Is it Natural Selection? Key

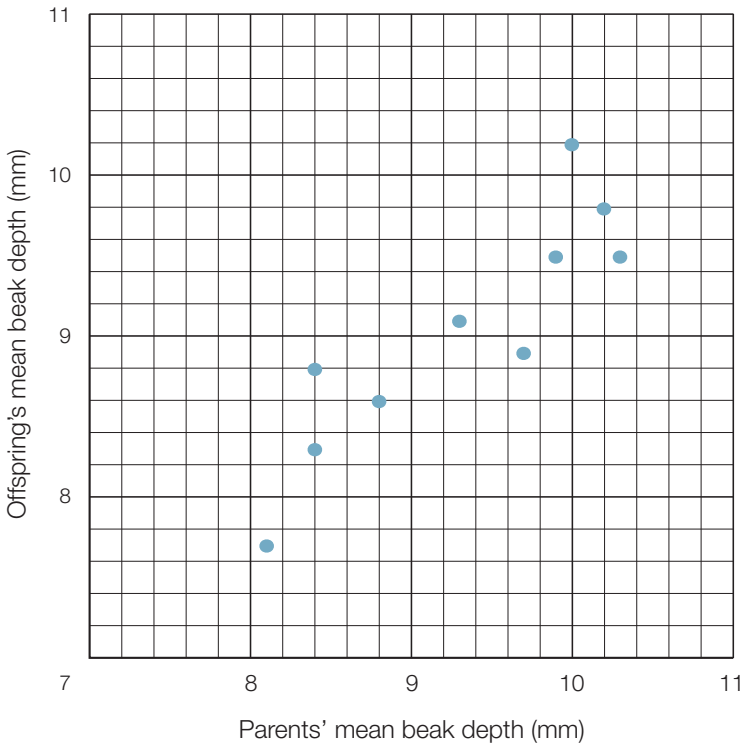
Beak Depth in Darwin's Finches

Checklist key

Checklist item	Yes or no?	Evidence and notes
Change over time	Yes	Mean beak depth was greater in the offspring that were born after the drought.
Variability	Yes	Individuals have different beak depths.
Heritability	Yes	Beak depth in offspring resembles (has a positive relationship to) that of the parents.
Reproductive Advantage	Yes (inferred)	Individuals with greater beak depth survived, presumably because they were able to eat larger seeds. Therefore, they were more likely to reproduce.
Is it natural selection?	**Yes**	

Beak depth in finch parents and their offspring

Mean beak depth (mm)	
Parents (**x**)	Offspring (**y**)
9.3	9.1
10.3	9.5
9.7	8.9
8.1	7.7
9.9	9.5
8.4	8.8
10.2	9.8
8.4	8.3
8.8	8.6
10.0	10.2



Horn Length in Bighorn Sheep

Checklist key

Checklist item	Yes or no?	Evidence and notes
Change over time	Yes	Mean horn length decreased over 30 years of study.
Variability	Yes	Individuals have different horn lengths.
Heritability	Yes	Horn length of sons resembles that of their fathers.
Reproductive Advantage	Yes	Hunters selectively harvested rams with longer horns, making rams with smaller horns more likely to reproduce.
Is it natural selection?	**Yes**	

1. Calculate the mean horn length for all of the rams:

$$\frac{\text{total horn length}}{\text{number of rams}} = \frac{968 \text{ cm}}{14 \text{ rams}} = 69 \text{ cm}$$

2. Calculate the mean horn length for the rams that were harvested:

$$\frac{\text{total horn length}}{\text{number of rams}} = \frac{307 \text{ cm}}{4 \text{ rams}} = 77 \text{ cm}$$

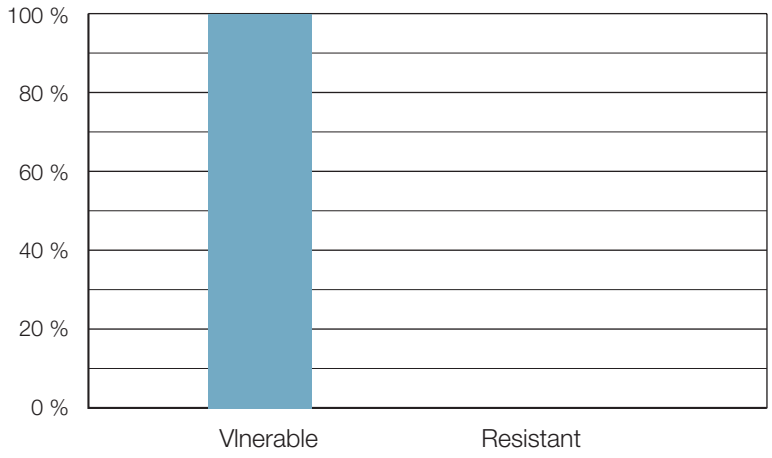
Horn lengths of 5-year-old rams in 1989 and if they were eventually harvested

Horn length (cm)	Harvested?
53	no
58	no
61	no
61	no
62	no
64	no
65	no
67	**yes**
73	no
77	**yes**
80	no
81	**yes**
82	**yes**
84	no

Mold Resistance in Irish Lumper Potatoes

Checklist key

Checklist item	Yes or no?	Evidence and notes
Change over time	No	No potatoes were resistant before or after the blight–all that were exposed died.
Variability	No	All plants were genetically identical clones.
Heritability	Yes	Mold resistance comes from an allele of the R1 gene, which passes from parents to offspring. Offspring (clones) had the same alleles as the parents.
Reproductive Advantage	No	All of the potatoes were vulnerable to infection, so none were more likely to reproduce.
Is it natural selection?	**No**	*Note: This example shows how a population with very low genetic diversity is vulnerable to extinction.*

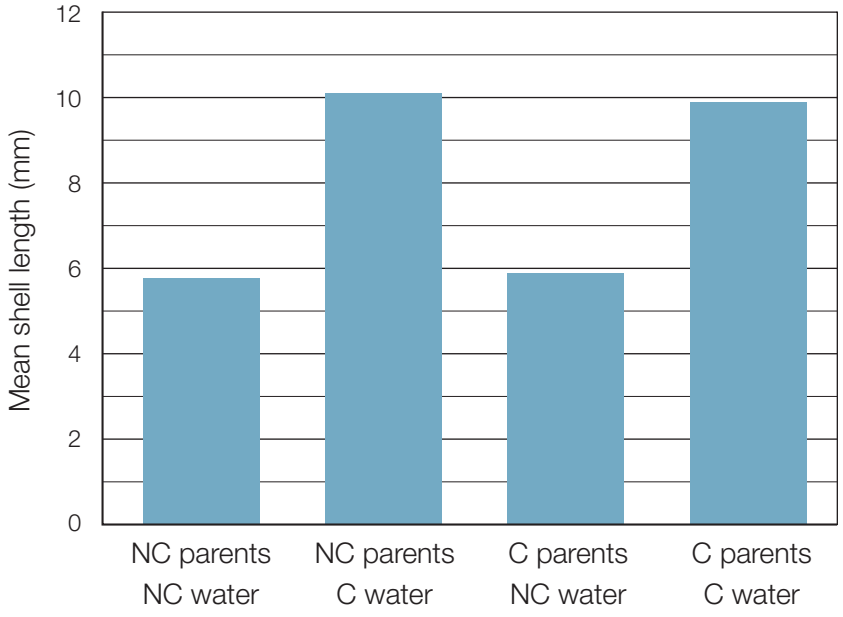


Shell Length in Freshwater Snails

Checklist key

Checklist item	Yes or no?	Evidence and notes
Change over time	No	In this example, we see no evidence.
Variability	Yes	Individuals have different shell lengths.
Heritability	No	Longer shell length is associated with presence of crayfish in the water, not with the shell length of the parents.
Reproductive Advantage	Yes	When they are present, crayfish eat the smaller snails, making the larger snails more likely to reproduce.
Is it natural selection?	**No**	

Snail parents	Water source	Mean shell length (mm)
NC	NC stream	5.8
NC	C stream	10.1
C	NC stream	5.9
C	C stream	9.9



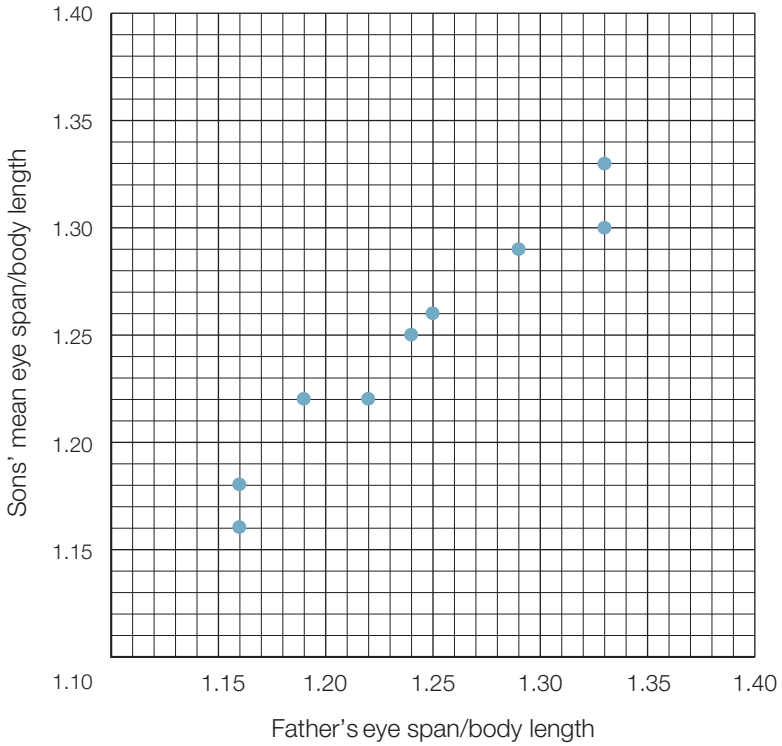
Eye span in stalk-eyed flies

Checklist key

Checklist item	Yes or no?	Evidence and notes
Change over time	Yes	Fossilized stalk-eyed flies had shorter eye spans than stalk-eyed flies that are living today.
Variability	Yes	Individuals have different relative eye spans.
Heritability	Yes	Eye span/body length of sons resembles that of their fathers.
Reproductive Advantage	Yes	Males with longer eye spans are more likely to get to mate.
Is it natural selection?	**Yes**	

Relative eye span of stalk-eyed fly fathers and sons

Fathers (**x**) $\frac{\text{eye span}}{\text{body length}}$	Sons (**y**) mean $\frac{\text{eye span}}{\text{body length}}$
1.16	1.16
1.16	1.18
1.19	1.22
1.22	1.22
1.24	1.25
1.25	1.26
1.29	1.29
1.33	1.30
1.33	1.33

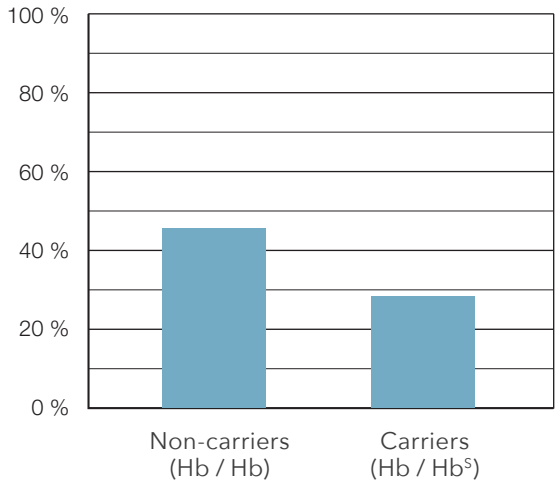


Malaria Resistance in People in Uganda

Checklist key

Checklist item	Yes or no?	Evidence and notes
Change over time	Yes	We can infer change over time, because the Hb^S allele is much more common in the Ugandan population than it is in the rest of the world.
Variability	Yes	People in the population have different combinations of the Hb and Hb^S alleles, which make some people resistant to malaria and others not resistant.
Heritability	Yes	Hb alleles pass from parents to offspring.
Reproductive Advantage	Yes	People with one copy of the Hb^S allele are more likely to survive malaria, reach reproductive age, and have children of their own.
Is it natural selection?	**Yes**	

Alleles	Children with malaria	Children without malaria	Total number of children	% of children with malaria
Hb/Hb (non-carrier)	113	134	247	46
Hb/Hb^S (carrier)	12	31	43	28
TOTAL	**125**	**165**	**290**	---



Color Blindness in Pingalapese People

Checklist key

Checklist item	Yes or no?	Evidence and notes
Change over time	Yes	Color blindness is more common today than it was in the past.
Variability	Yes	People in the population have different combinations of working and non-working CNGB3 alleles, which make some people color blind, some carriers of the non-working allele, and some non-carriers.
Heritability	Yes	CNGB3 alleles pass from parents to offspring.
Reproductive Advantage	No	We see no evidence that people's CNGB3 allele combination or color blindness makes some individuals more likely to reproduce than others.
Is it natural selection?	**No**	*Note: This is an example of the founder effect, which is a type of genetic drift.*

Time	Color blind	Carrier	Unaffected	Total
After the 1775 typhoon	0 %	5 %	95 %	100%
Today	5 %	30 %	65 %	100%