Extinction

Frog declines and extinctions due to emerging infectious disease

Speciation

Lizard adaptation and speciation due to recent environmental change
Extinction

Frog declines and extinctions due to emerging infectious disease
Disease and amphibian declines

Frog photo: Joel Sartore
Disease and amphibian declines
Disease and amphibian declines

Rapid spread of Bd to every continent with amphibians, infecting >500 species

Map courtesy of www.spatialepidemiology.net
Genomics of amphibian declines

Comparative genomics

Functional genomics

Gene expression:
Genomics of amphibian declines

Ecological genomics
Genomics of amphibian declines

Ecological genomics

- Extant
- Extinct

Vredenburg et al 2007
Data: V. Vredenburg, Knapp, Briggs et al., MVZ, CAS, CDFG, USFS, USGS surveys, C. Davidson
Chytrid functional genomics

Lab studies to identify pathogenicity genes

Rosenblum et al. 2008 PNAS
Rosenblum et al. 2010. *PLoS Pathogens*
Frog functional genomics

Uninfected frogs vs Infected frogs

Whole-genome expression

Rosenblum et al. *in revision*. Science
Speciation

Lizard adaptation and speciation due to recent environmental change
Ecological speciation in novel environments
Ecological speciation in novel environments

The dune sedimentation is only 2,000-7,000 years old making White Sands a great place to study rapid adaptation
Ecological speciation in novel environments

Rosenblum. 2005. *Copeia*
Ecological speciation in novel environments

Lesser Earless Lizard  Eastern Fence Lizard  Little Striped Whiptail

White Sands  Desert Scrub

Rosenblum. 2006. *American Naturalist*
Multidimensional selection

WS and dark soil morphs differ in:
- color (e.g., dorsal darkness)
- morphology (e.g., limb length)
- performance (e.g., sprint speed)
- resource use (e.g., microhabitat)
- behavior (e.g., predator wariness)
- hormones (e.g., testosterone levels)

Rosenblum & Harmon, 2010. *Evolution*
Robertson et al. in press. *BJLS*
Genetic mechanisms of adaptation

Whiptail lizard
threonine $\rightarrow$ isoleucine

Earless lizard
valine $\rightarrow$ isoleucine

Fence lizard
histidine $\rightarrow$ tyrosine

Rosenblum et al 2004 Evolution
Rosenblum et al. 2010. *PNAS*
Genetic mechanisms of adaptation

Functional assays confirm *Mc1r’s* role for 2 species

Rosenblum et al 2004 Evolution
Rosenblum et al. 2010. *PNAS*
Allelic dominance relationship differ

**Fence Lizard**

- blanched allele is dominant

**Whiptail Lizard**

- blanched allele is recessive

\[ p < 0.000005 \]

Rosenblum et al. 2010. *PNAS*
Consequences of *Mc1r* mutations

- point mutation
  - functional mechanisms
  - allelic dominance
  - population genetics
    - spatial distribution of alleles
    - visibility to selection
    - direction of migration
  - speciation?
Can White Sands lizards discriminate?

White Sands

home

away

Drawing by Simone DesRoches
Can White Sands lizards discriminate?
Male mate choice experiments

White sands males preferentially court “home” females

Time Spent Courting

Brightness

Robertson & Rosenblum. 2010. *J. Evolutionary Biology.*