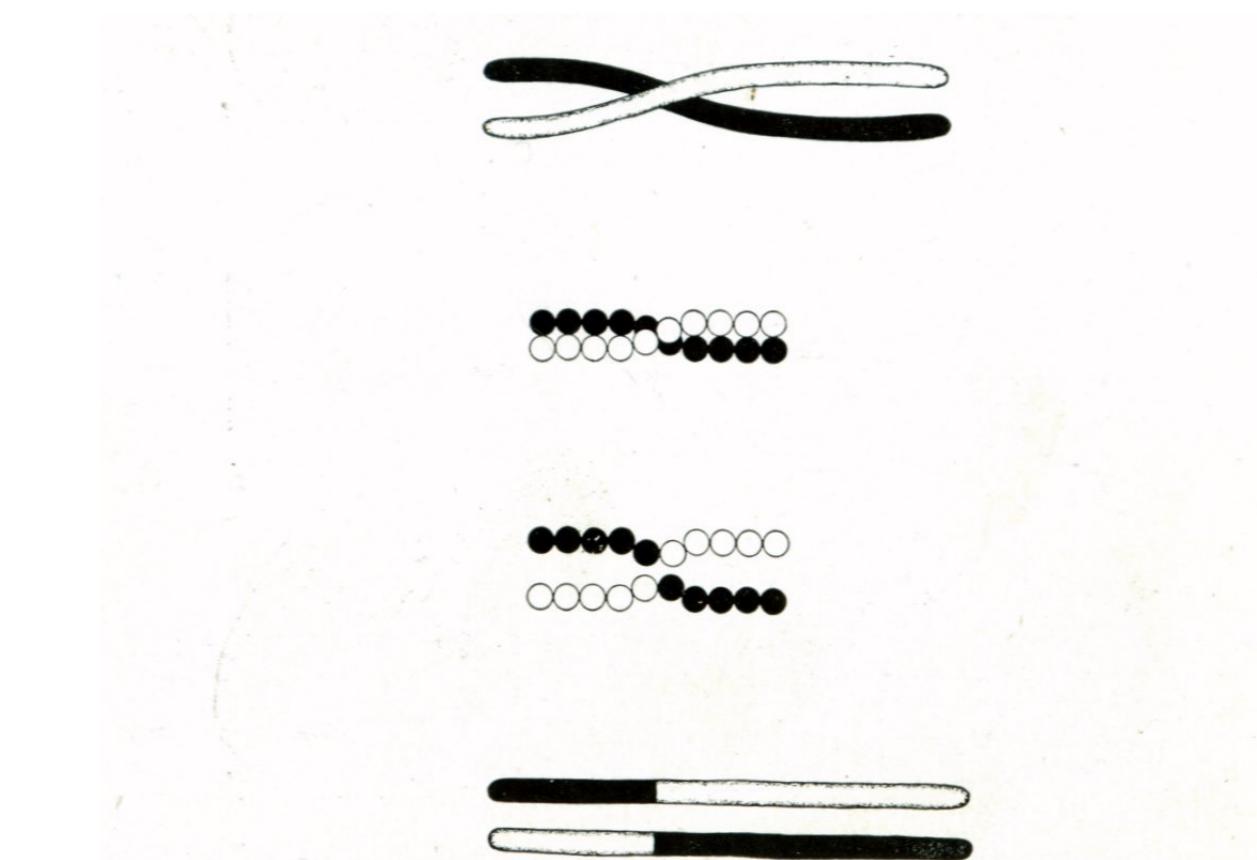


FIG. 64. Scheme to illustrate a method of crossing over of the chromosomes.

Thomas Hunt Morgan's illustration of crossing over (1916)

Natural genetic engineering

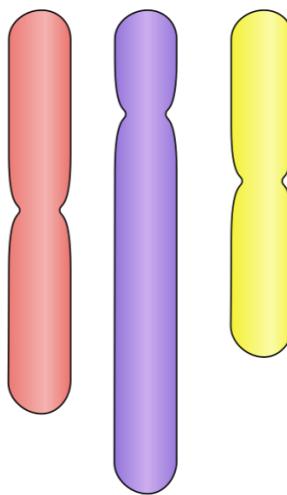
- using nature's techniques (getting a DNA sequence, cutting it, putting into the new cell, glue the new DNA sequence to the cell's DNA)
- adding new genes
- turning on/off genes
- cutting out genes

gene duplication

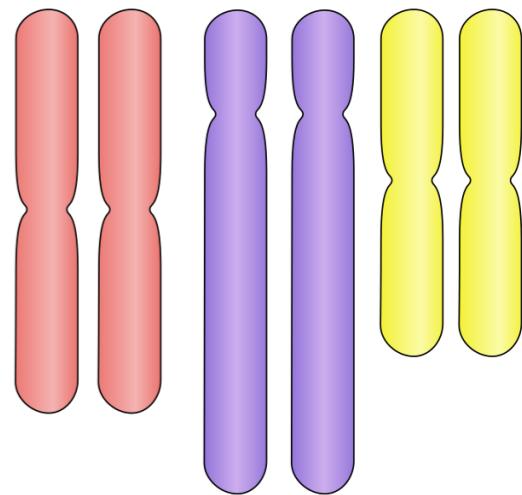
- the new version is ready to change
- more gene could be more efficient

Polyplody

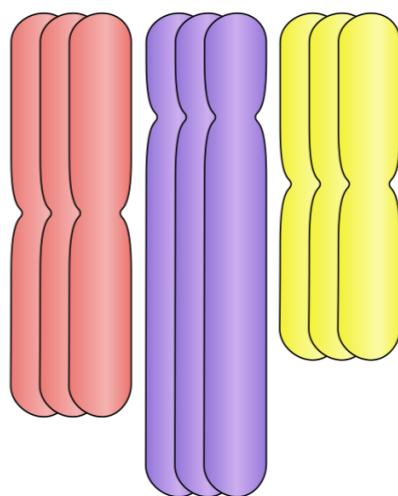
Haploid (N)



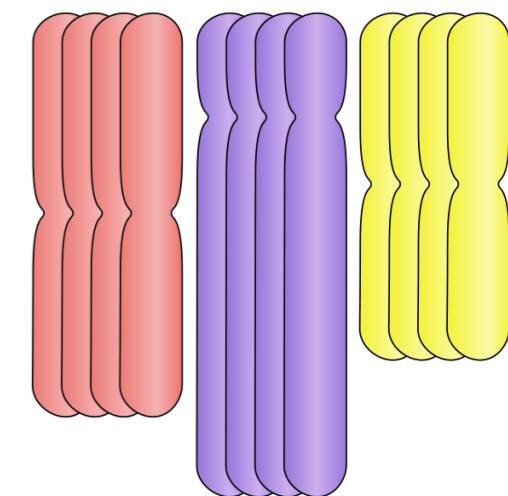
Diploid (2N)



Triploid (3N)



Tetraploid (4N)

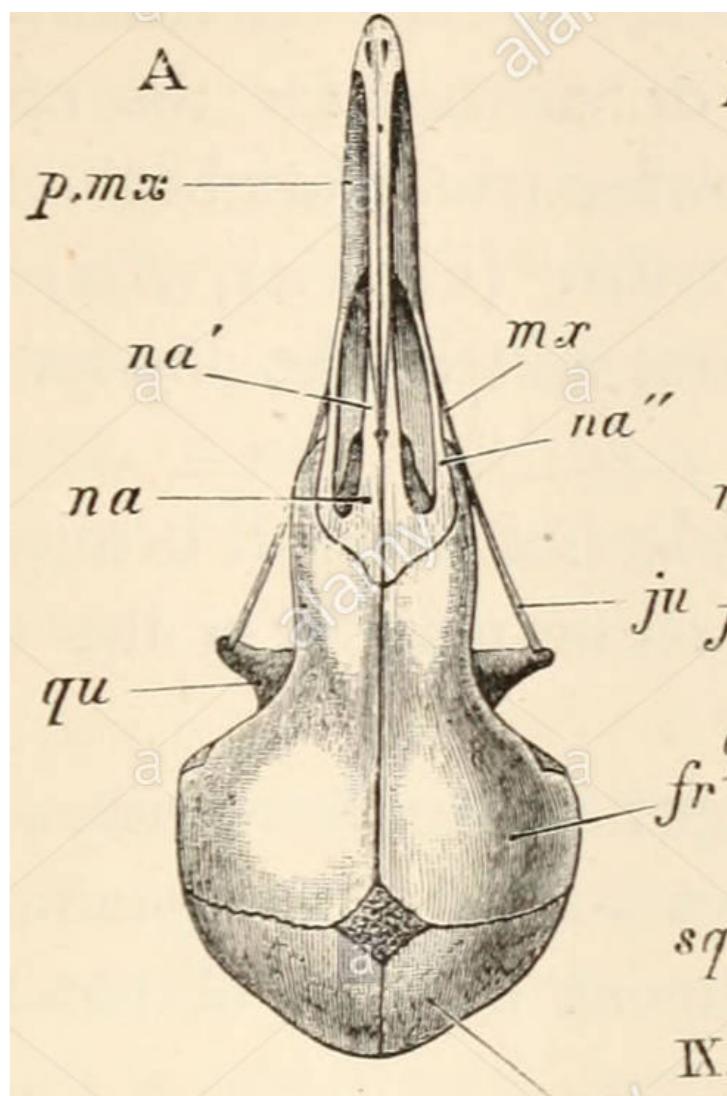


horizontal gene transfer

adaptation

adaptation

- adaptation = a characteristics selected to best fit to the environment
- not every detail on a living creature is an adaptation
- a phenotype could exist because it's connected to another characteristics that is beneficial
- **exaptation:** the characteristics was selected to something else, but it's useful today as well



adaptation

- for adaptation we need:
 - heritability
 - diversity
 - the phenotype are differ in fitness
- convergent evolution



adaptation stories

stickleback

in seawater

predators: fish



armor:

bigger fish can't eat it

slower growing

heavy, energy to make it



in freshwater

predator: bird



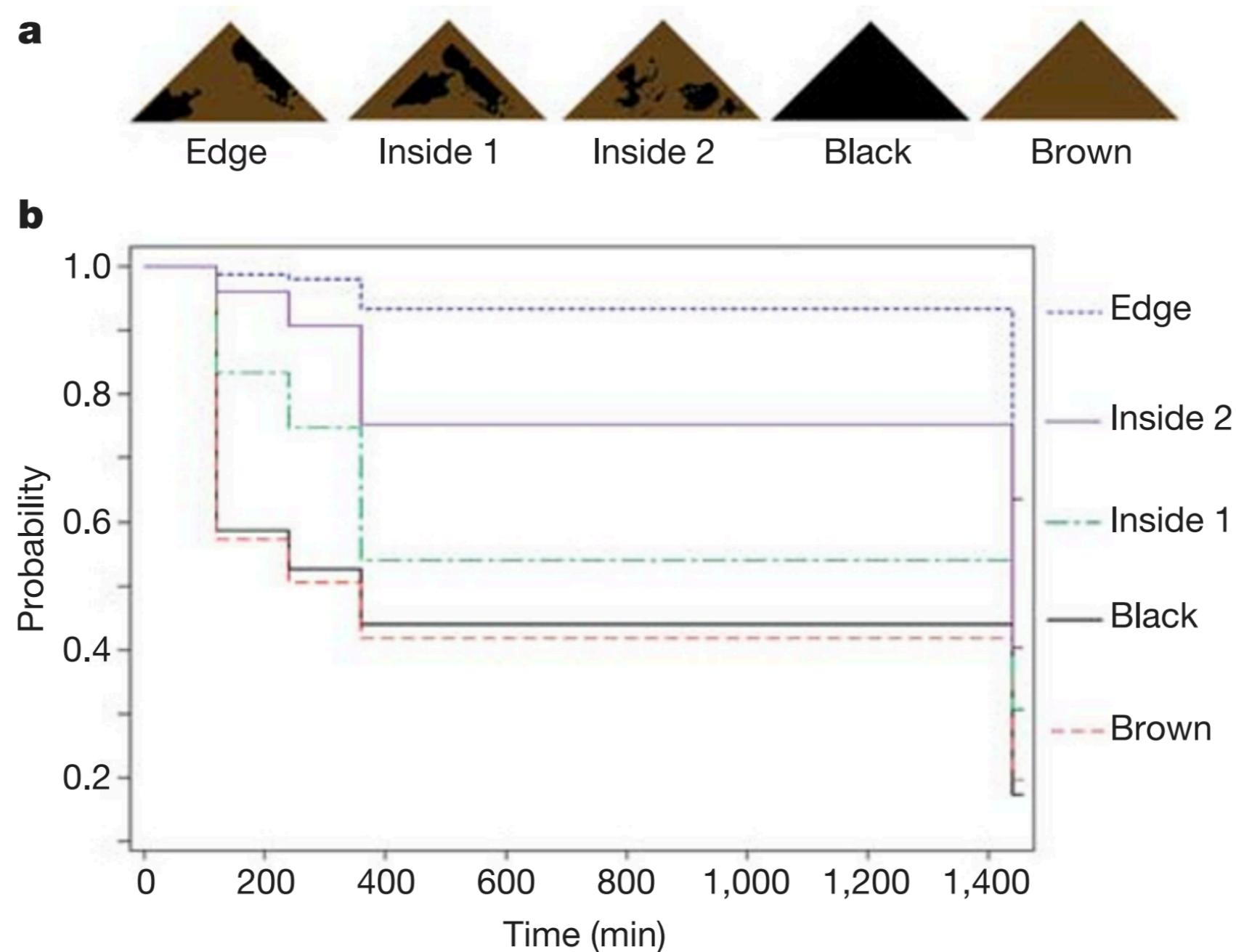
10 mm

Rock pocket mouse

- the colour of the mouse and the colour of the environment correlates
- *Mc1r* gene (red haired humans)

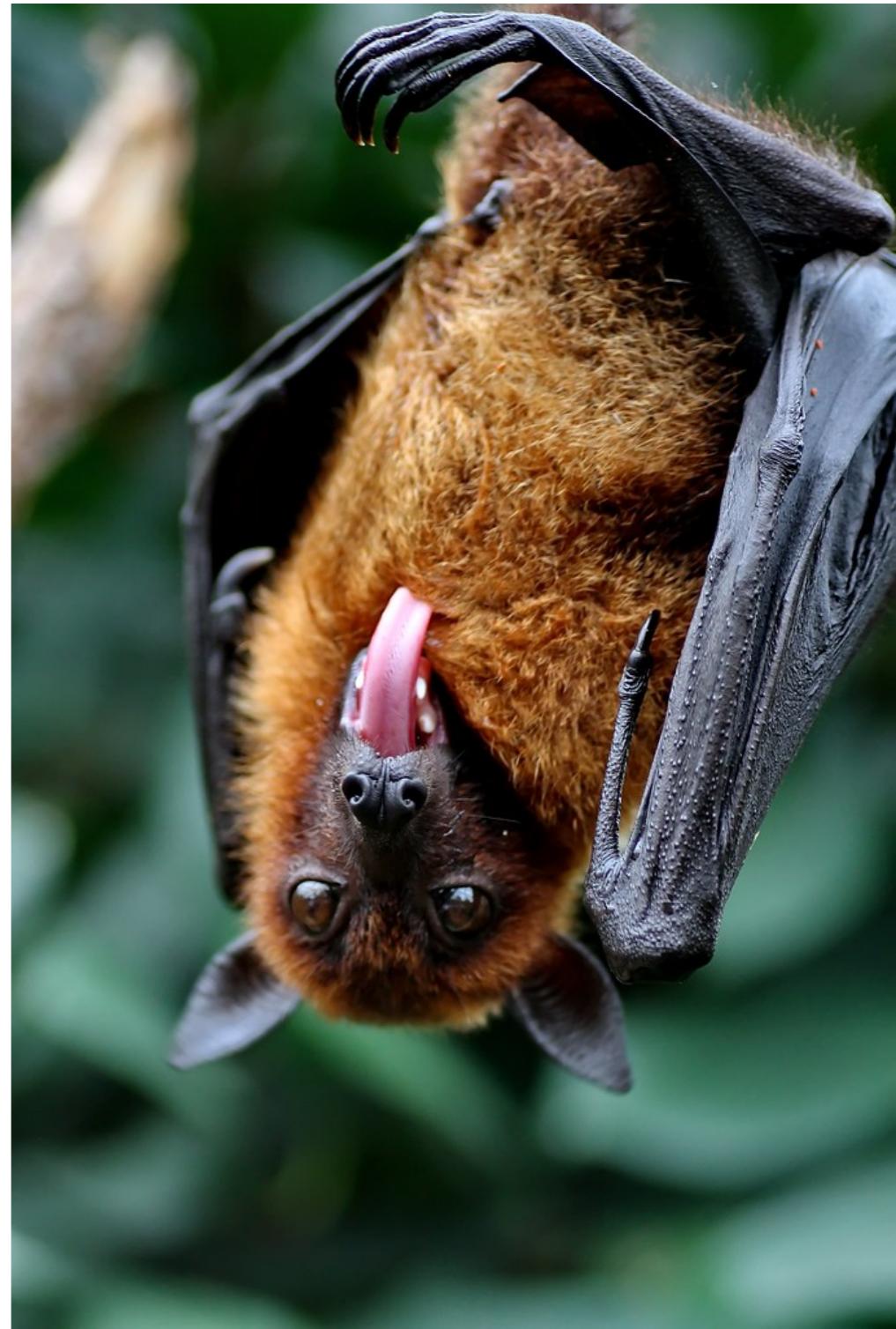


experiment and coloration



megabat species and sexual selection

- sperm competition
- testis size correlates with group size



**not everything is
adaptation**

Red-billed oxpecker and African buffalo



human and evolution

**humans' effect on
others**

extinctions

- human the hunter
- contrary selection pressure than predators
fishing -> smaller fish
Bighorn sheep
- prey animals don't know and don't fear human
- overkill hypothesis



despeciation

- coyote (open area, grasslands)
- wolf (forest)
- hybridisation
- smaller living areas, smaller populations



agriculture

- monocultures
- in the world: sugar cane, corn, rice, wheat, potato
- in Hungary: corn, wheat, sunflower, barley, sugar beet
- edible/clothes/tobacco
 - easy to seed
 - live for 1 or 2 years
 - easy to harvest
 - easy to store
- mutant allele in wheat: seeds stay on the plant making the harvest easier. the plant can't reproduce without human



domestication

- mutualist relationship
- last for several generations
- one of the organisations maintains the reproduction of the other
- predictable source of benefits (ie. food)
- the domesticated individual has fitness benefits over the non domesticated
- artificial speciation



domestication

- farmer ants and herd aphids
- ants and fungi



domestication

- which species are good to domesticate?
 - easy to feed - eat everything, not specialised
 - grow fast
 - live in groups, tolerate other animals
 - breed in captivity
 - calm and not aggressive
 -



dog

- oldest domesticated animal
- domesticated several times
- understanding human gestures
- eye contact
- bark more
- amylase enzyme
- worst ability of orientation



**modern human and
evolution**

drift

- humans lived in small populations (before airplanes)
- peoples of islands have unique genetics
- migration



mutations

- beneficial:
 - drinking milk
 - amylase enzyme
- lethal/disadvantageous:
 - modern medical care
 - decreasing selection pressure



selection on humans

- parasites and pathogens (sickle cell anaemia)
- malnutritions

adaptation

- people in different places are different
- high altitude
 - Tibetans (3000 ys ago):
breath faster
take more air with each breath
enlarged lung volumes
 - Andeans (11 000 ys ago):
haemoglobin concentration is higher
increased oxygen level in their haemoglobin, that is,
more oxygen per blood volume, carry more oxygen
each red blood cell
their breathing is essentially at the same rate
- water, island, sea nomads Bajau people:
smaller body size
free diving up to 13 mins
see better underwater

