

# Evolution in nature: Species

*Task: Pick your favorite species (not domesticated) and make a list of adaptations.*

Remember, adaptations are the features themselves (but you can also describe WHY they are adaptations / what environment the species is adapted to).

*If you get stuck, think about what is unique about that species—it's probably an adaptation!*

# Evolution in nature: Species

Remember that **adaptations** are environment-specific.

Penguins are exceptional swimmers and incredible cold-tolerators (they have morphological & behavioral adaptations to the cold).



## Evolution in nature

- ✿ Now you have a good understanding of evolution in nature (in the absence of humans), and we are ready to discuss how humans influence these processes.
  
- ✿ More questions?



## Evolution under human influence

*Activity: Go on a hunting trip on the table in front of you and select the elk you will kill to bring back for food, mounting on your wall, or other purpose.*



# Evolution under human influence

We started with a population of 19 females, 11 males, and 10 calves. Which elk remain?

females

males      Which males?

calves



# Evolution under human influence

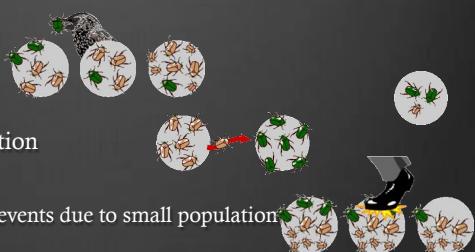
Assuming elk are genetically like their parents, what will future characteristics of elk be?



# Evolution under human influence

⌘ 5 evolutionary processes humans can influence:

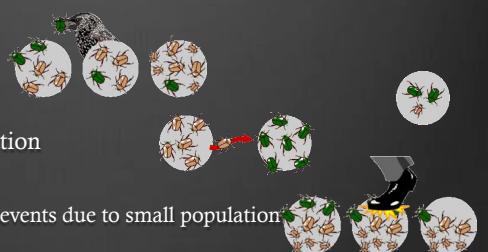
- ⌘ 1) natural selection
- ⌘ 2) mutation
- ⌘ 3) gene flow / immigration
- ⌘ 4) non-random mating
- ⌘ 5) genetic drift (chance events due to small population size)



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## Human influence on natural selection

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## Human influence on natural selection



- ⊕ Humans change what it means to be “fit”
  - ⊕ i.e., we change which phenotypes have the most surviving offspring
- ⊕ What are some other examples of species in nature for which we have changed the most-fit phenotype?



## Human influence on natural selection

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## Human influence on natural selection

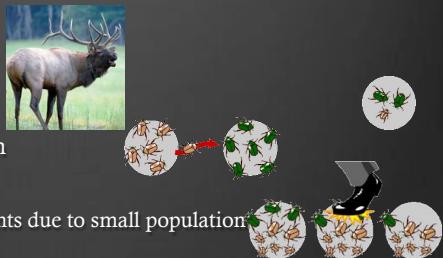
- ⊕ Humans change what it means to be “fit”
  - ⊕ We change which phenotypes have the most surviving offspring

Body size evolution in fish & game (rattle size in snakes)  
Antibiotic resistance  
Introduced competitors & predators  
Introduced diseases  
Rescuing off-course penguin  
Behavioral changes (e.g., birds & other animals we feed become less shy)

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# Human influence on mutation

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## Human influence on mutation

- ⊕ We don't influence the *rate* of mutations; this appears to be constant
- ⊕ We do influence whether or not a mutation survives (and whether the individual with that mutation has offspring)



*Task: Make a list of all the ways dog breeds—one species—differ.*



## Evolution in nature: Variation



## Human influence on mutation



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## Human influence on mutation



- ⊗ We don't influence the *rate* of mutations; this appears to be constant
- ⊗ We do influence whether or not a mutation survives (and whether the individual with that mutation has offspring)
- ⊗ In other words, we eliminate a great deal of natural selection.

## Human influence on mutation



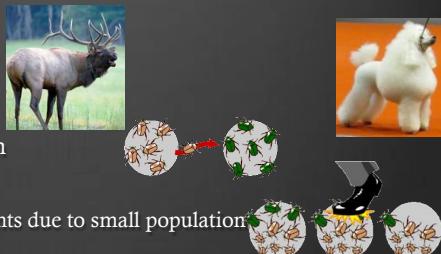
Will all of these dogs survive in the wild?



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## Human influence on gene flow

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## Human influence on gene flow



If you were a transportation designer tasked with building 3 new roads to improve transportation of goods and people across the U.S., where would you put them?

## Human influence on gene flow



What habitat did we build through?

## Human influence on gene flow



## Human influence on gene flow



## Human influence on gene flow



*Edge Effect: animals dislike being near the edge of a habitat*



Why?

- noise prevents animals from hearing mating calls
- increased predation / fewer hiding spots
- no nest sites
- fewer foraging options



## Human influence on gene flow



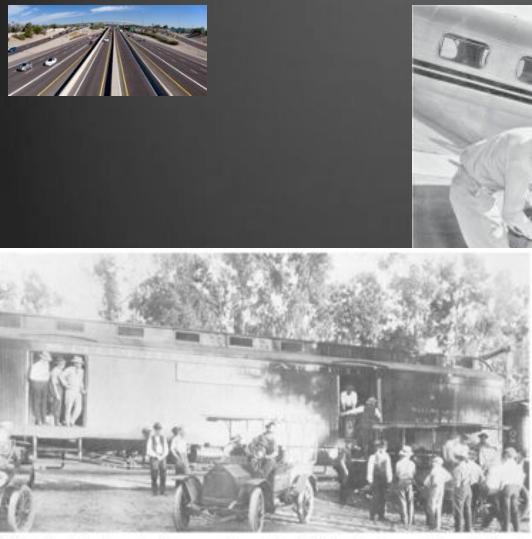
Human activities have the general effect of isolating populations and reducing gene flow



...but there are some ways in which we increase gene flow. Any ideas?



## Human influence on gene flow



<http://khon2.com/2014/07/12/hundreds-of-fish-dropped-from-plane-in-utah/>

## Human influence on genetic drift

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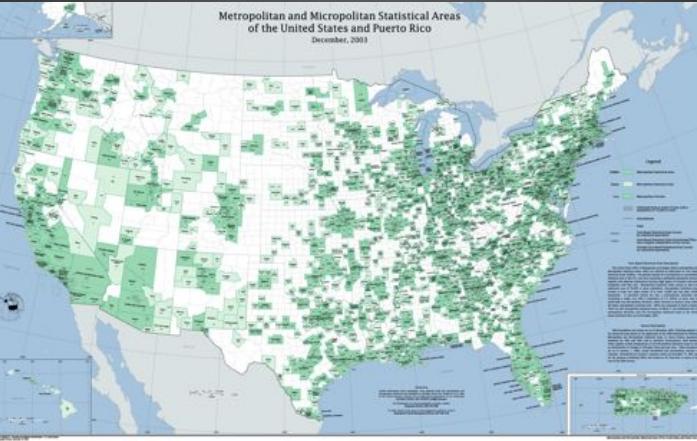
## Human influence on genetic drift



- ⊕ Genetic drift = the loss or fixation of an allele due to chance; happens in small populations

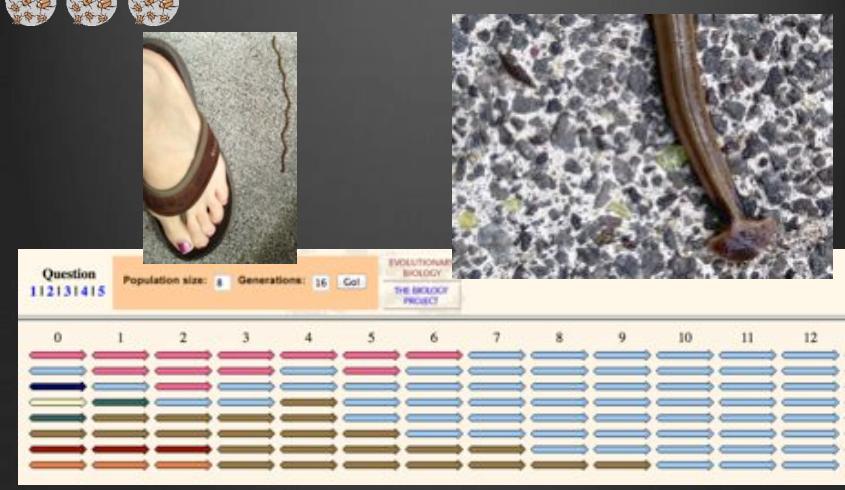


## Human influence on genetic drift



Decreasing population size = increases probability of loss or fixation of an allele = weakens natural selection

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**Overall effect = erode adaptation to environment**

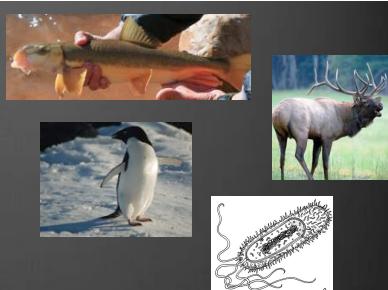
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*What questions do you have?*

- ⊗ 5 evolutionary processes:
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**Task:** Think of at least one NEW example of a wild (not domesticated) species whose evolutionary path has been influenced by humans.

For that species, Write down at least one way we have changed each of the 4 highlighted processes above.

## Evolution under human influence

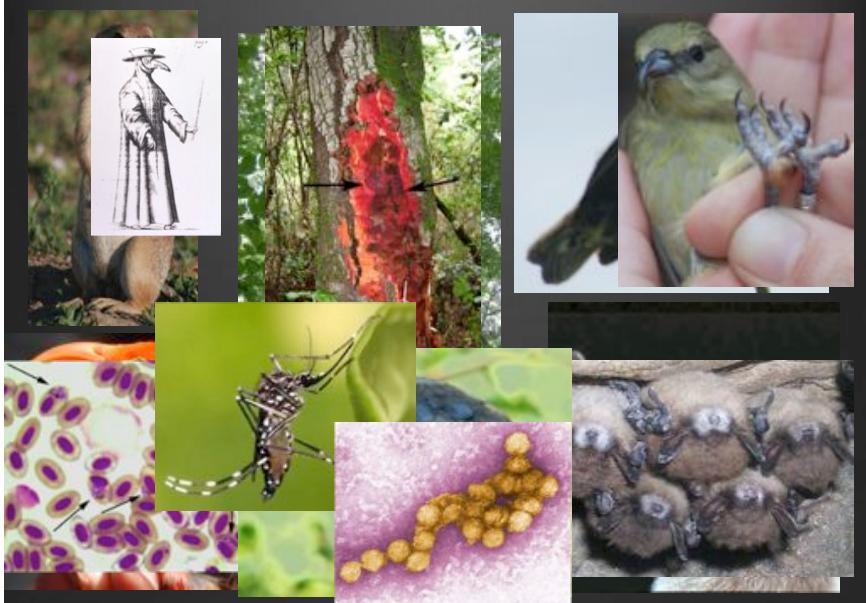
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Let's focus in on one aspect of influence on selection.

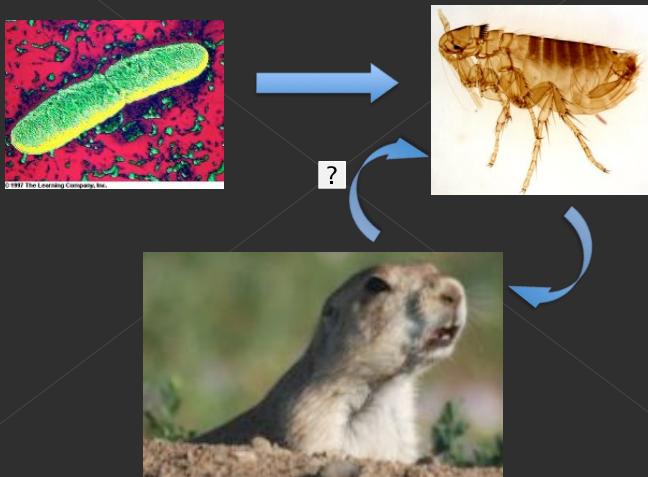
How do introduced diseases influence the evolution of hosts?



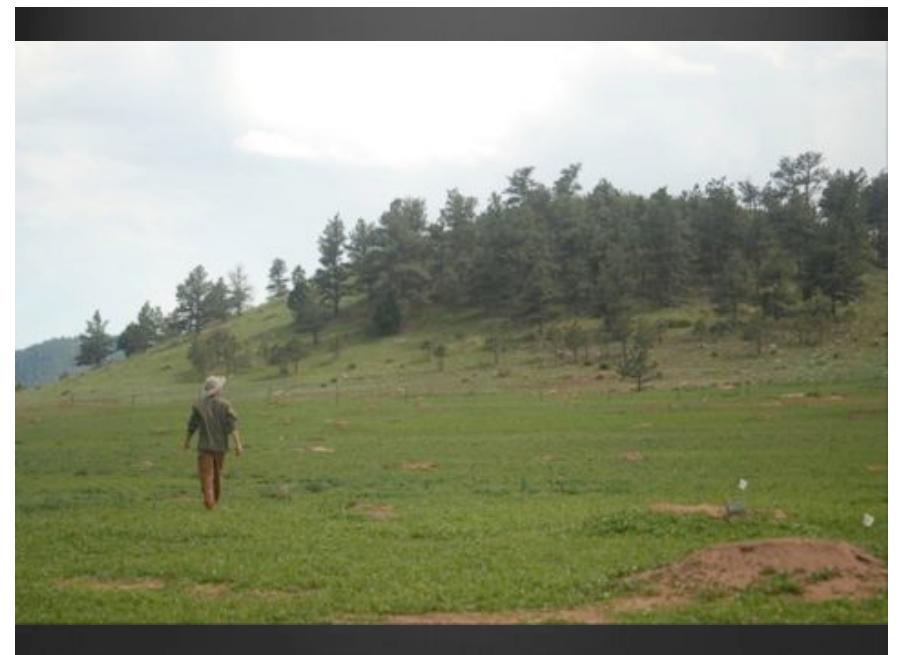
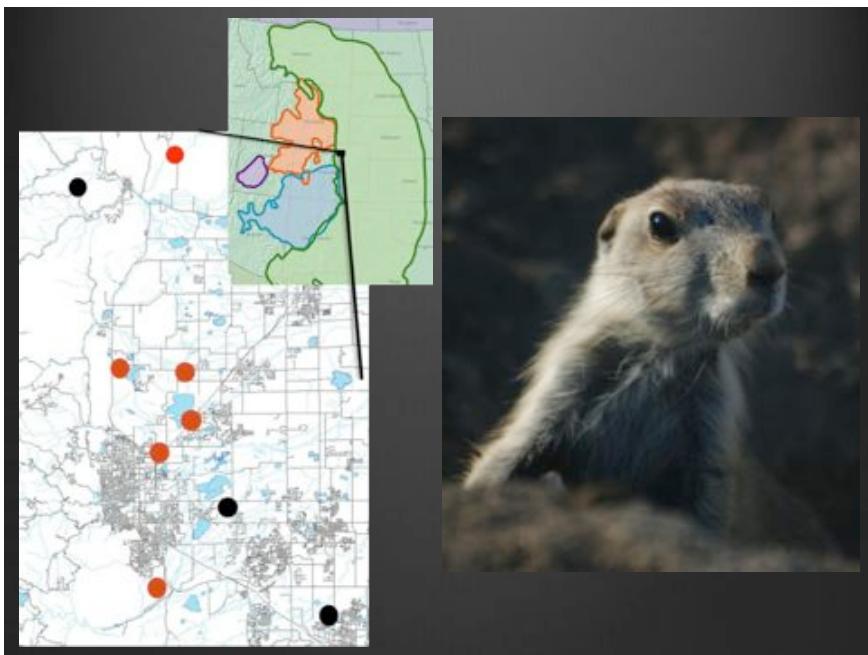
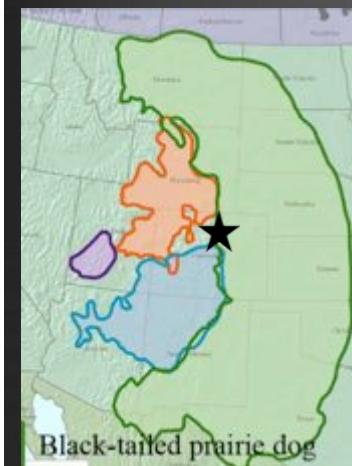
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How do introduced diseases influence the evolution of hosts?



## Black-tailed prairie dogs



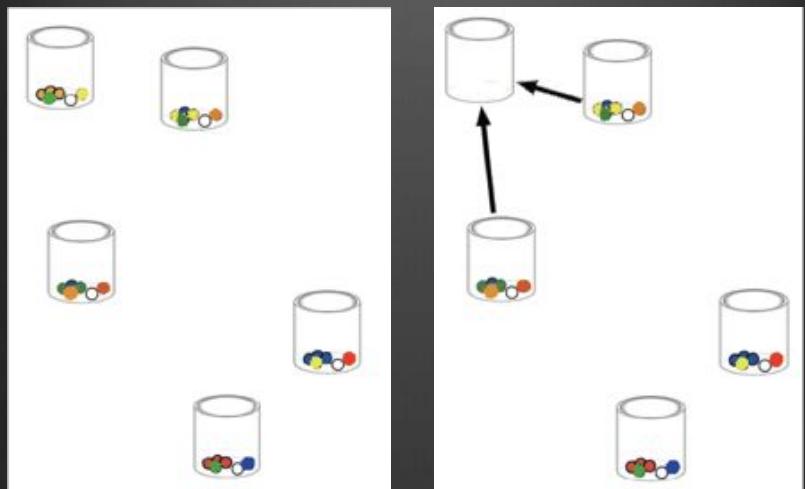


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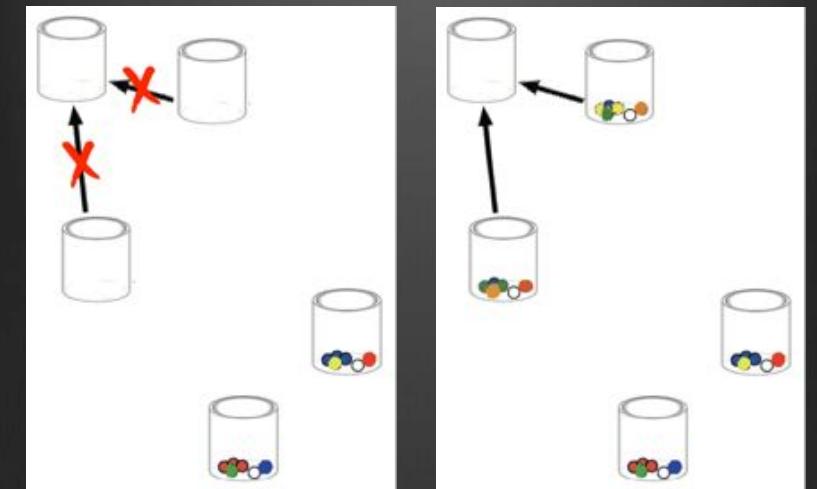


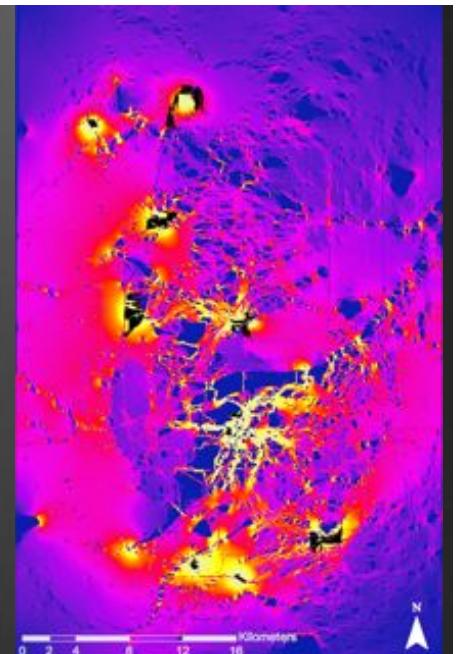
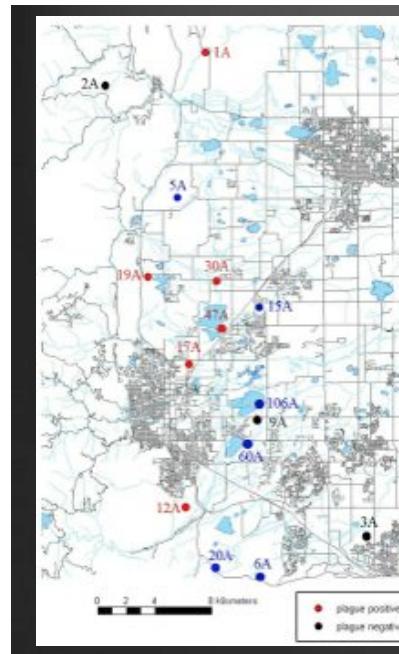
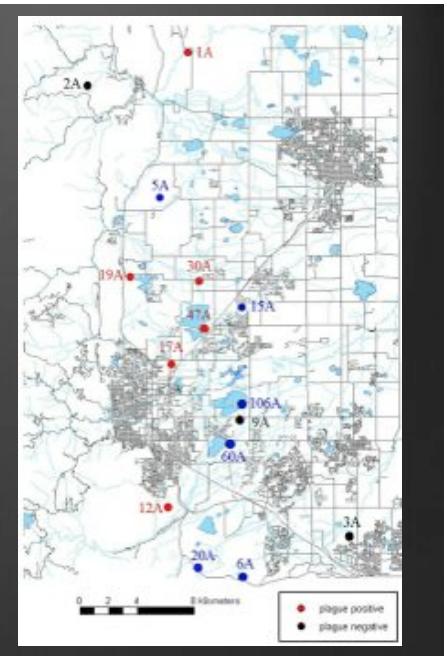
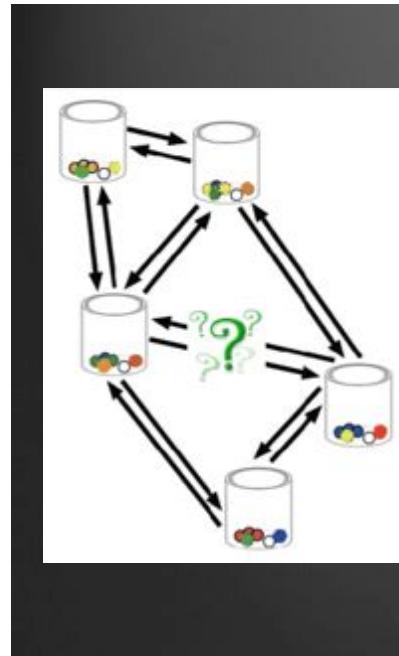
To answer this question, it is important to remember that genetic variation is the fuel for evolution.

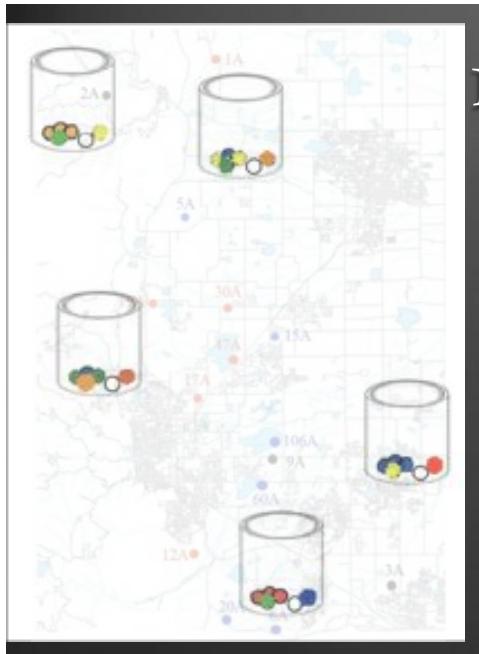
## Metapopulation dynamics



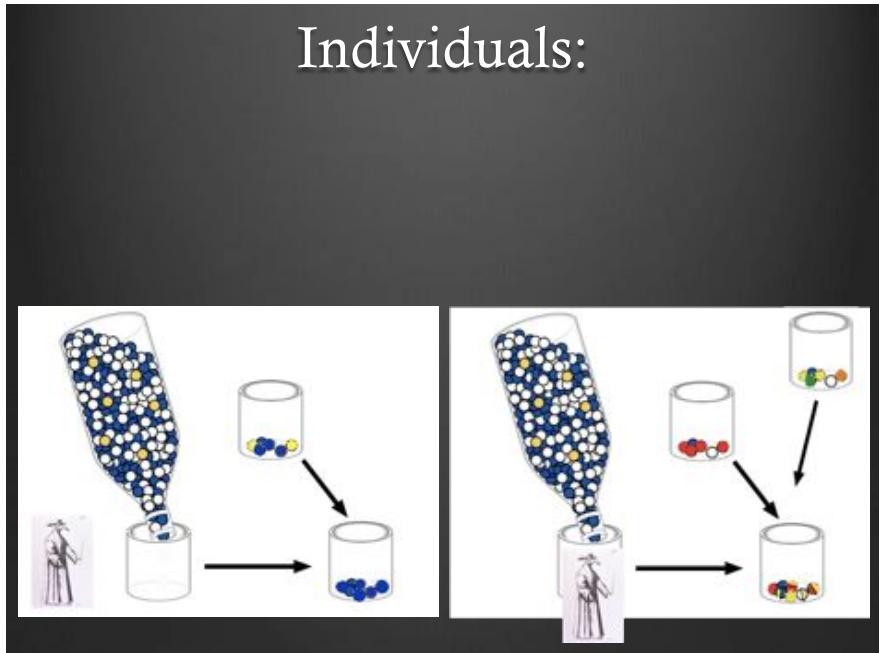
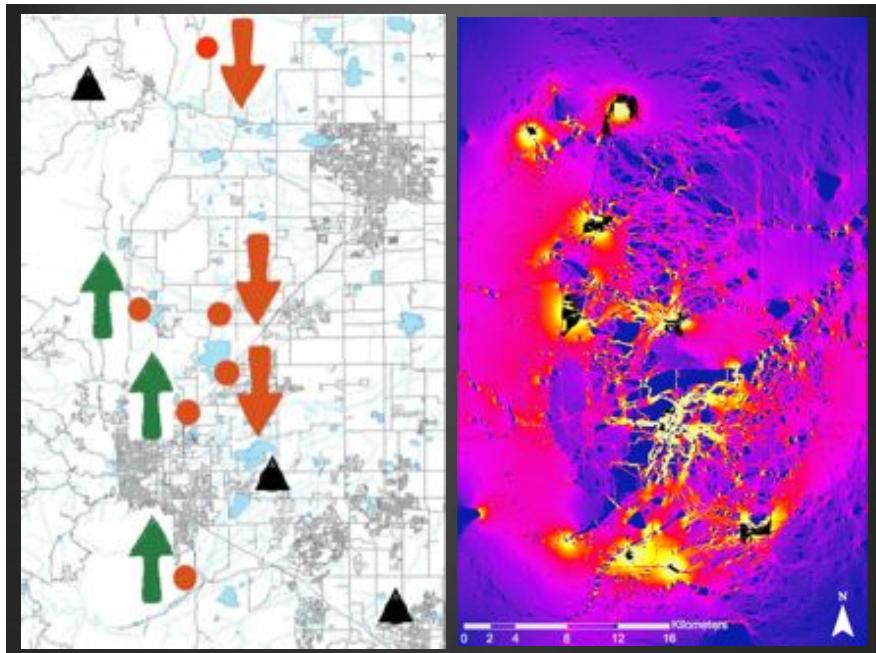
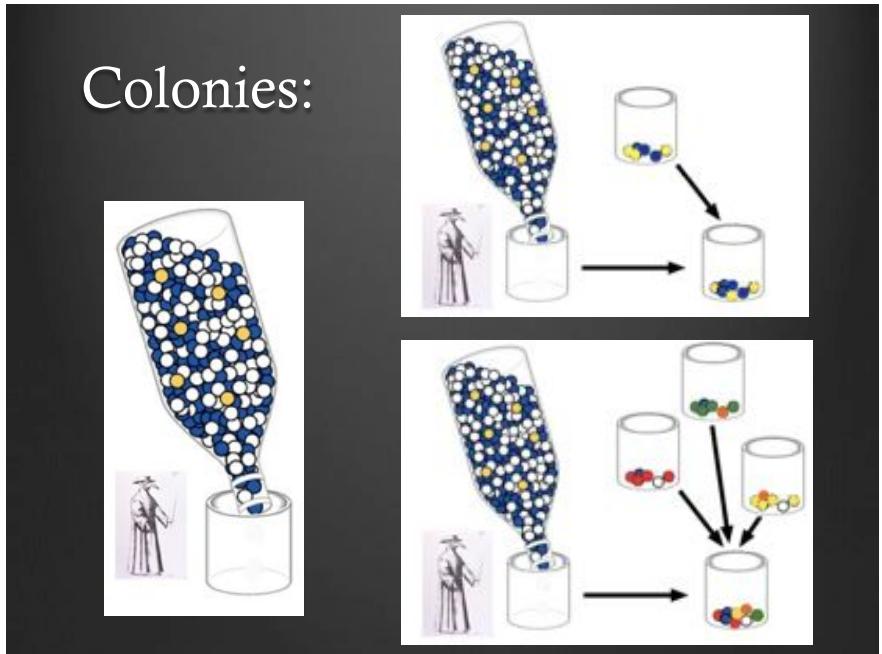
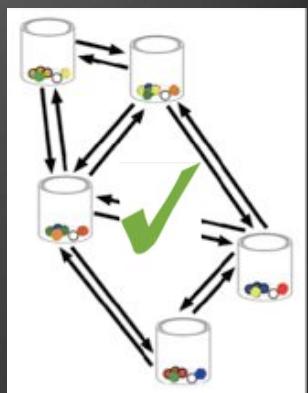
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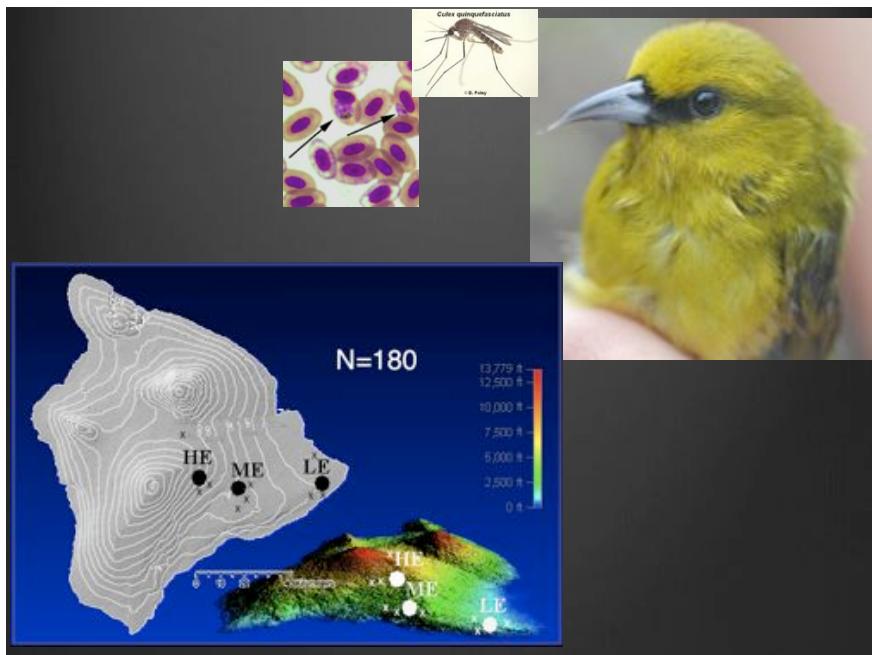
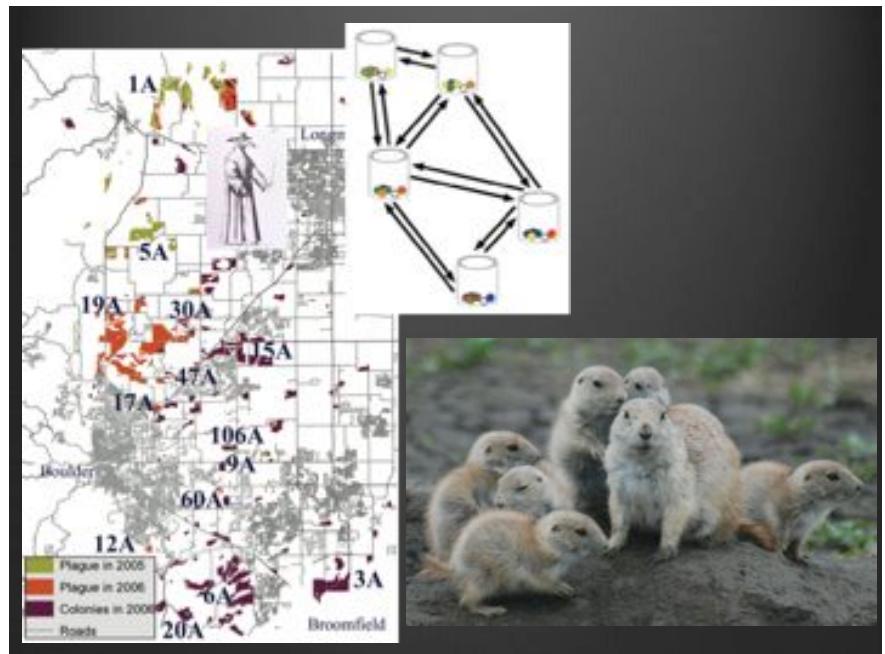
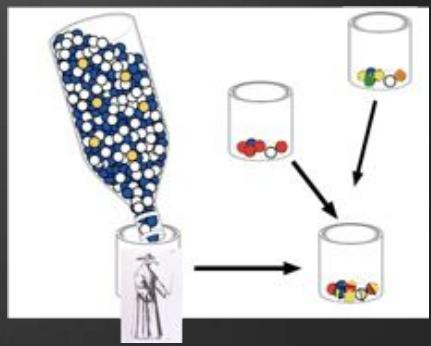
Metapopulation:



# Individuals:

1) individuals in colonized populations have higher heterozygosity than pre-plague individuals

2) survivors have significantly higher heterozygosity than expected



To find out more...

↗ [www.colorado.edu/ebio/sackett](http://www.colorado.edu/ebio/sackett)



I would appreciate your feedback on a short evaluation. Thank you for being a great group!

