

# *Frozen Evolution*

---

---

...for newbies

Petr Baudis <pasky@ucw.cz>  
MFF, Prague, 2010

...based on “Zamrzlá evoluce”  
by Jaroslav Flégr

# *Table of Contents*

---

---

Basic Evolution Model

Evolutionary Factors & Sexual Evolution

Selfish Gene

Frozen Evolution

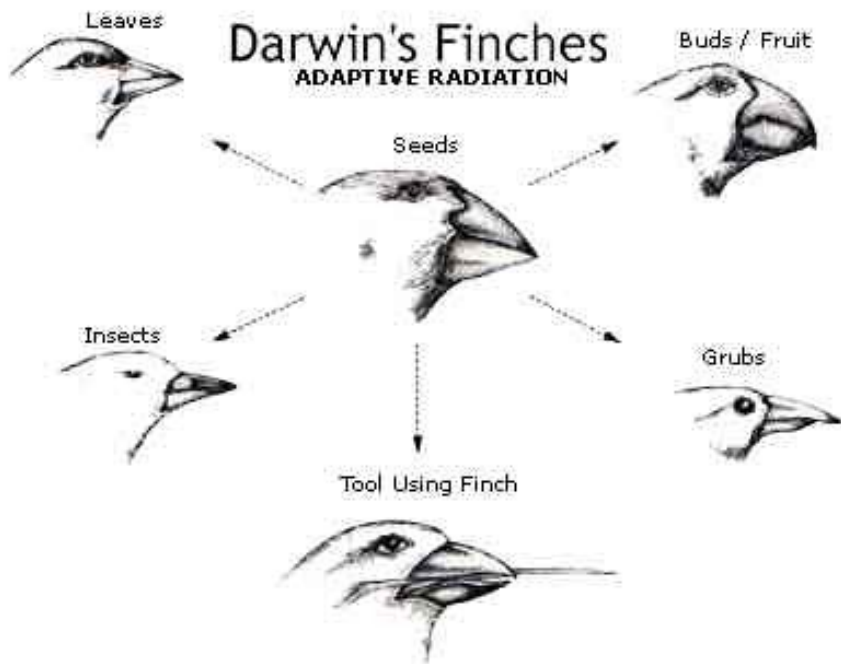
# *Evolution*

- Species develop from other species
- (Mostly?) tree-like structure
- But what is a “species”?
  - Macroevolution vs. microevolution
  - Inter-species breeding not sustainable



# *Evolution Factors*

- Why do we have useful traits?
  - **Natural selection:** Fitness
  - **Stability-based selection**

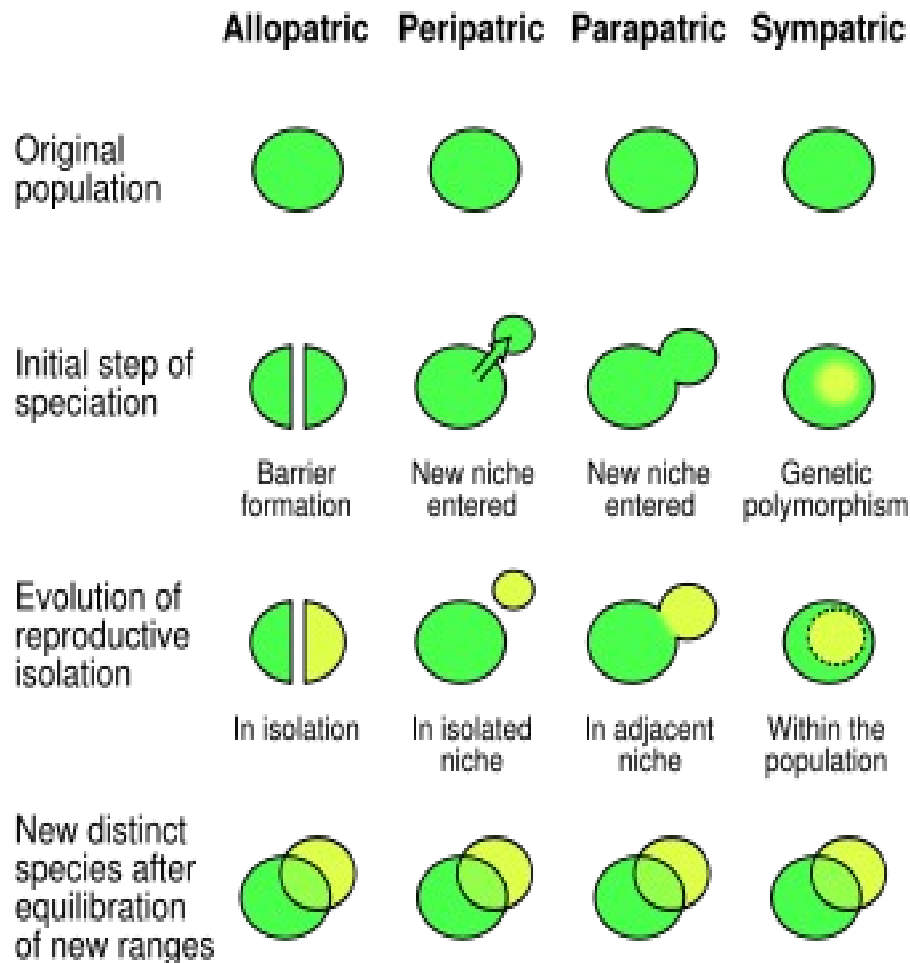


- **Autoelection** (colors)

- **Randomness**

- Genetic drift (+wall effect)
- Genetic draft (gene links)
- Passive evolution

# Speciation



- *Evolutionary barriers*
  - Isolated island, river, volcano
  - Etologic
- *Species barriers*
  - Pre-zygotic, post-zygotic



# *Sexuality*

- Asexual organisms:

- No recombination
- *Complete* genotype of the best individual eventually prevails



- Sexual organisms:

- Recombination
- Fitness not inherited, wasteful!
- **Genetic background** problem



# *Selfish Gene*

---

---

# *Selfish Gene?*

---

---

- Fitness of genes, not individuals
- Problem: Alleles just control proteins; effect depends on **genetic background!**
- Sexual reproduction allows more variability!
- Genetic background can vary wildly



# *Frozen Evolution*

---

---

- Can natural selection work w/ sexual reproduction?
- Yes! But natural selection can only pick genes if they have “predictable” effect...

# *Frozen Evolution*

---

---

- Can natural selection work w/ sexual reproduction?
- Yes! But natural selection can only pick genes if they have “predictable” effect...
- ...when the population is small – at the beginning of the speciation!

# *New Sexual Species*

- *First phase:* small population, drift
- *Second phase:* boost of population size, little actual selection
- *Third phase:* evolution of useful traits, natural selection (**plasticity**)
- *Fourth phase:* too much genetic variability, frozen species



# *Sexuality in Light of Plasticity*

---

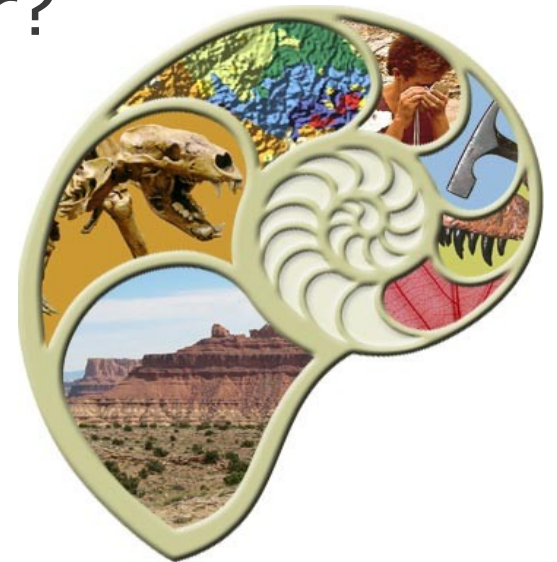
---

- Asexual reproduction: evolutionary *plasticity*, unable to recover from sudden change back
- Sexual reproduction: limited degree of plasticity + suboptimal spectrum of individuals  
X genetic variability => quick adaptation to large changes



# *Problems*

- Why do we have sexual evolution?
- Why are some animals so difficult to farm?
- Why do we have altruistic behavior?
- Why are “missing links” missing from paleontological evidence?
- What about evolutionary trends?





# *Conclusion*

---

---

- How to prove/disprove the hypothesis?
  - Problematic experimentation setup: we need genetically homogenous small populations
  - Limited paleontological and experimental evidence
- Evolutionary trends, dealing with invasions
- Domestication, eugenics

# *Thank You*

Q&A <http://pasky.or.cz/~pasky>  
<http://web.natur.cuni.cz/flegr/ctvrtky.php>

