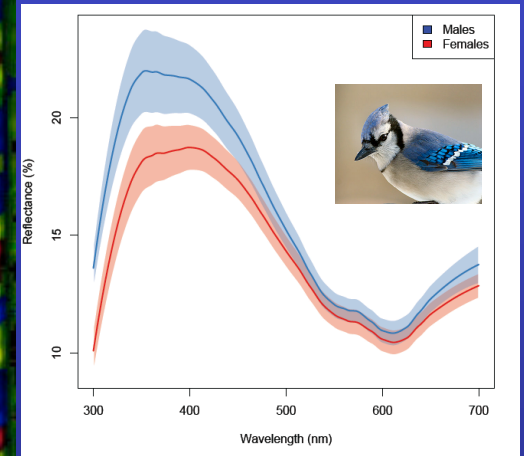


# *The Attraction of Modern Biological Science*



Scott V. Edwards

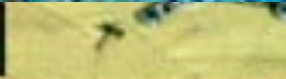
Department of Organismic and Evolutionary Biology

Harvard University

Cambridge, MA USA

<http://www.oeb.harvard.edu/faculty/edwards>







# A Career in Biological Science

## Self-fulfillment

Are you happy in your job?  
Do you make a decent salary?  
What about life outside your job?  
Kids, family, house, car?

## Research

Curiosity?  
Studying the evolution of life  
Saving endangered habitats  
Your scientific community  
Will you travel the world?

## Society

How are you giving back?  
How can your research help society?  
Teaching the next generation  
Are you a mentor for anyone?



# Curiosity





# Wave Hill Environmental Center



Riverdale, Bronx, NYC

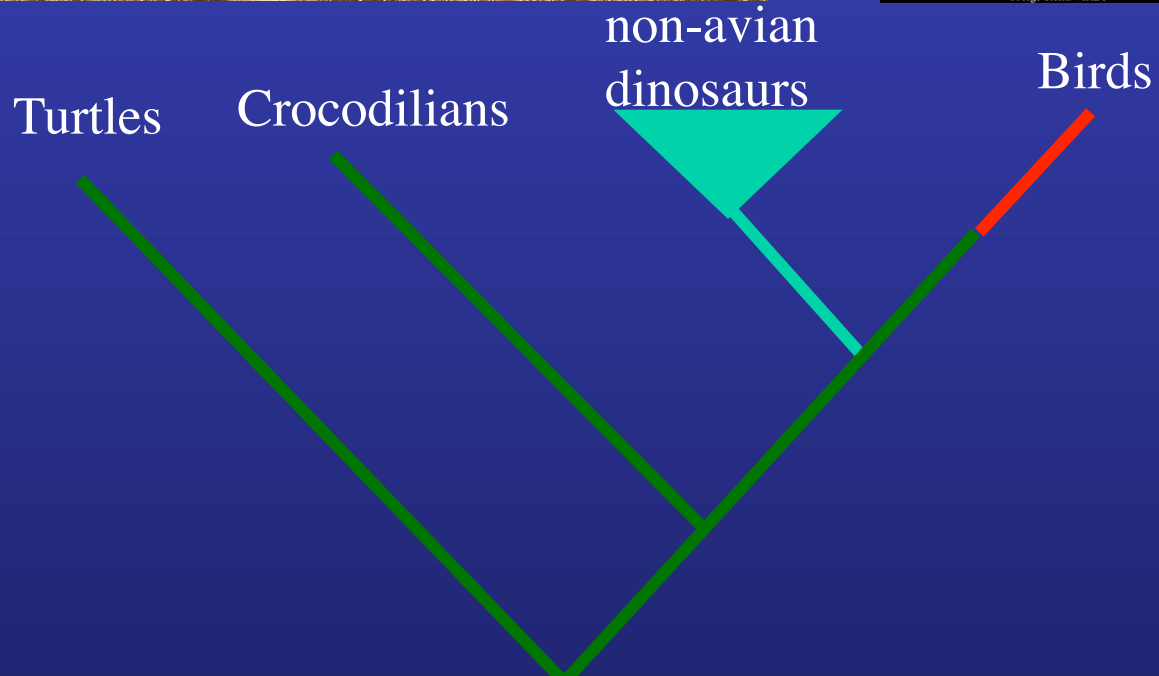
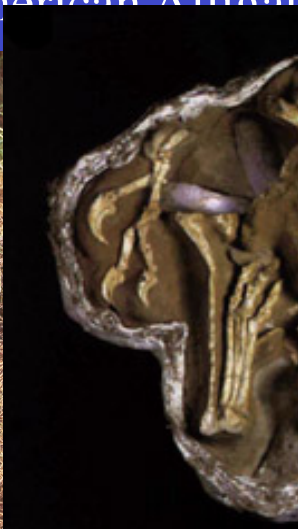






# Evolutionary Biology

Snapping turtle   American Alligator   *Oviraptor*   Ostrich   Mallee Fowl   Neotropical ovenbird

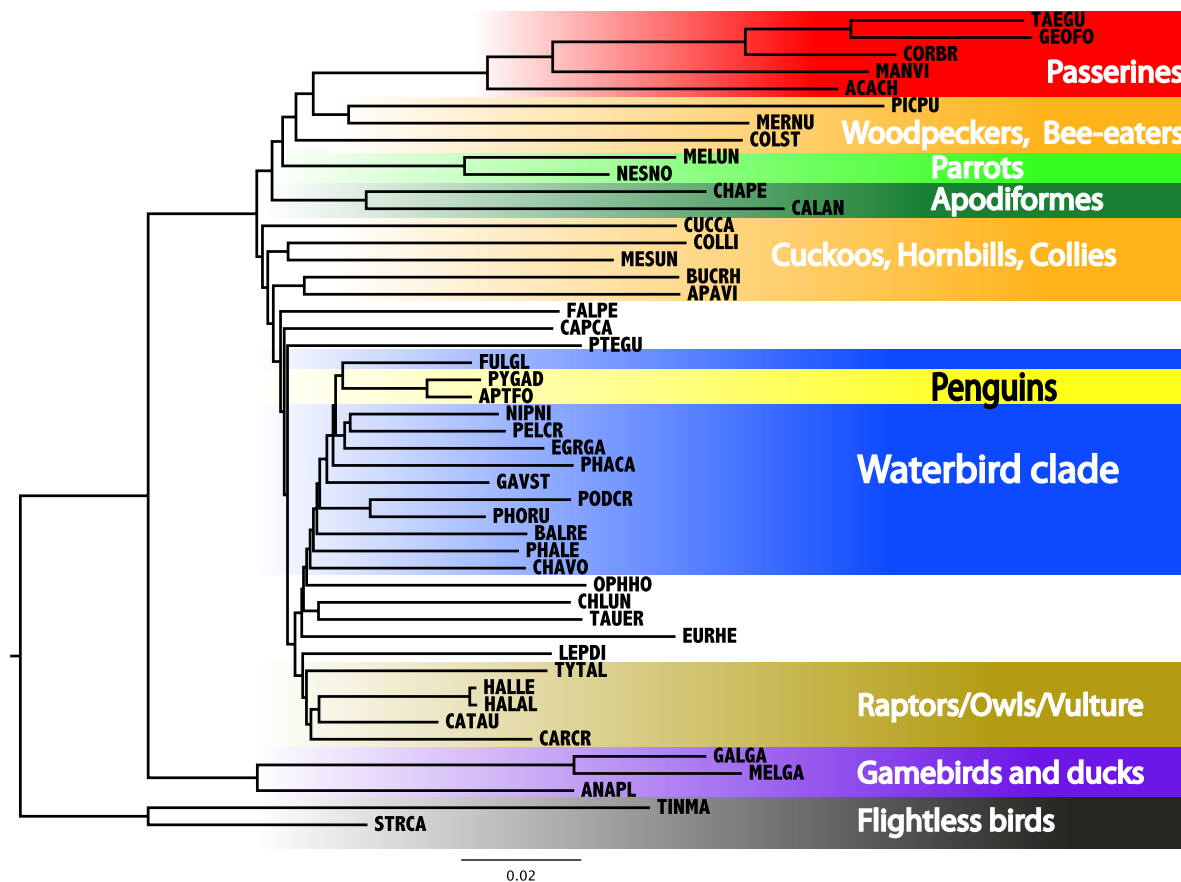


THE FAMILIES OF NON-PASSERINE BIRDS

THE FAMILIES OF PASSERINE BIRDS

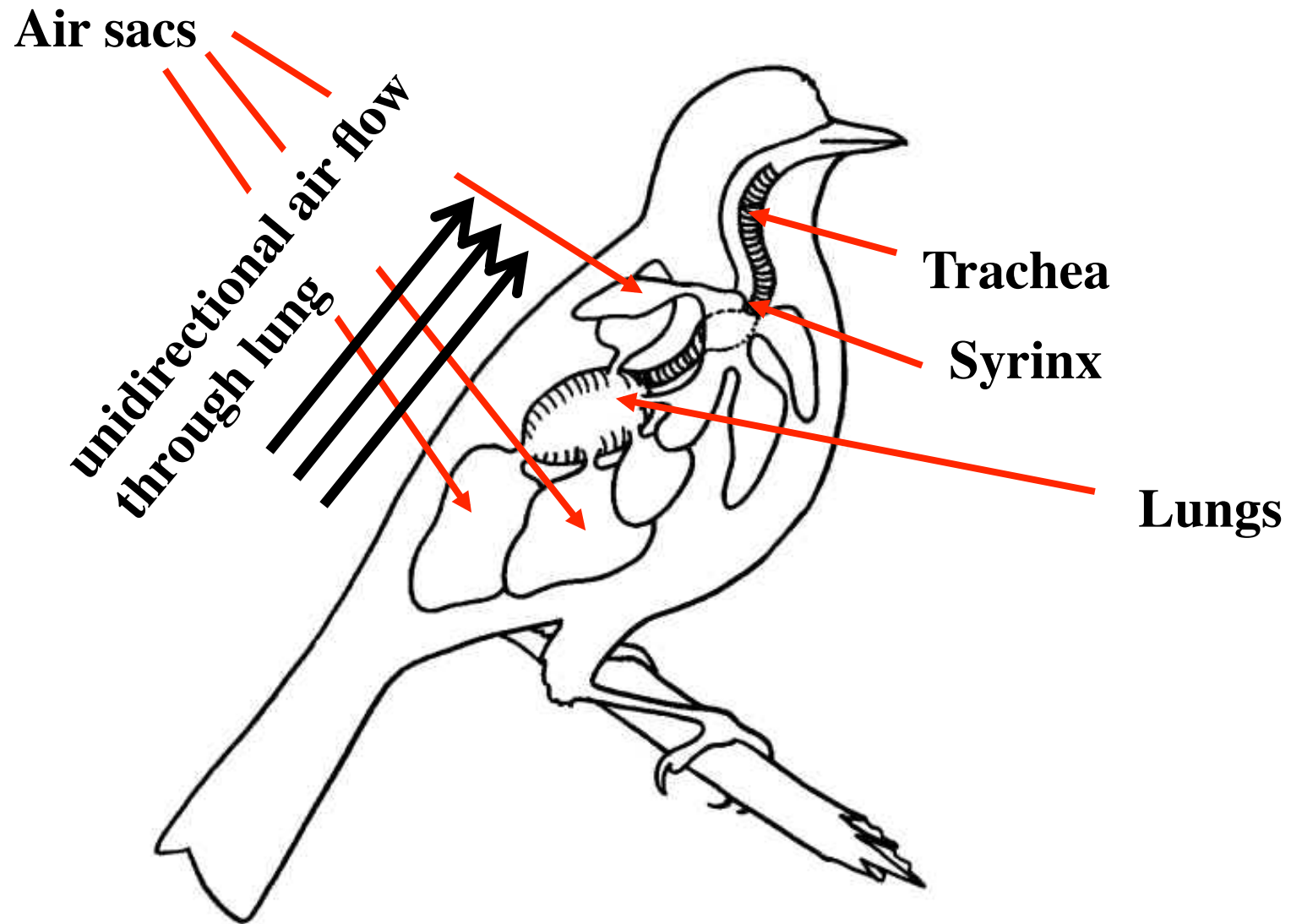


# Phylogenomic analysis of ~8000 genes across the avian Tree of Life



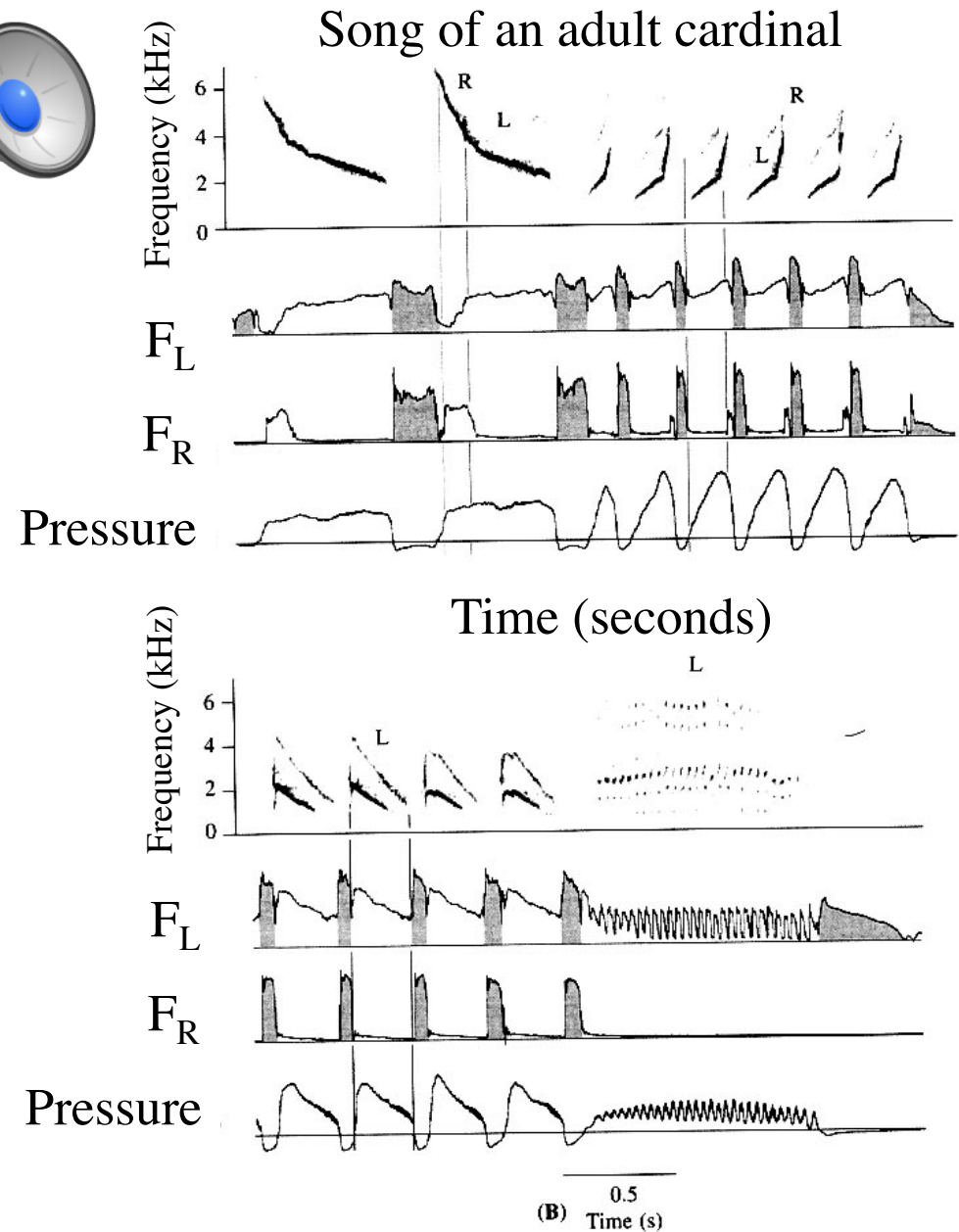
Topology and support values made by MP-EST method (ML species tree method of Liu et al. 2010 BMC Evol. Biol) on 8295 RaxML gene trees. Branch lengths fitted by ML estimation using concatenation of longest 100 loci (~850 kb).

# The avian respiratory system



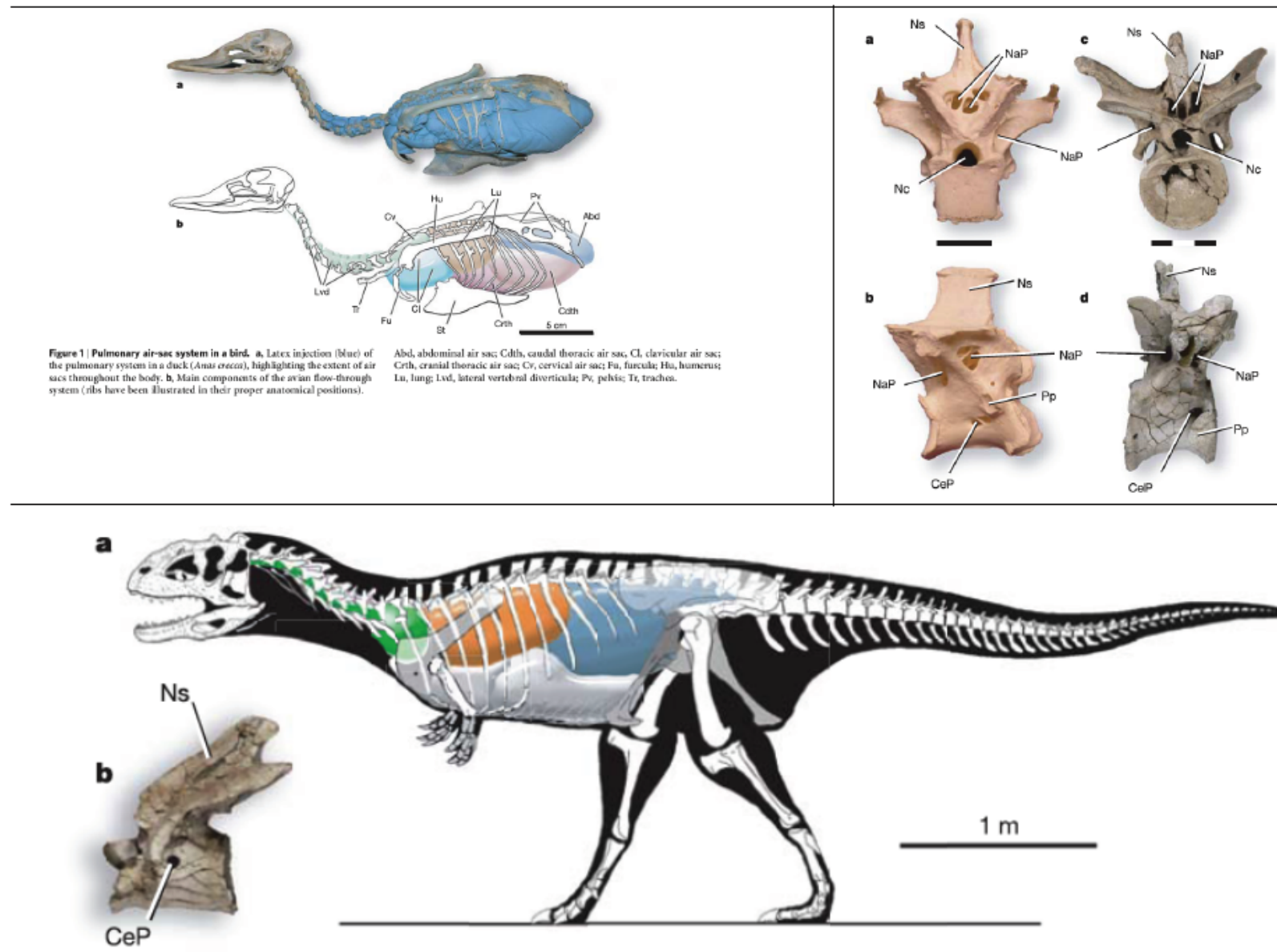


# Dual syringeal action in singing cardinal



$F_L$ ,  $F_R$ : Air flow through left and right sides of syrinx

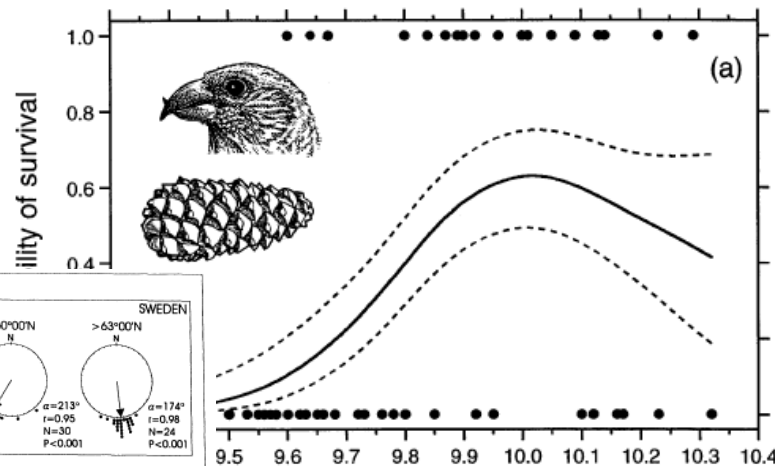
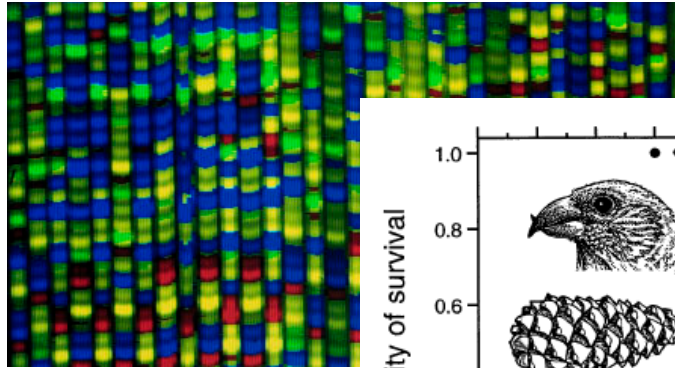
# Bird-like pulmonary design in theropod dinosaurs



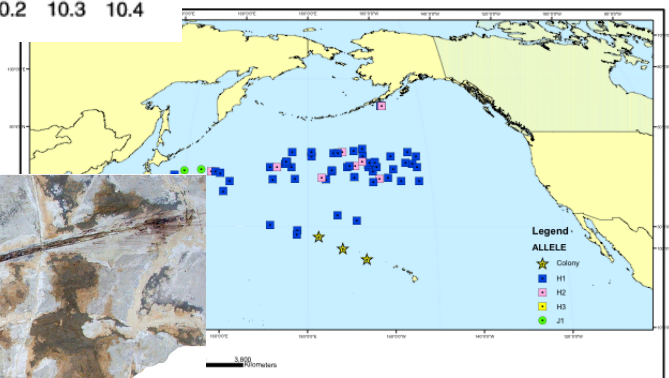
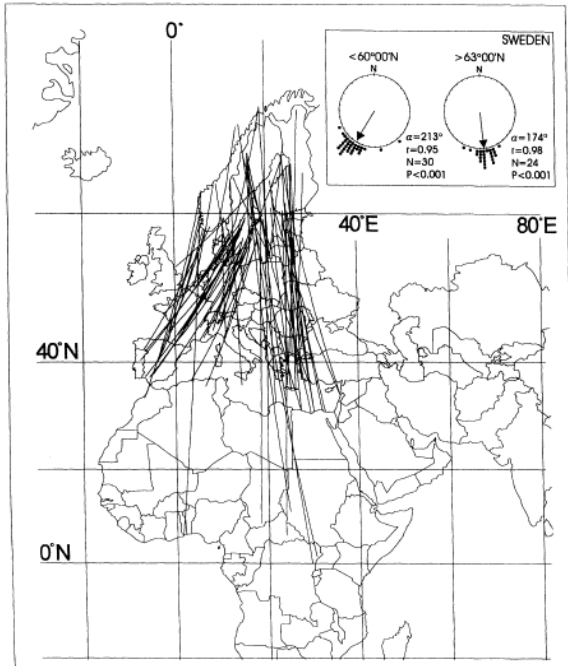
O'Connor and Claessens 2005



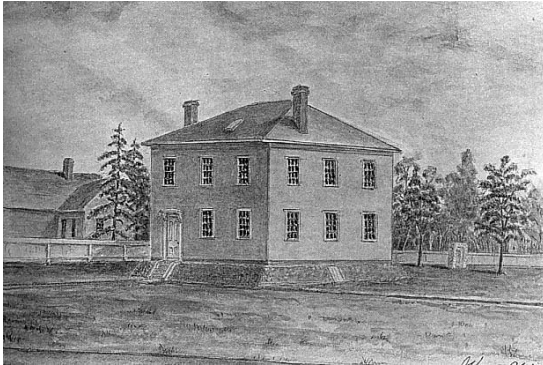
# Many research tools available to ornithologists



- DNA sequencing
- Satellite telemetry
- Stable isotopes
- Geographic information systems



# Museum of Comparative Zoology: a research and teaching museum



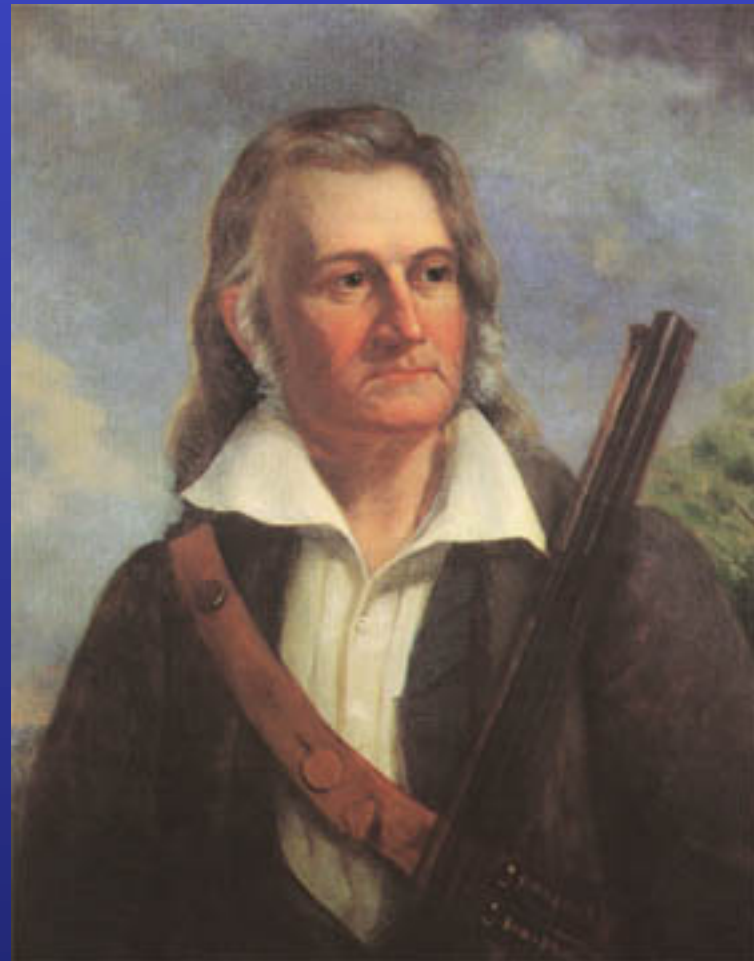


# Ornithological collections and the beginnings of American ornithology

Alexander Wilson  
1766-1813

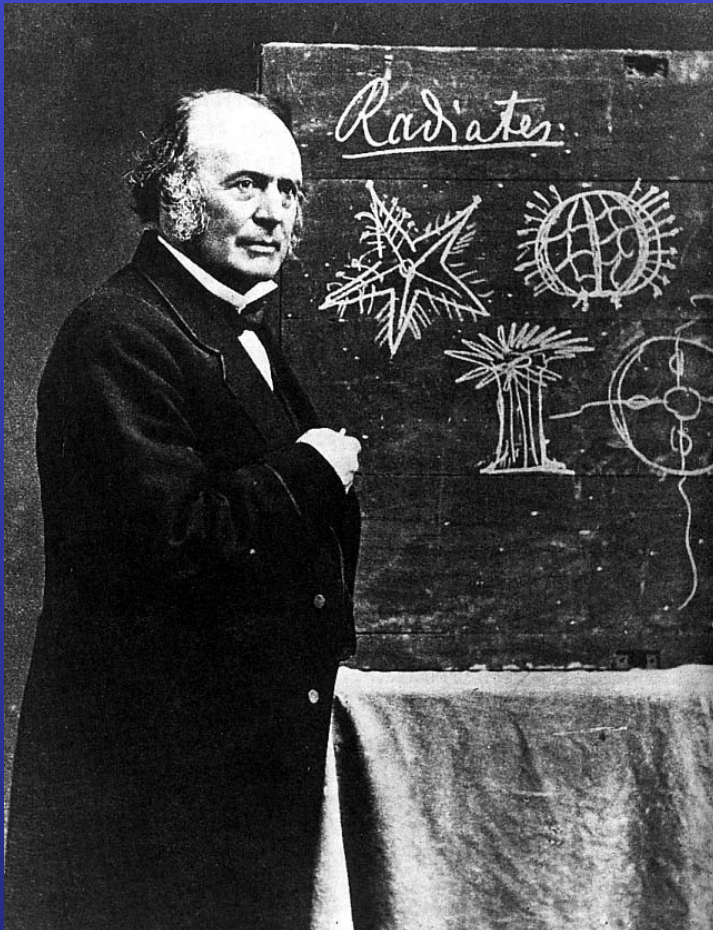


John James Audubon  
1785-1851



# The fledgling MCZ: 1859 - 1885

First MCZ director



Louis Agassiz

First Curator of Ornithology

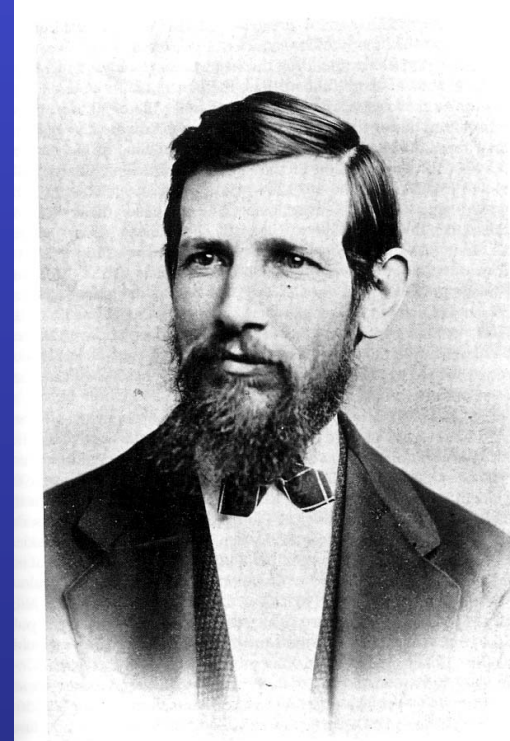


Fig. 1. J. A. Allen, Curator of the MCZ Bird Department, ca. mid-1860s to 1885. This portrait was made around 1876. Allen trained under Louis Agassiz during the mid-nineteenth century, when the MCZ was as an important center for advanced education in science. One of the institution's most accomplished curators, he greatly expanded the size of the MCZ bird collection, helped to found the American Ornithologists' Union, and made numerous contributions to biogeographical and evolutionary theory. Photograph courtesy of Museum of Comparative Zoology, Harvard University.

J. A. Allen



# The MCZ Bird Department today

- 5th largest bird collection in the world (360,000 specimens)
- global representation
- computerized and searchable data base
- fieldwork in North America, Costa Rica, Australia, Alaska, Russia, Mongolia
- Teaching and research in ornithology, conservation, and evolutionary biology



# Natural history collections: Libraries of Life





# Diversity of eggs and nests





# Paleognath (flightless) bird eggs

Elephantbird



Emu



Great Tinamou



Chilean Tinamou



# Murre egg: cliffhanger



# Hosts for parasitic cowbird eggs

Red-eyed vireo



Song Sparrow



Yellow Warbler





# Museums: a place to study extinct and endangered species



Courtesy Leon Claessens, Aves 3D <http://aves3d.org/>

# New space for MCZ ornithology collection



Traditional specimens



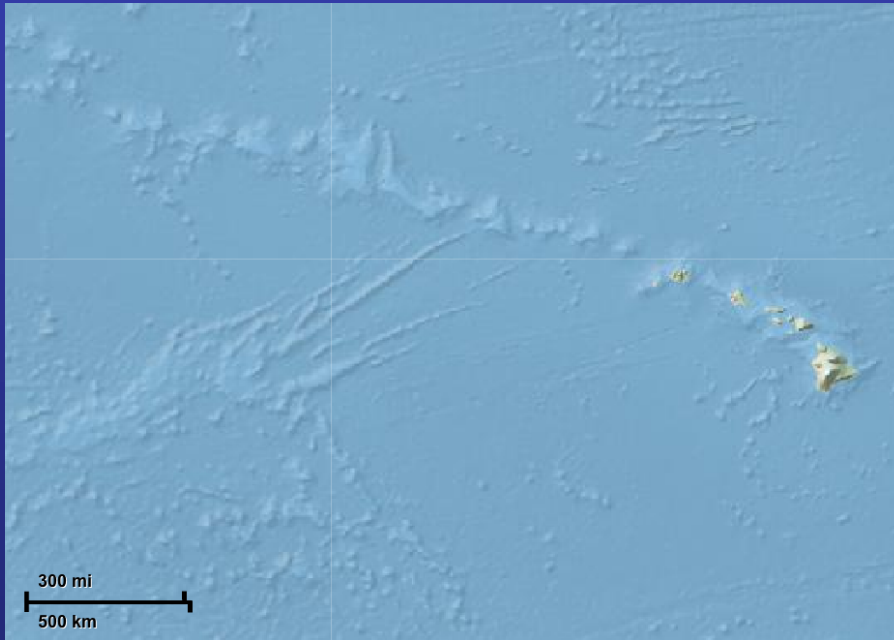
Frozen tissues





Hawaiian Honeycreepers (Drepanididae)

# Leeward Hawaiian Islands





# Hawaiian seabirds





# Hawaiian albatrosses – a northern outpost



Laysan albatross

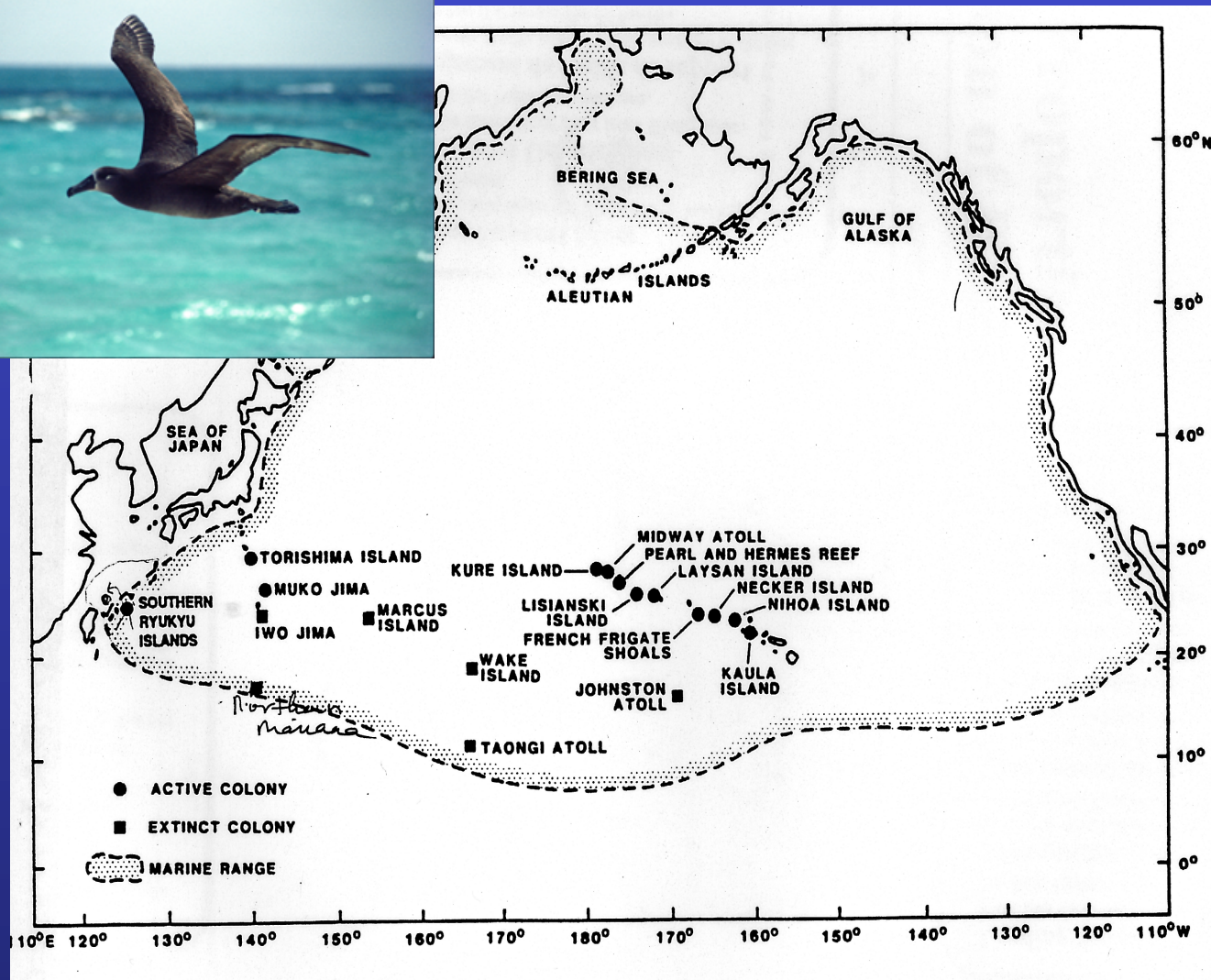


Black-footed albatross

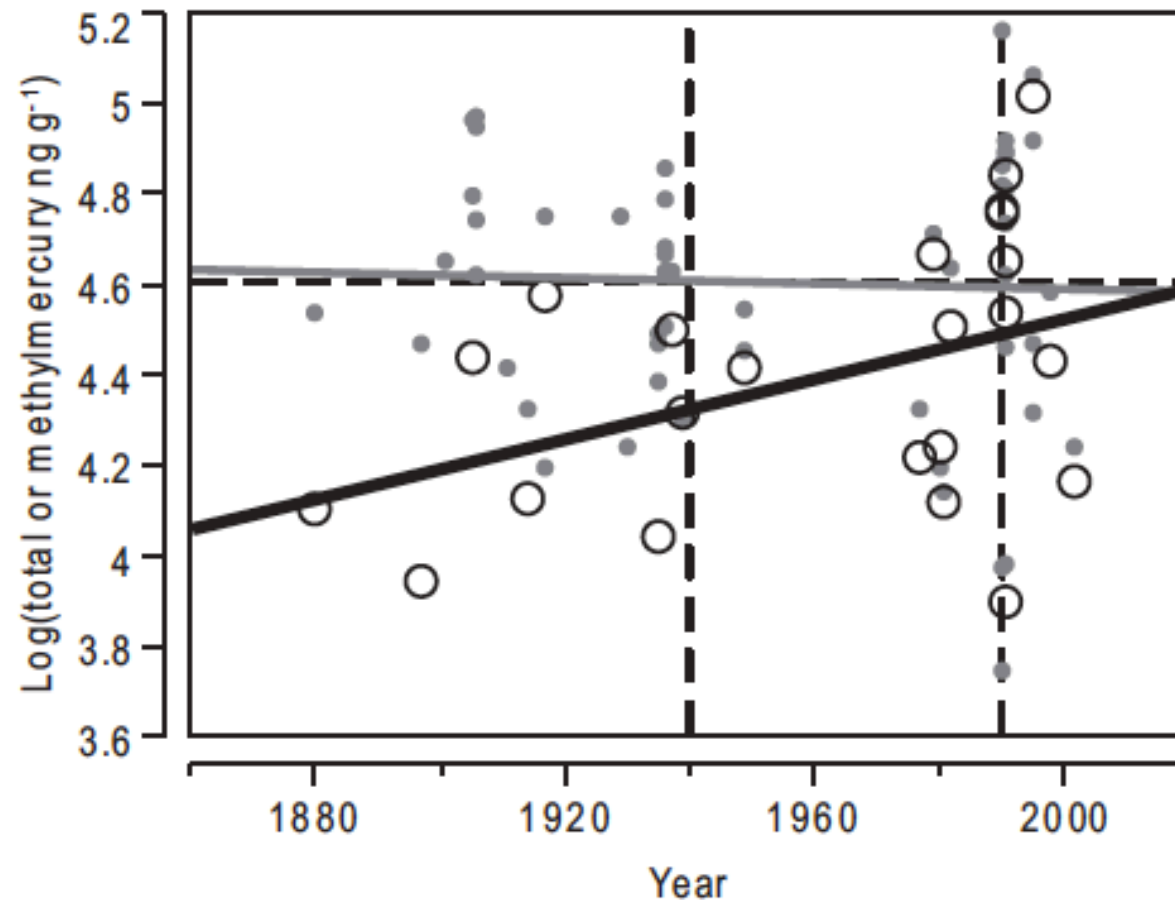




# Active and extinct colonies of Black-footed Albatrosses



# Old museum specimens reveal increases in organic mercury

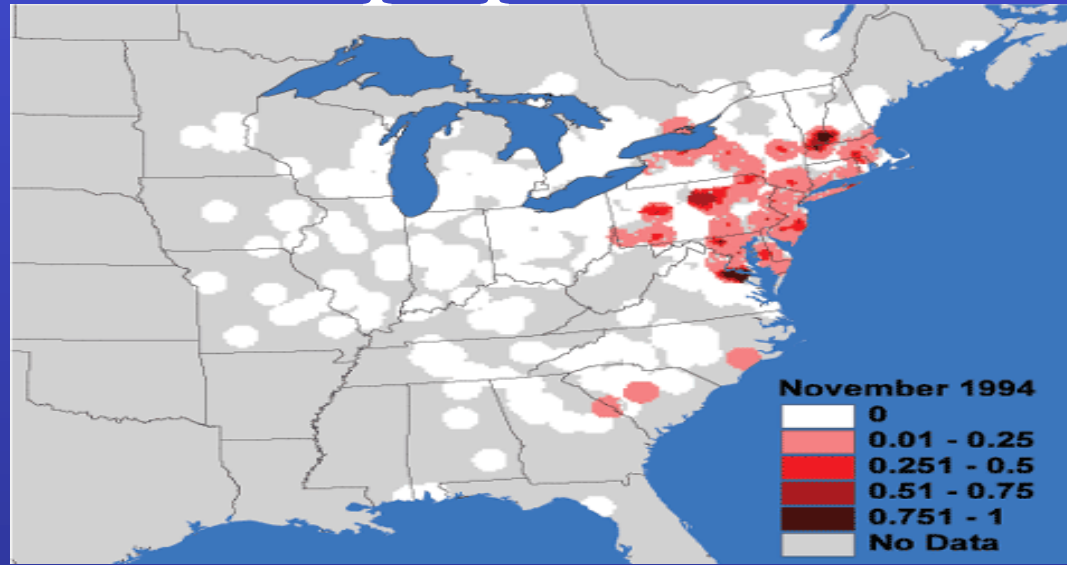


Organic mercury

Total mercury  
(organic + inorganic)



# Rapid spread of *Mycoplasma* in House Finch populations



Courtesy Cornell Lab of Ornithology

- *Mycoplasma* is transmitted horizontally, often at bird feeders
- Expanded throughout the eastern US in just five years
- Has now crossed the Rockies and is spreading south through California and the southwest.



Postdoctoral fellow Niclas Backström studying House Finch specimens

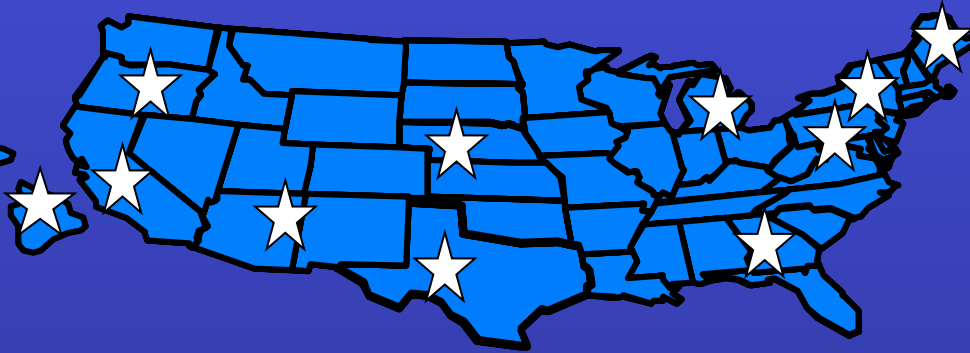




# House Finches and the rapid spread of *Mycoplasma gallisepticum*

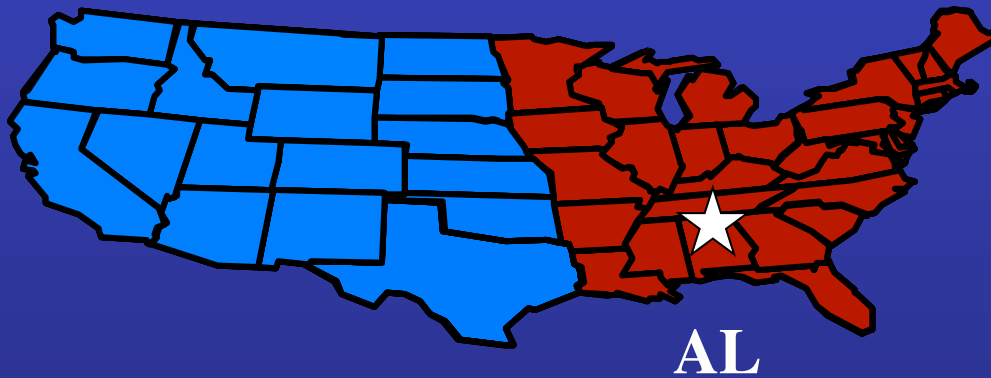


1980s



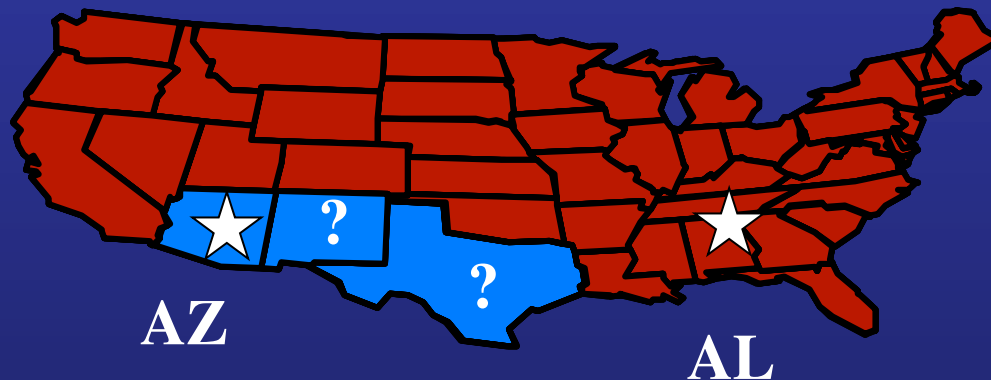
*Mycoplasma*  
unexposed areas

2001

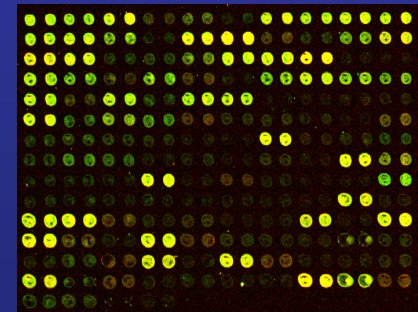


*Mycoplasma*  
exposed areas

2007



Gene expression  
in exposed and unexposed  
populations



Wang et al. 2003 *Evolution*; Wang et al. 2006 *Mol. Ecol.*; Bonneaud et al. 2011 *PNAS*

# Breaking news...?

## Edwards studies birds with genetic databases, not binoculars

(Continued from previous page)

Upon his return to Cambridge, Edwards joined the laboratory of Rodney Honeycutt, then an associate professor at Harvard and curator of MCZ's mammal collection. He earned an A.B. in biology in 1986, followed by a Ph.D. from the University of California, Berkeley, in 1992. He joined the University of Washington faculty in 1995, following an Alfred P. Sloan Postdoctoral Fellowship at the University of Florida. In recent years he has also served as a visiting researcher at the Australian National University in Canberra and the Institute for Animal Health in the United Kingdom. Recognizing the role played by Honeycutt and other dedicated colleagues in charting his path, Edwards is proud to be a premier graduate of the Harvard School of Public Health, and a testament to the past three years of his Harvard education.

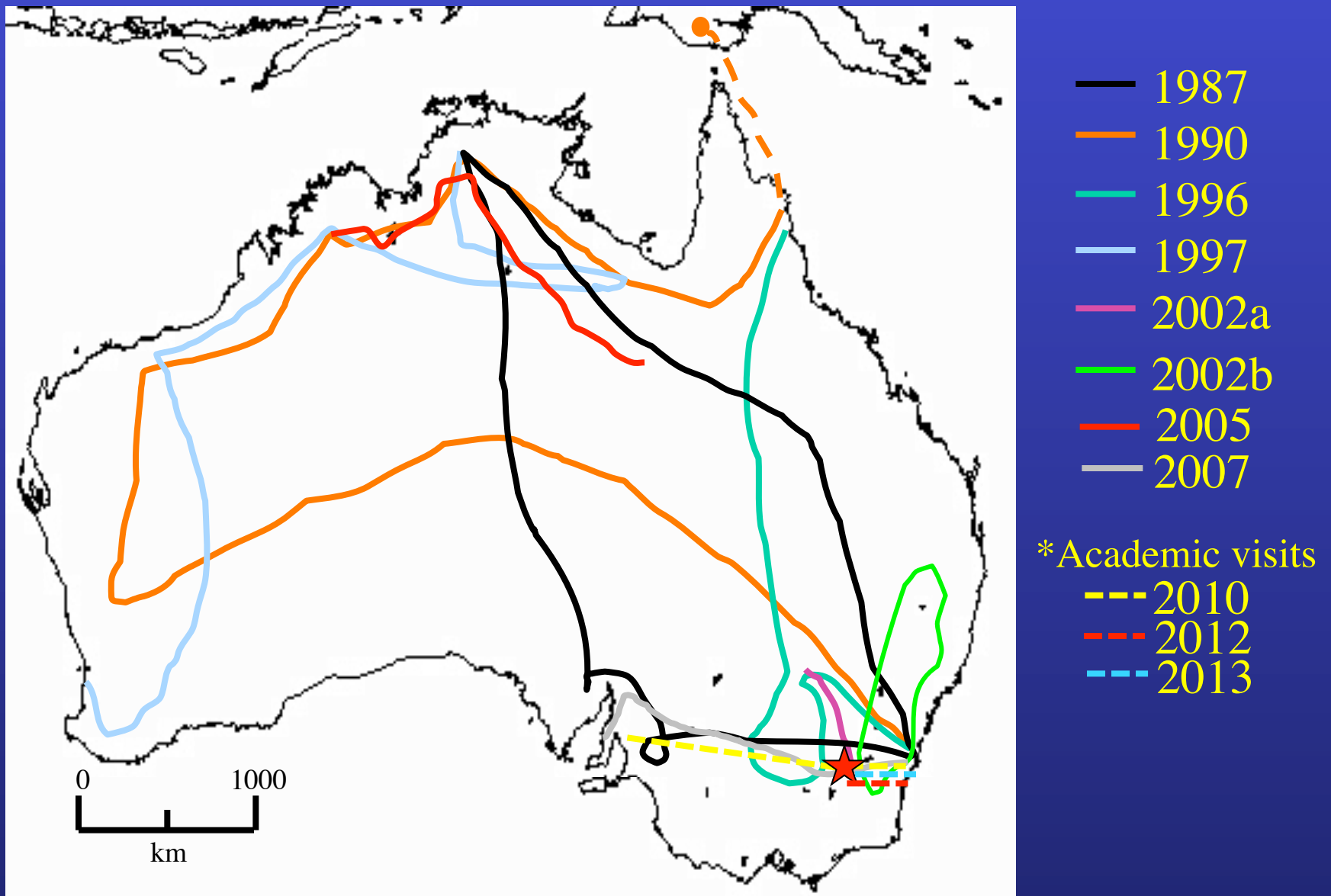


change in concert with one another. This setting presents unusually fertile ground for big-picture questions: Can scientists detect common evolutionary histories among species now distributed across similar locales and landscapes? When species inhabit the same habitat, does that imply more similar evolutionary history than if they inhabited different habitats? At what point in time did slightly different species with similar geographic ranges diverge, and why? Closer to home, Edwards is studying the plight of the house finch, a species common in Massachusetts that was devastated a decade ago by a bacterial infection originating in chickens. However, the damage was not random, and Edwards is investigating the factors of and biogeographic patterns of selectivity: "It could be a matter of the house finch's distributional history."

### Harvard Gazette, 2004



# Australia expeditions\*, 1987 - 2013

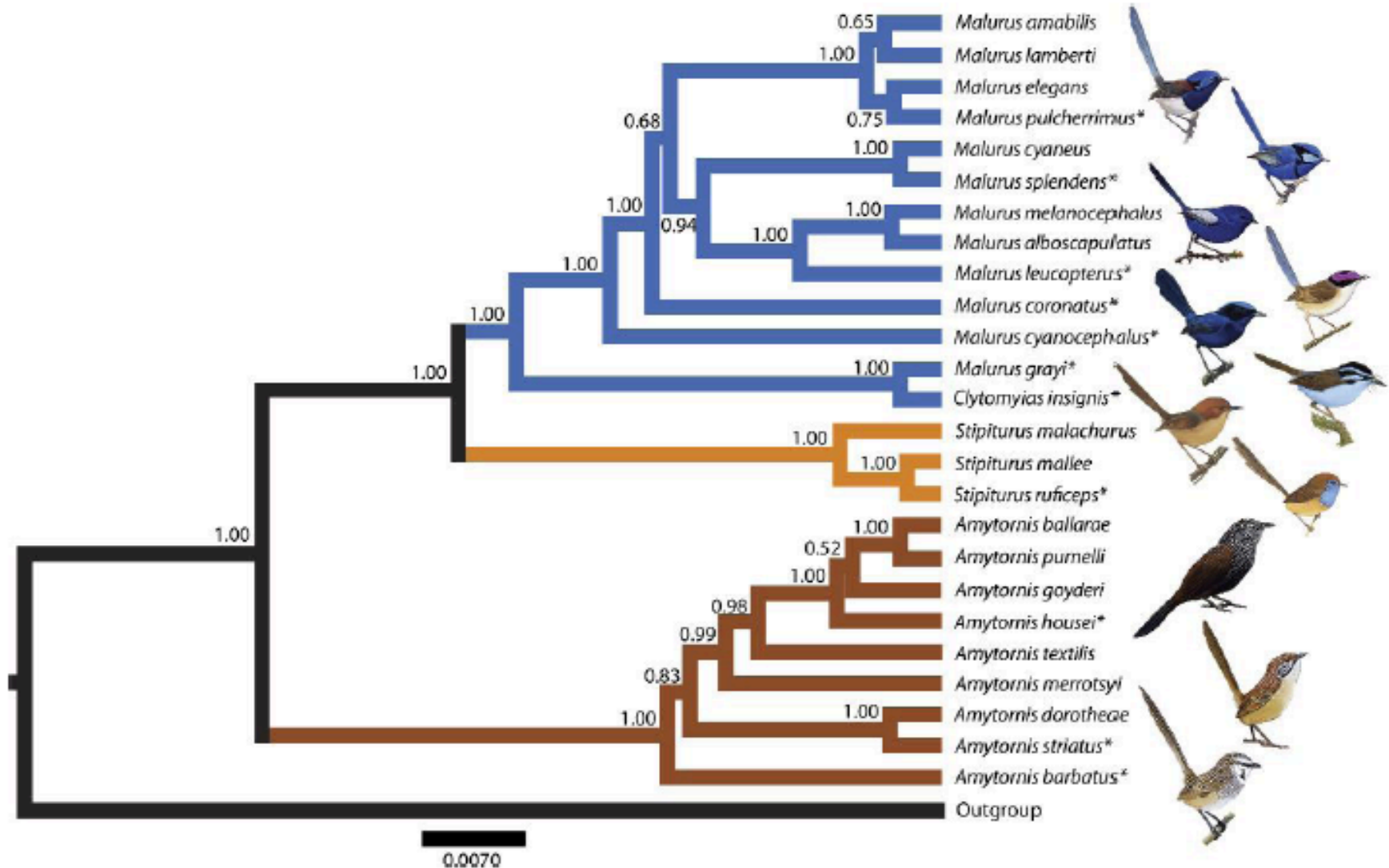


# Australian Corvida radiation





# Understanding the genealogical tree for Fairy Wrens (Maluridae)



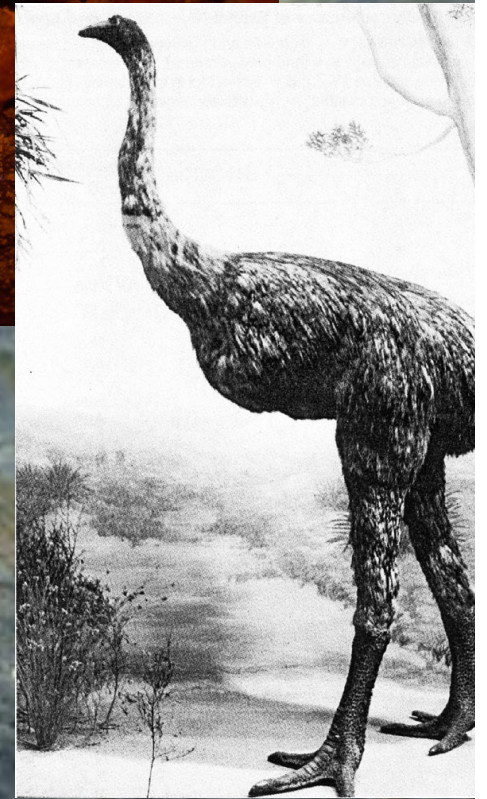
Lee, Joseph, & Edwards 2012. *Syst. Biol.* 61:253-271.

# The flightless birds – a Gondwanan radiation





# The Moas of New Zealand





*My lab community:* Flavia Termignoni, Maude Baldwin, Cassie Stoddard, Christie Riehl, Kate Eldridge, Alison Pirie, Mark Liu, Bob Stymeist, Amanda Lu, Mary O'Connell, Shane Campbell-Staton, Allison Shultz... and me!



September 2012



Eastern Mongolia Expedition Team 2012



OEB grad student  
Allison Shultz &  
Lesser Kestrel

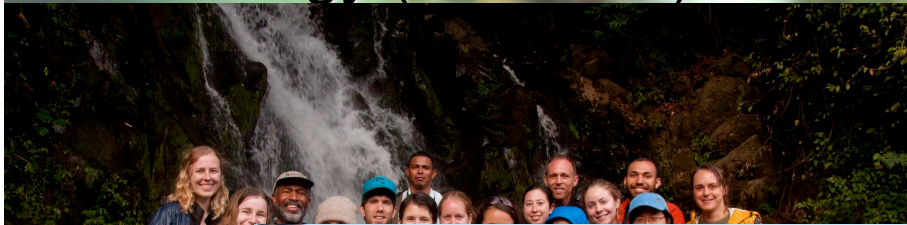


Demoiselle Cranes (*Anthropoides virgo*)





# Ornithology (OEB 190) 2012 Spring break trip to Panama



Panama Canal

Three-wattled Bellbird

Rufous motmot

Photo: Liz Schold '12

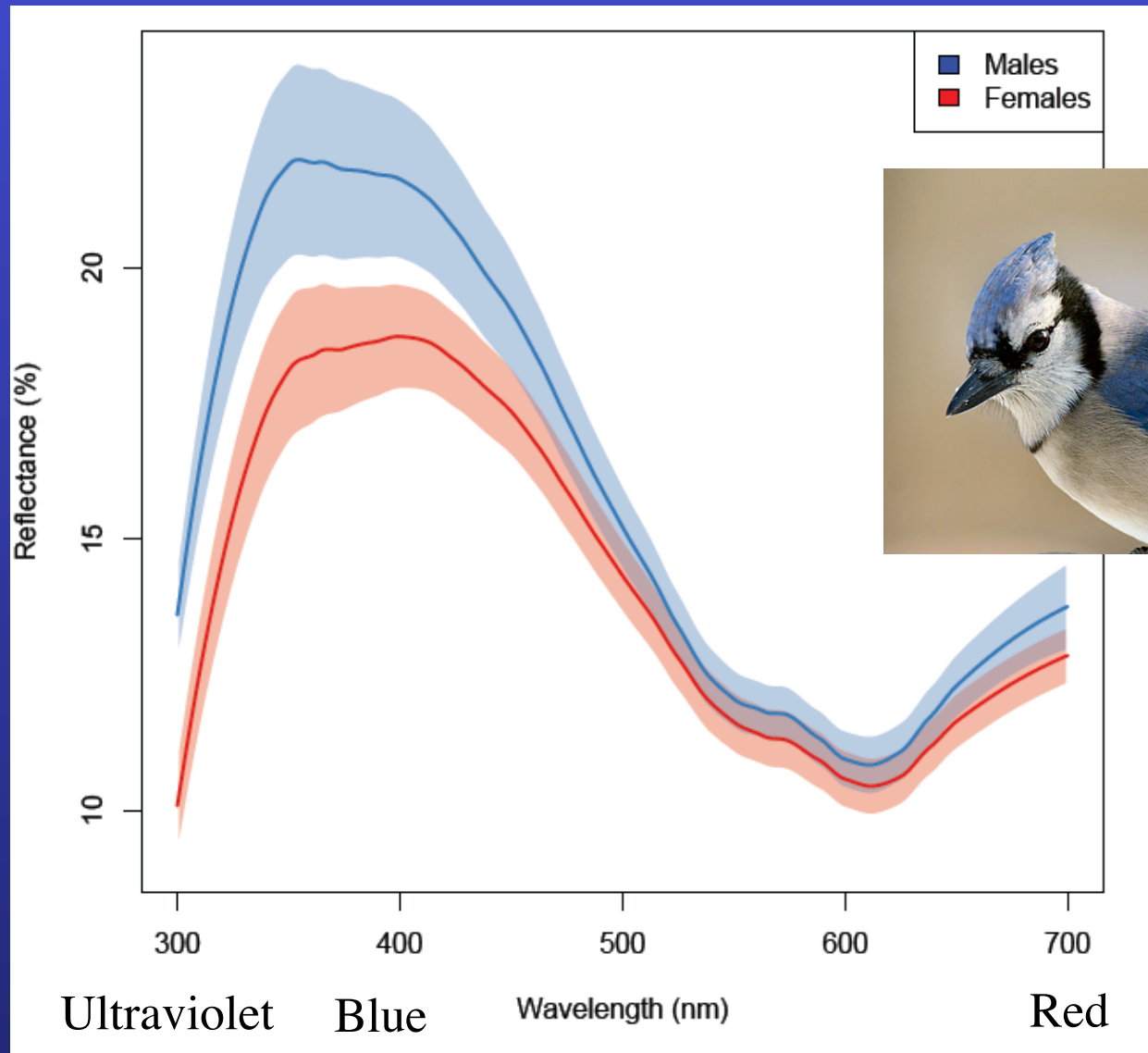


# Classroom: Measuring avian coloration using spectrophotometry



Spring 2013: AIM-UP! Project <http://www.aim-up.org/>

# Cryptic dimorphism in blue jays discovered through spectrophotometry



<http://www.allaboutbirds.org/>



Giving back:  
The National Science Foundation



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## SCIENCEMAKERS

Home | ScienceMakers | **SCOTT EDWARDS**

PROFESSION

Biologist

FAVORITES

Color: Orange and Brownish Colors  
Food: Pasta  
Season: Spring and Early Summer  
Vacation Destination: American West

BIRTHPLACE

Honolulu, Hawaii



BIOGRAPHY | INTERVIEW DATE: 10/12/2012

Professor of biology and curator Scott V. Edwards was born on July 7, 1963 in Honolulu, Hawaii, but he grew up in Riverdale in the Bronx, New York City. From an early age, Edwards was interested in natural history. Before graduating from Harvard University in 1986 with his B.A. degree in biology, he worked at the environmental institute Wave Hill. While earning his undergraduate degree, Edwards took a year off to volunteer at the Smithsonian National Museum of Natural History where he was first exposed to the world of museum research on birds. Upon graduation, Edwards was accepted into the University of California, Berkeley where he worked with bird evolution and graduated with his Ph.D. degree in zoology in 1992. His dissertation focused on songbirds from Australia and New Guinea

<http://www.thehistorymakers.com/sciencemakers>



# My brother, Mark Edwards, and Barack Obama (2008)



# Become a scientist!

Fascinating research

Global impact

A diverse  
community

# Thank you!

