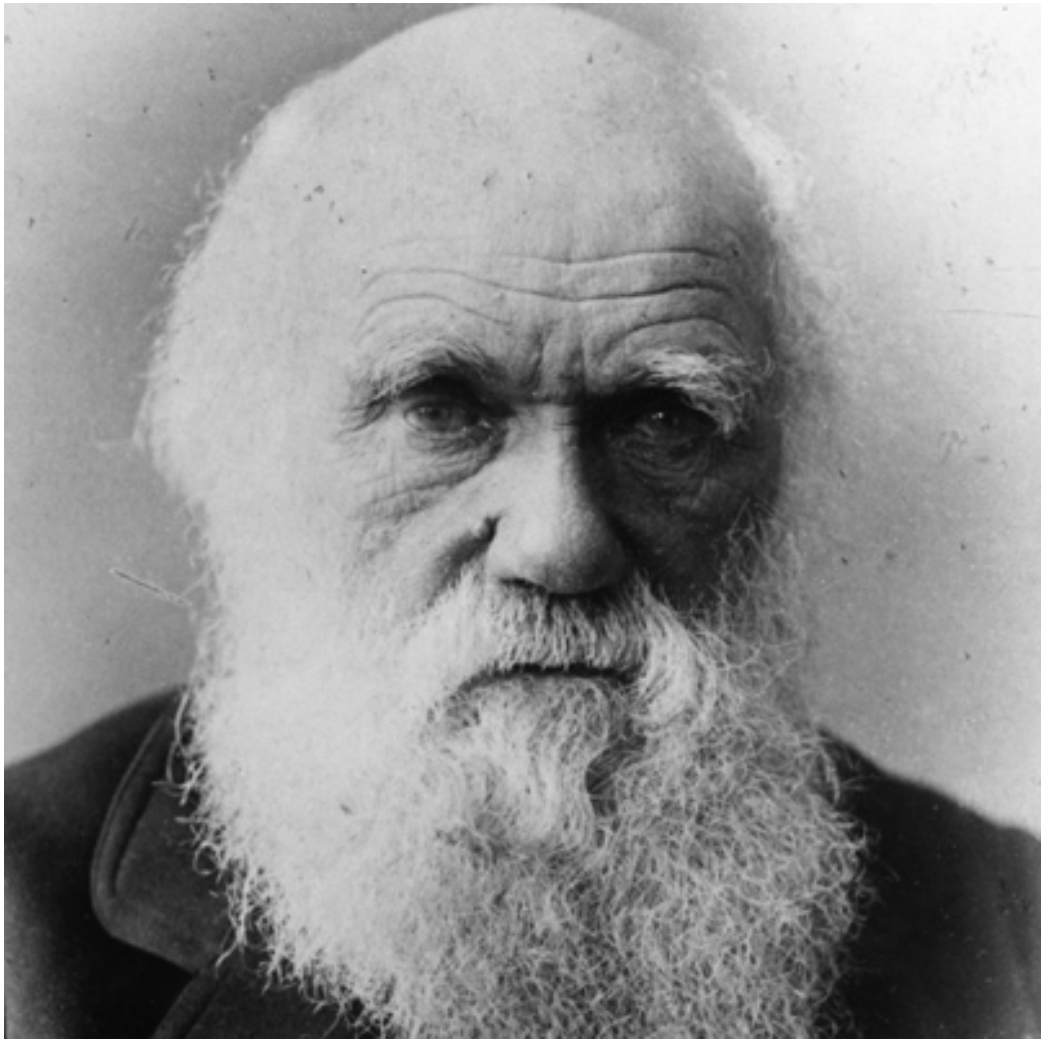
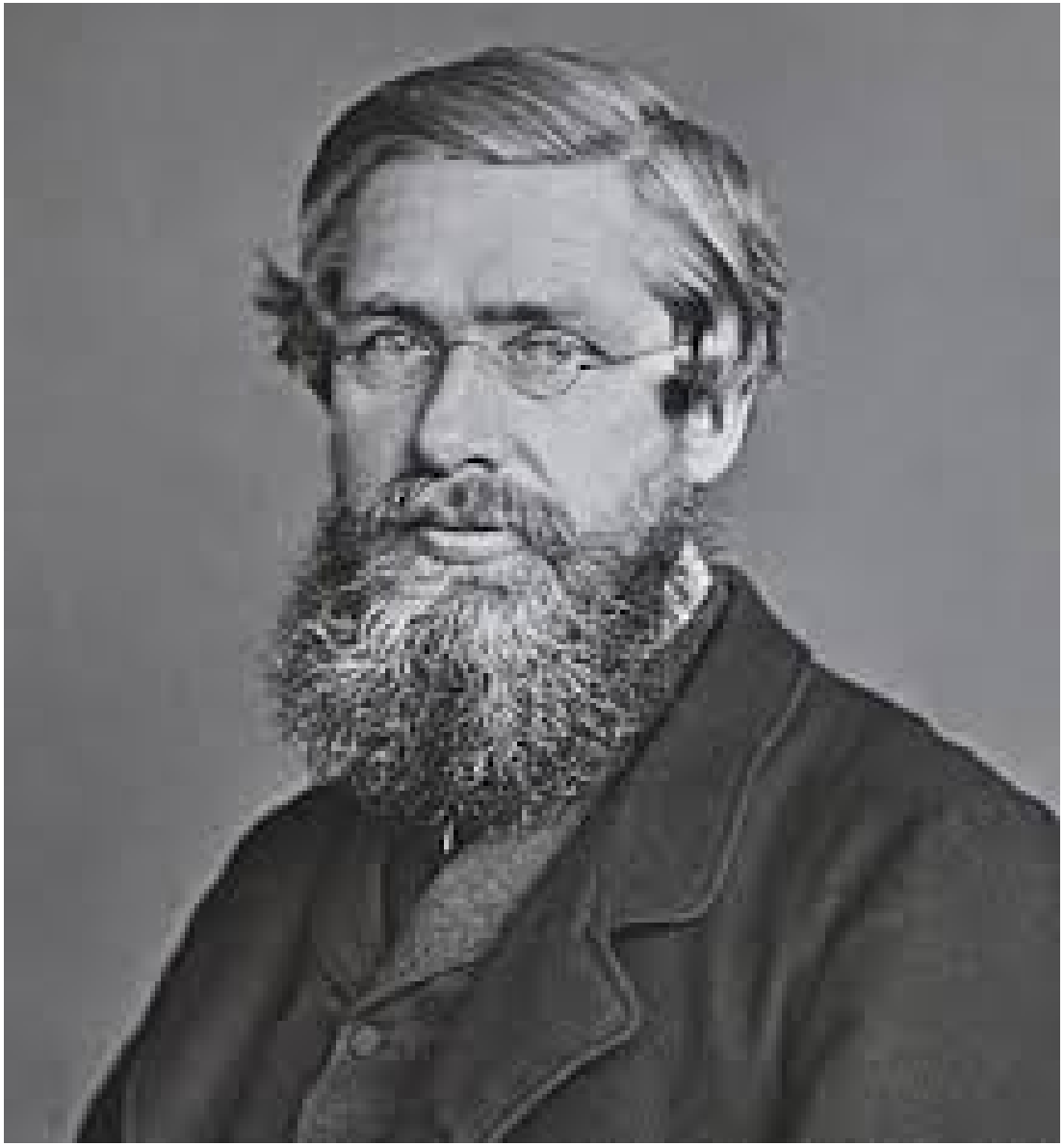
Outline

- Natural Selection
- Adaptation and maladaption
- Cultural evolution

Darwin



Wallace



Natural selection

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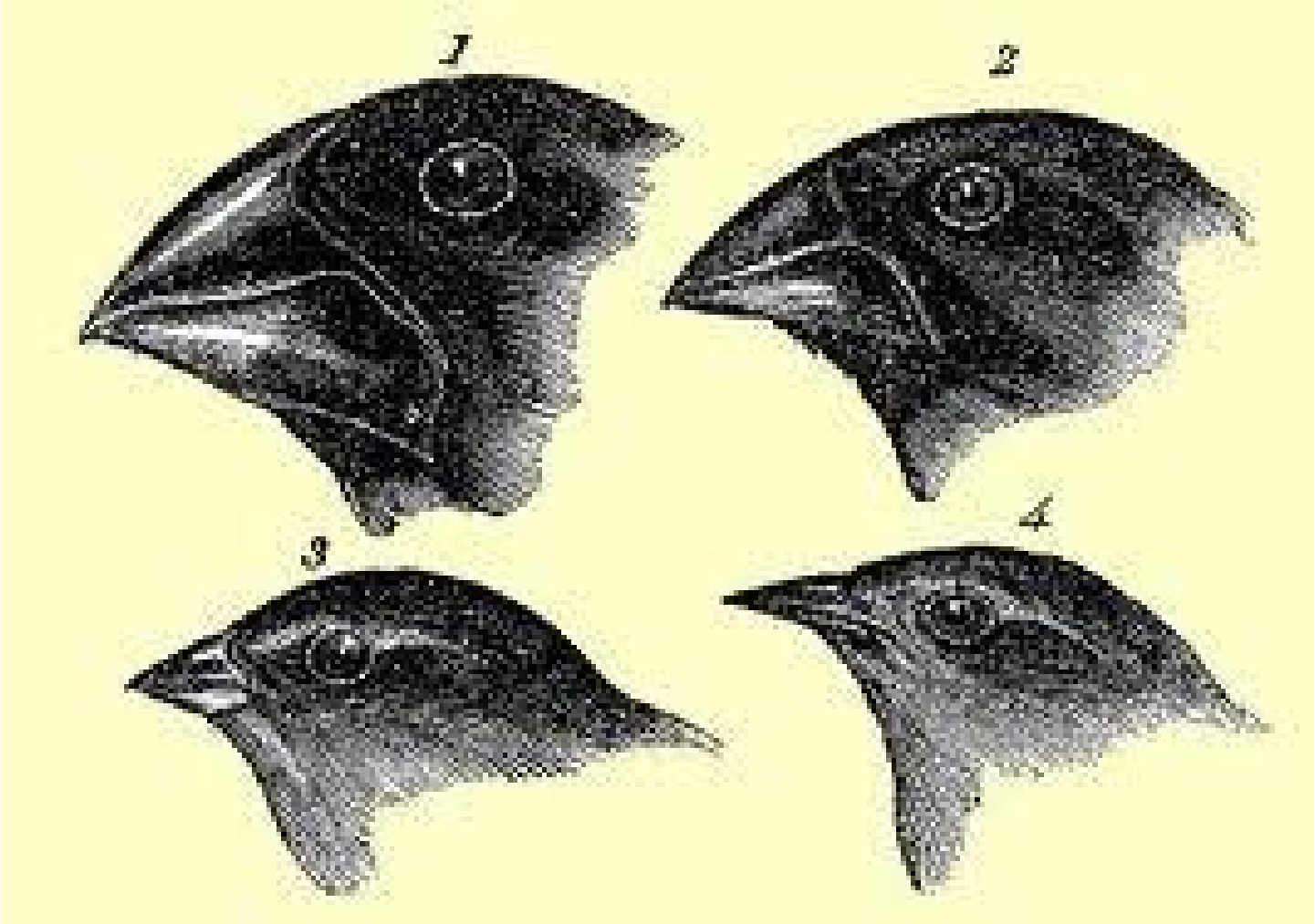
Natural selection results from differential reproductive success

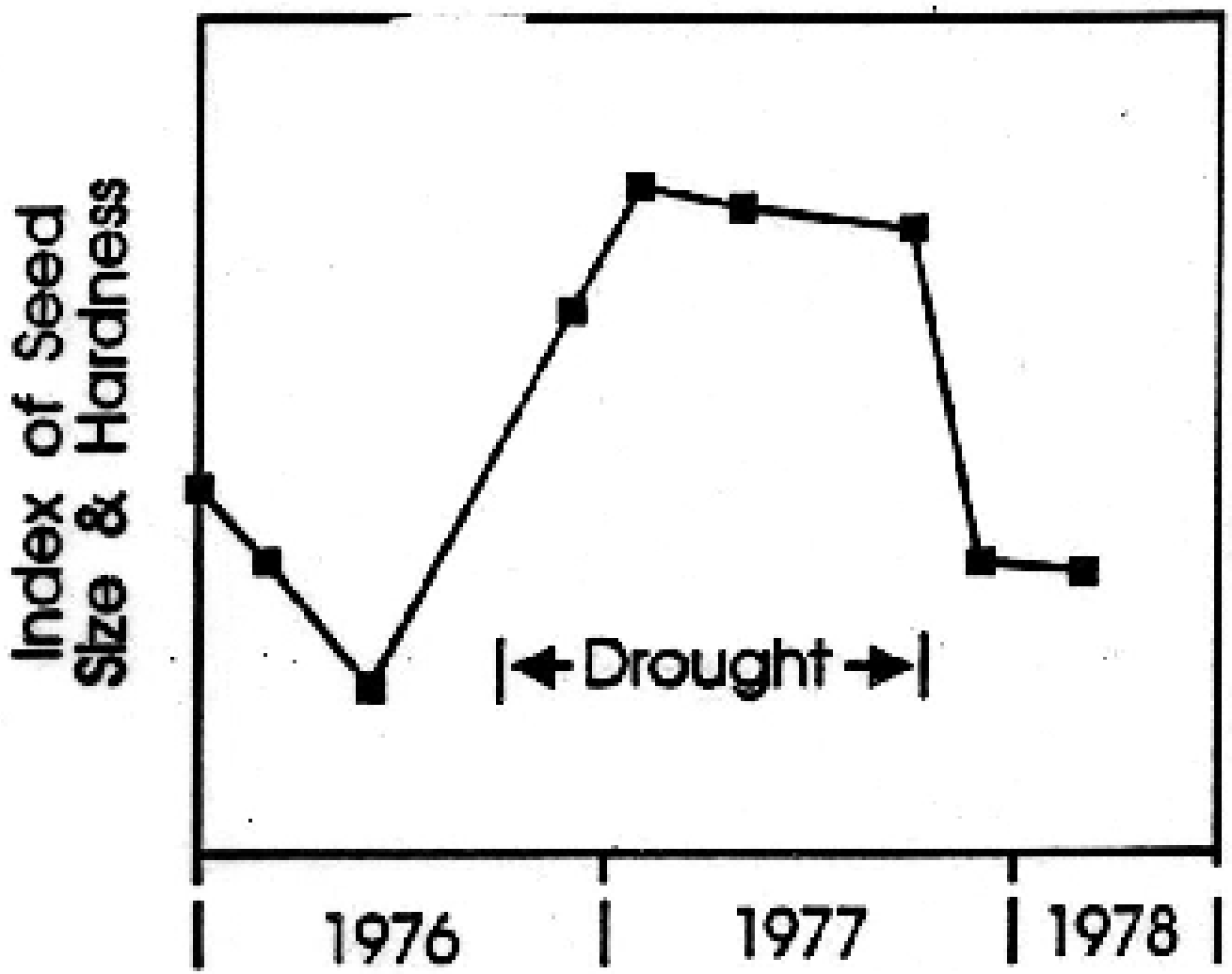
Darwin's Finches of the Galapagos Islands



Peter and Rosemary Grant re-studied one of "Darwin's Finches" on the island of Daphne Major.

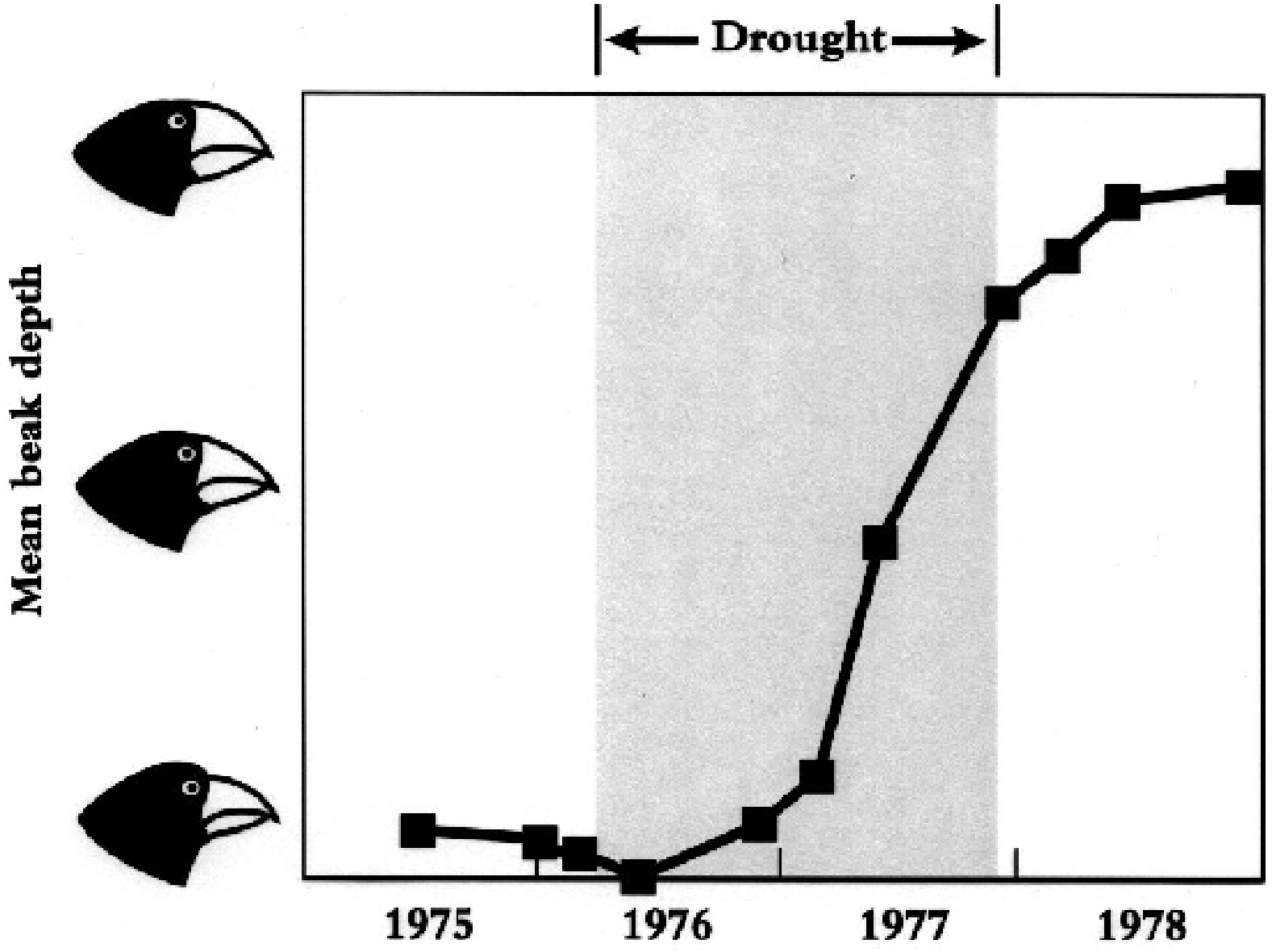
Effects of the drought on Daphne Island Seeds

During the drought, the seeds the birds ate became larger and harder

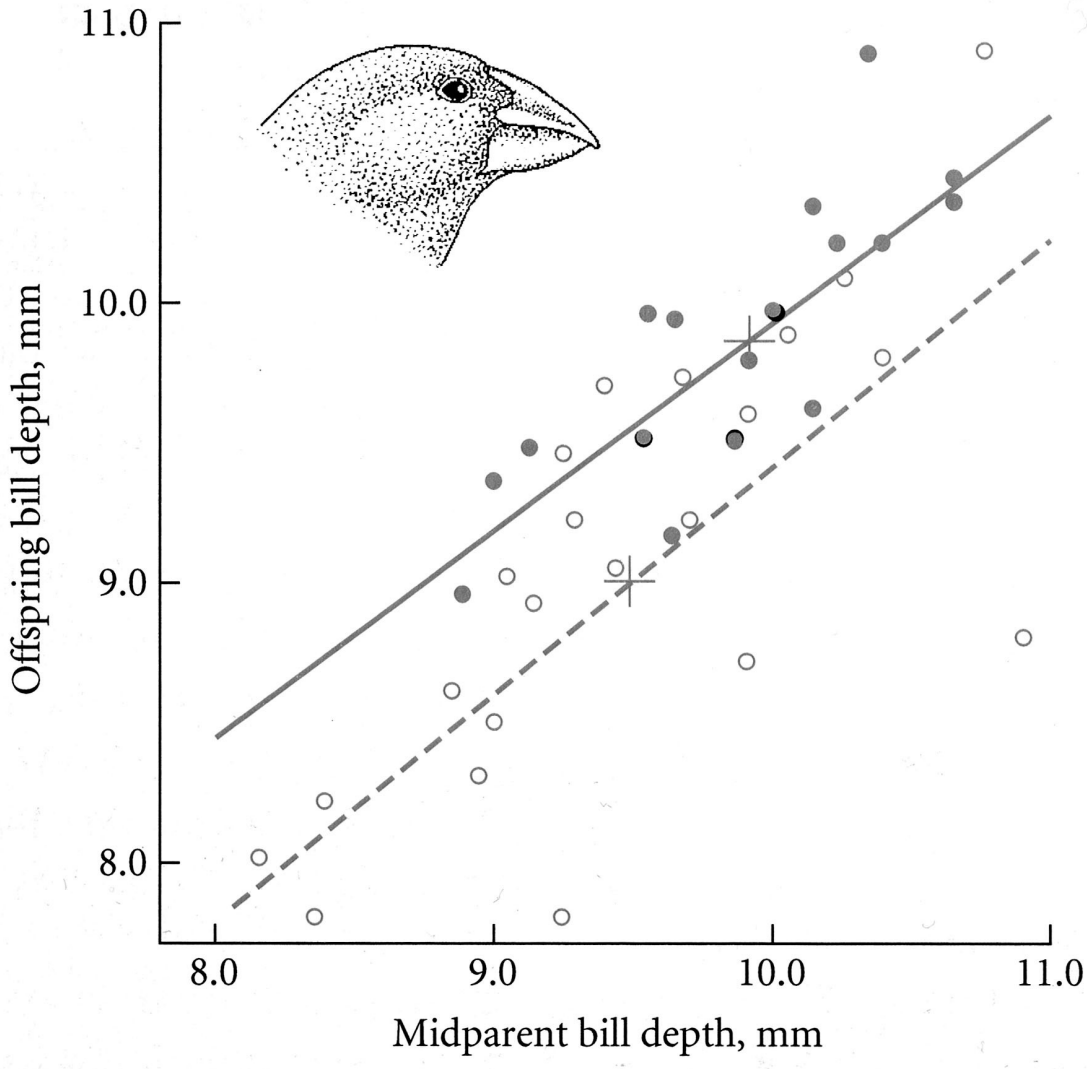


Effects of the drought on beak size of Geospiza fortis

Birds with deeper beaks were better able to process big tough seeds

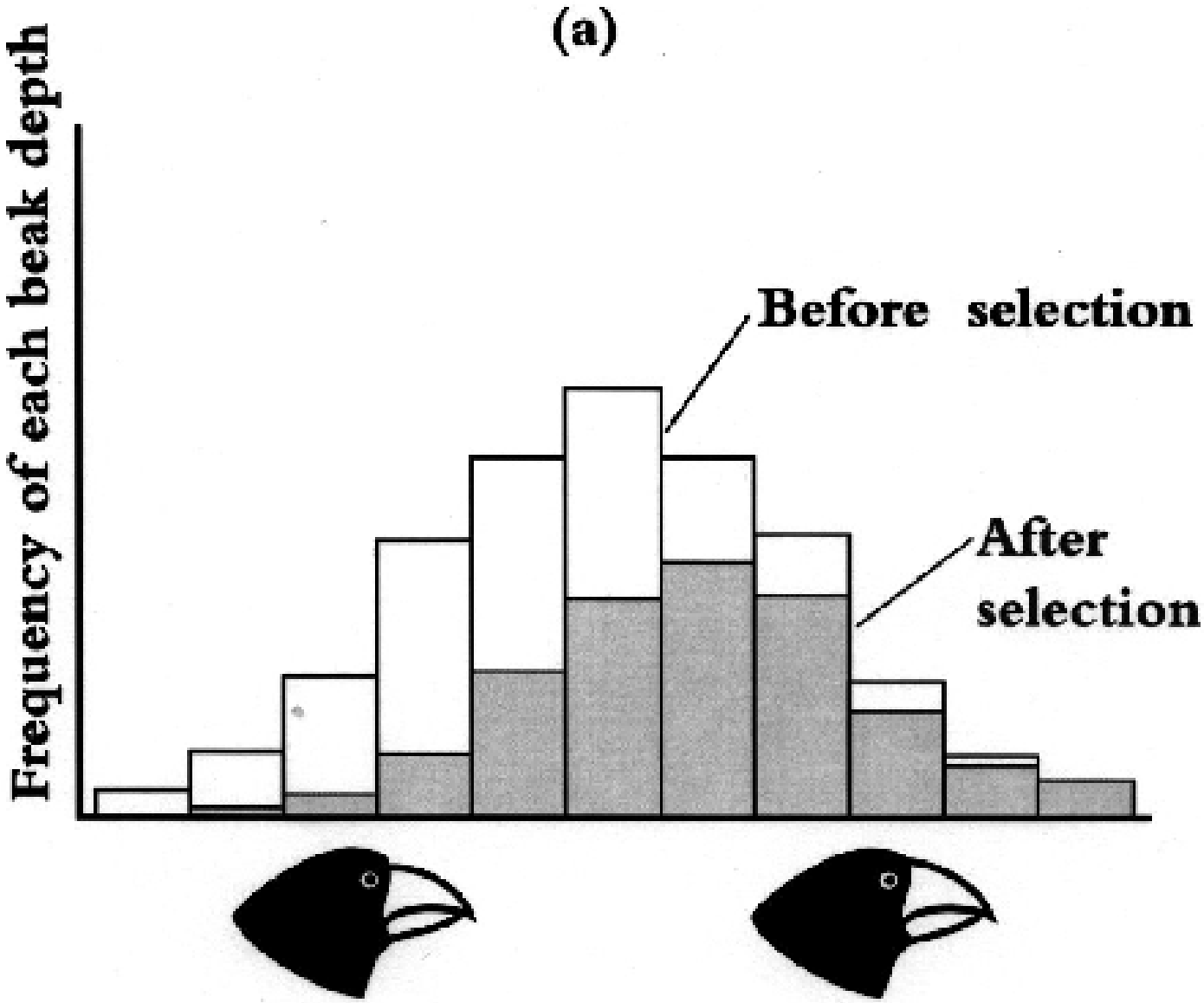


Finches with deeper beakas produced offspring with deeper beaks



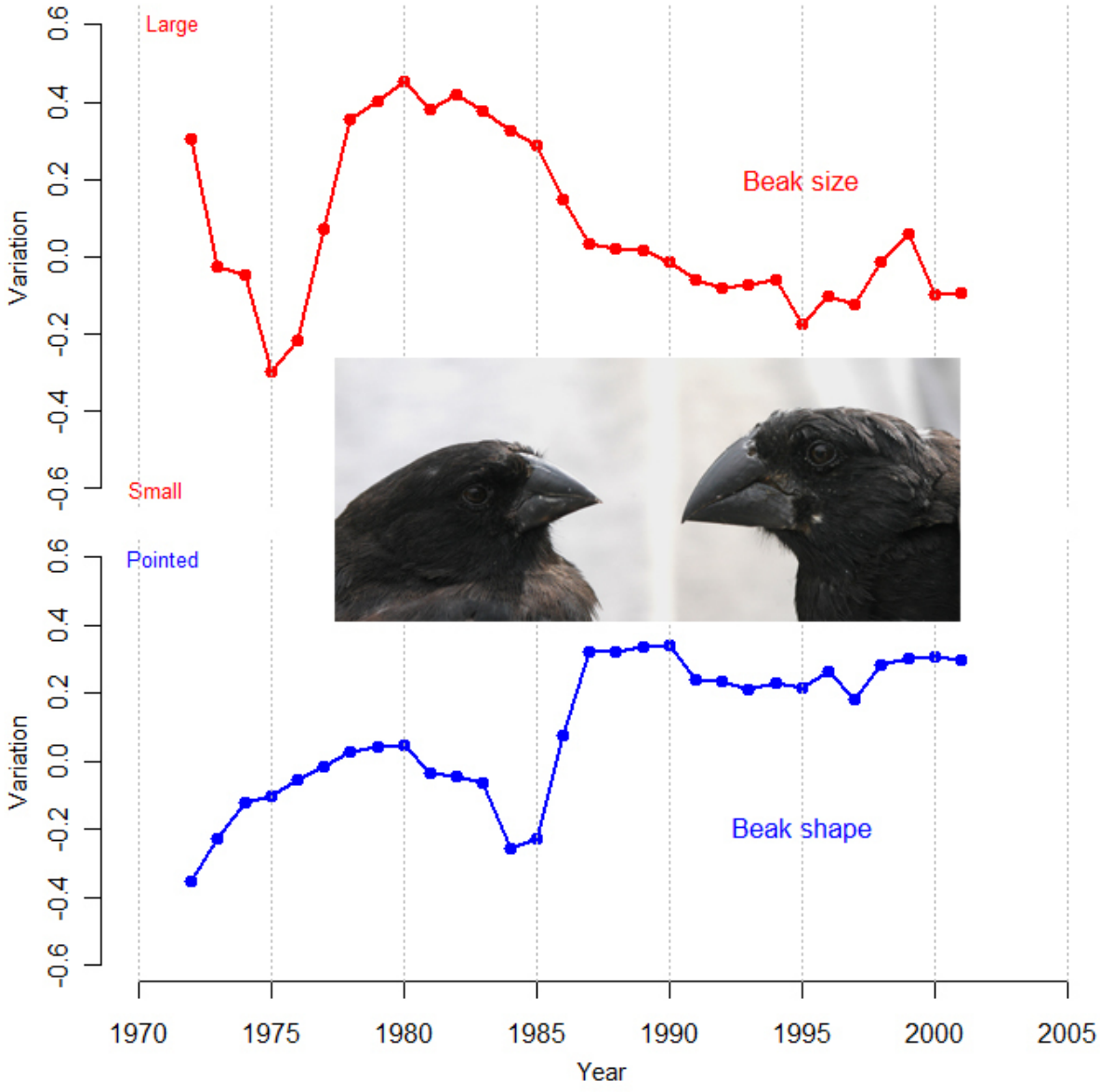
Beak size before and after selection

Selection pressure from the drought affected survivorship, produced evolutionary change to larger beaks

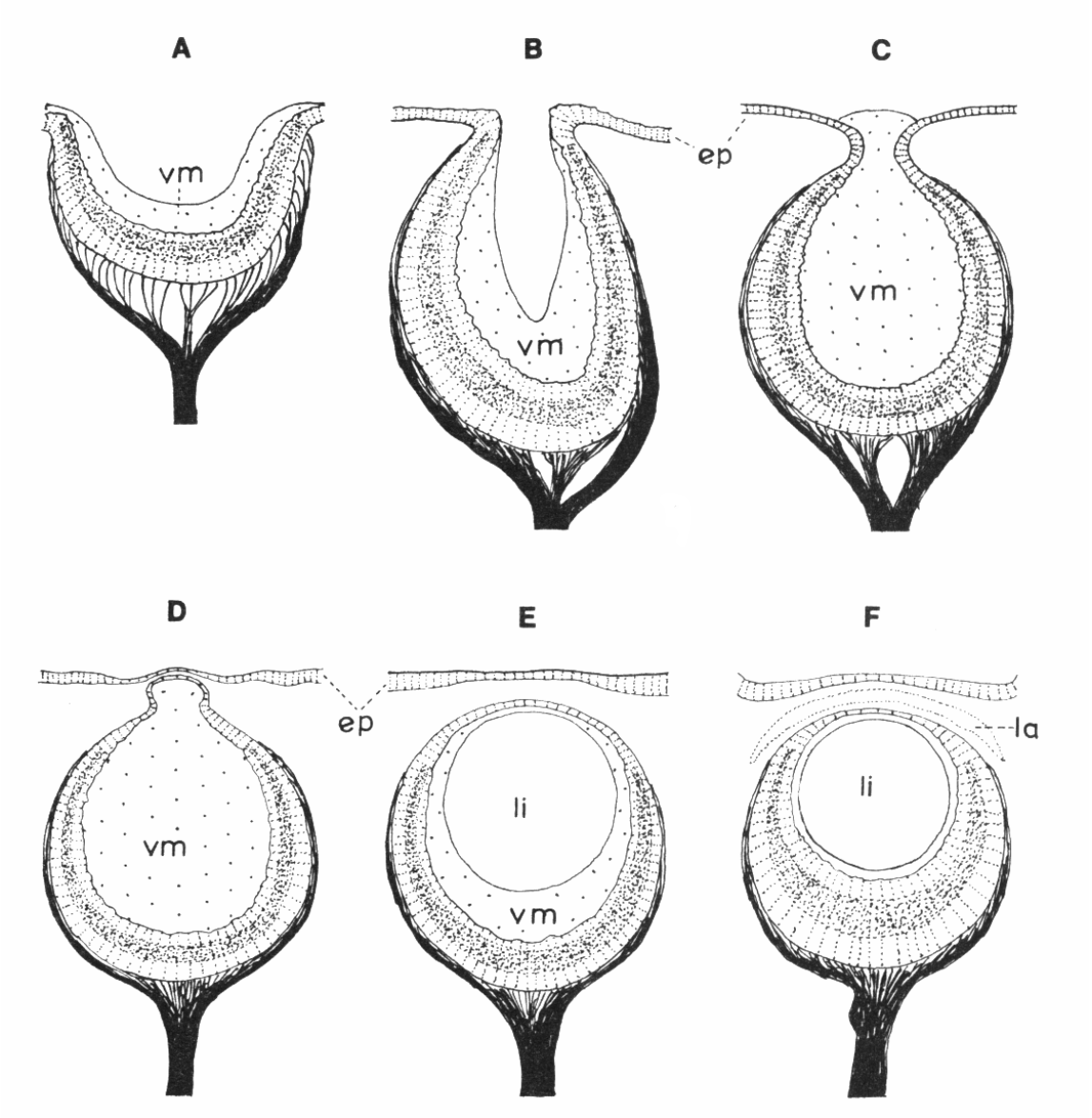


Later changes: Invasion of the large finch G. magnirostris

G. magnirostris out-competed G. fortis for large seeds; only small-beaked G. fortis survived survived



Evolution of complex characters: Eyes



from Futuyma, Evolutionary Biology

The modern synthesis

- Darwin didn't know how heredity worked; how is variation maintained?

The modern synthesis

- Darwin didn't know how heredity worked; how is variation maintained?
- Mendel showed that inheritance is particulate
- integration of natural selection with genetics led to the "modern synthesis"

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Are we optimally designed?

Problems may not be evidence of bad design:

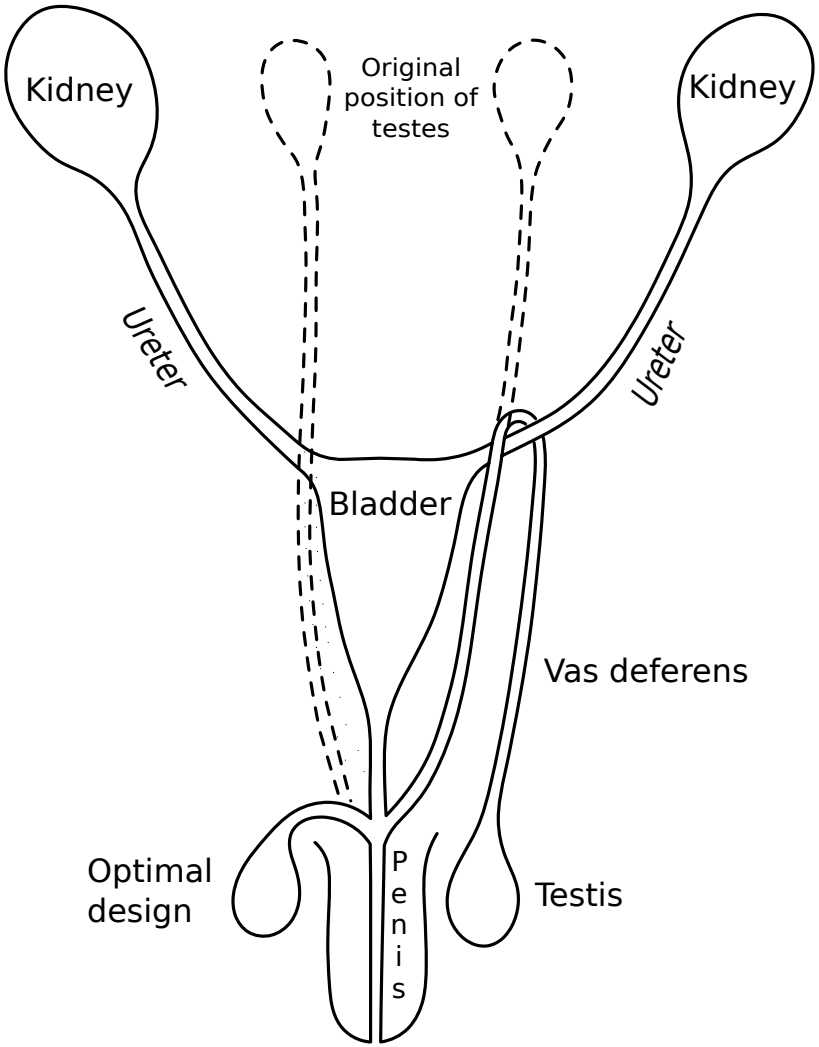
- pain, unethical behavior, etc. can be fitness-enhancing
- it may be adaptive, but not for you (manipulation)
- trade-offs between competing aims

Are we optimally designed? Historical constraints

Selection is a tinkerer, not an engineer

- Makes small adjustments, keeps those that help
- Does not see the big picture
- Does not plan for the future

Male urogenital system



- during evolution, testes moved from abdomen to scrotum
- went down wrong side of ureter.

Frequency dependent selection

No single best strategy: depends on what others are doing

- left-handedness? (fitness costs, why not eliminated?)
  - postulated fighting advantage against right-handed opponents
  - "interactive" sports: 20–30% left-handed
  - other sports: about average for the population (10%)
- Sociopathy?

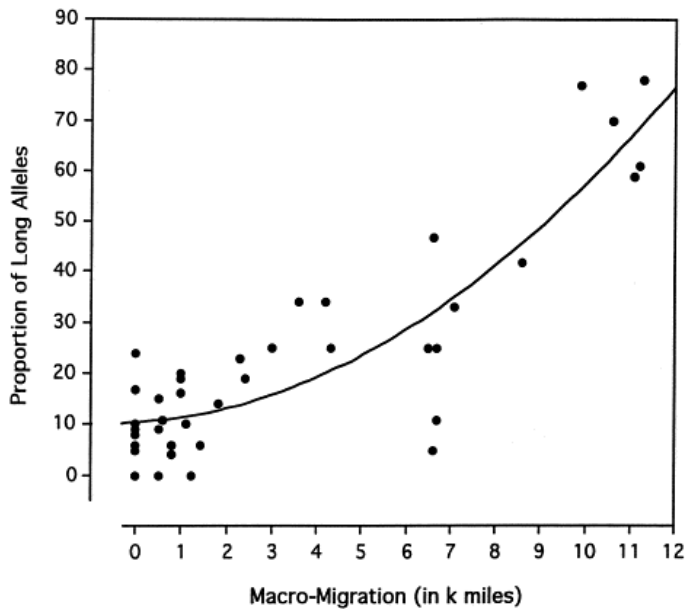
Traits adapted for another time or place

Evolutionary novelties

- diet
- social
- economic and political
- technological

DRD4: Adaptation or Maladaptation?

- impulsivity, novelty-seeking, difficulty concentrating, prone to addictive behaviors
- Associated with the "long alleles" of DRD4 (dopamine-receptor D4)
- more prevalent in populations that have travelled farther from their homeland



DRD4: Adaptation or Maladaptation?

Why has it not been selected out of the population?

- more common in migratory populations generally
- Ariaal nomaic pastoralists with the long form better fed
- Ariaal settled farmers with the long form more poorly fed

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Is there an analogous process of cultural evolution?

Remember the three requirements for natural selection:

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Dual inheritance theory

- how can natural selection can produce the process of cultural evolution?
- how do different *modes of cultural inheritance* affect rate and outcome of cultural evolution?

Are cultural traits fitness-enhancing?

Social learning is *biased* in favor of traits that

- are copied from successful people
- are practiced by many people rather than few ("peer pressure")
- make sense (content biases)

Conclusion

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- trade-offs
- historical constraints
- frequency-dependent selection
- adaptations that are out of date or for another environment

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Cultural traits can also evolve, but

- the process is different
- cultural transmission shaped by evolved learning biases