The Science of Dogs: History, Psychology, and Genetics of Man's Best Friend

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Pan-Pan Jiang
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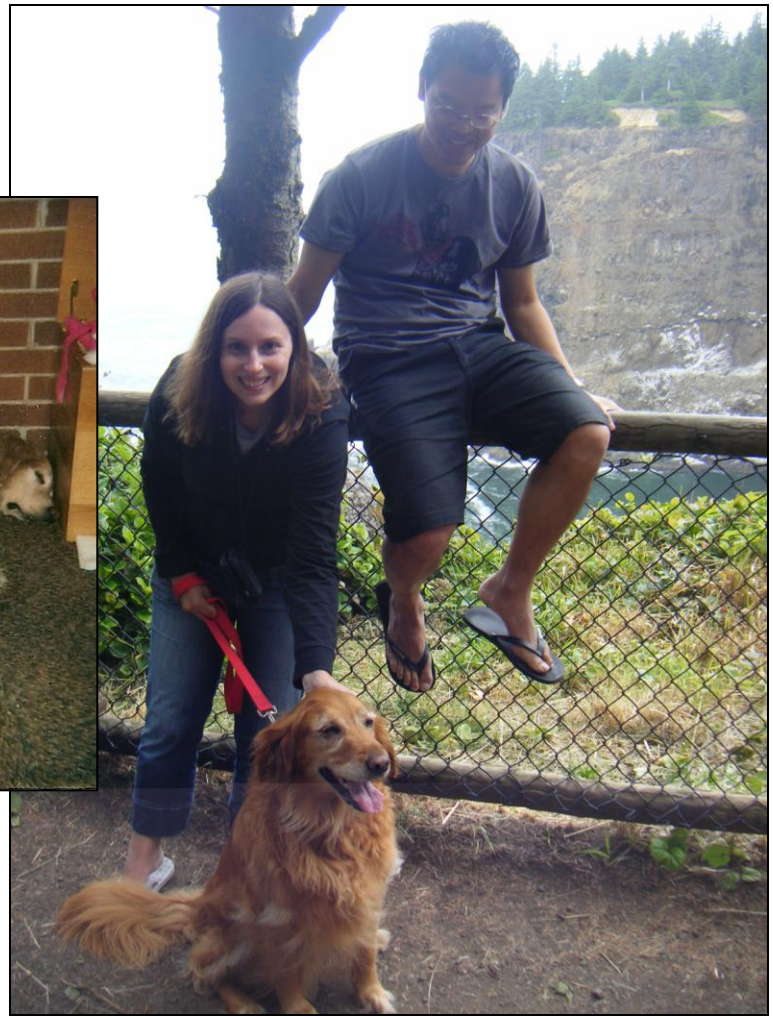
Why the Science of Dogs?



Outline

Amanda – Domestication of Dogs

Pan-Pan – Genetics of Dogs

Christine – Psychology of Dogs

Outline

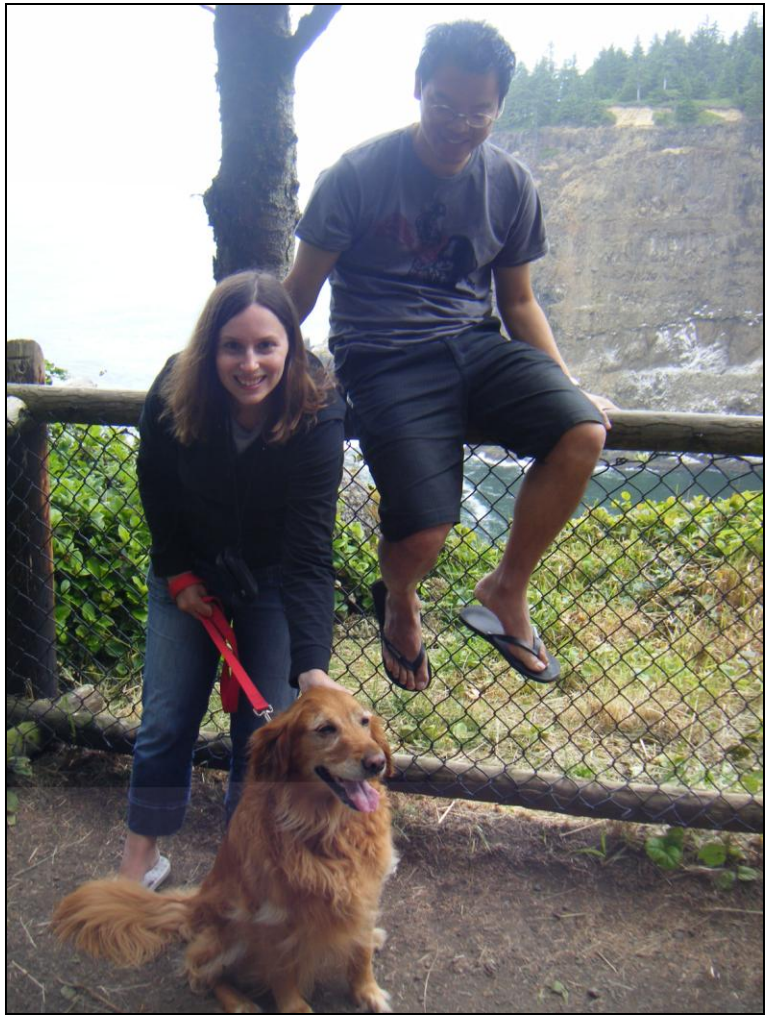
History of Dog Domestication

1. What did dogs evolve from?
2. Where and when did this occur?
3. Why were dogs domesticated?
4. How did it happen?

What Became Dogs?

Domestic Dogs:

- Appear similar to wolves, jackals and other canids
- Behaviorally different – socialized to humans
- How can we tell which one is the closest relative?
- Phenotype – comparative anatomy
- Genotype – DNA sequencing



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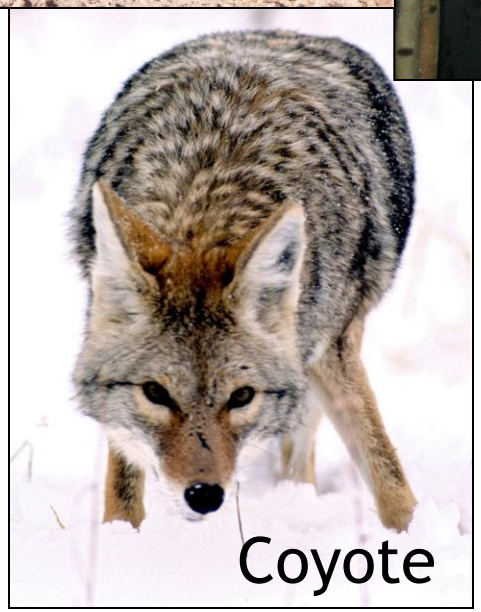

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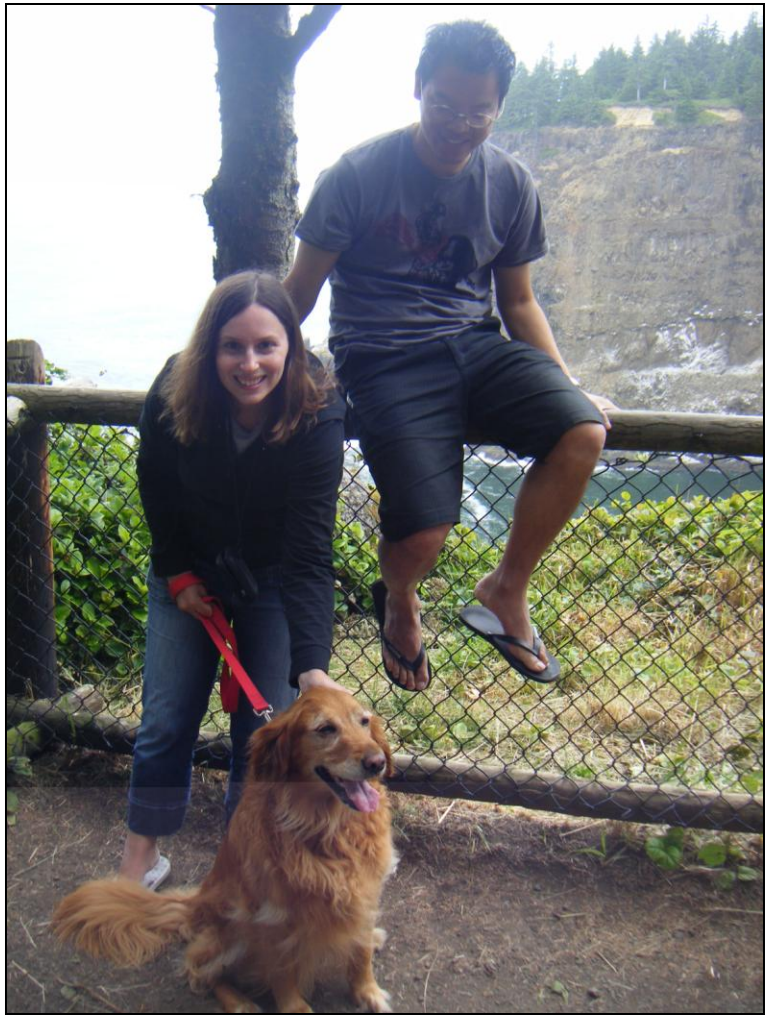
Phenotype Refers to Physical Characteristics

Domestic Dogs:

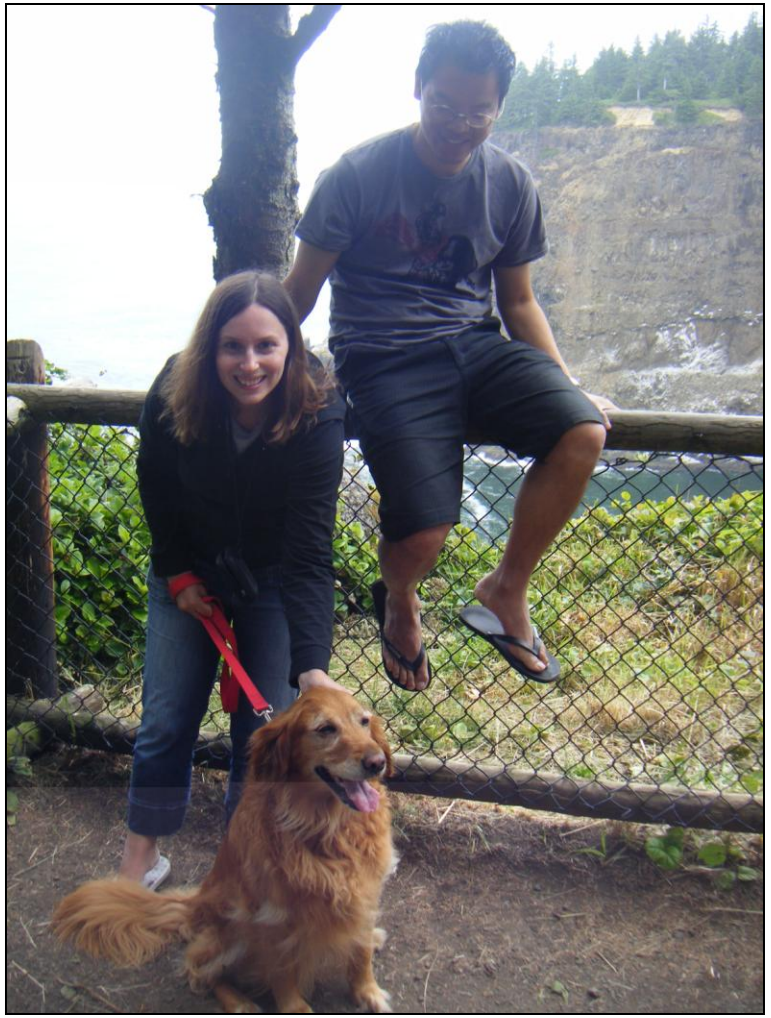
- Appear similar to wolves, jackals and other canids
- Comparative anatomy suggests wolves or jackals



Genotype Refers to DNA Sequence

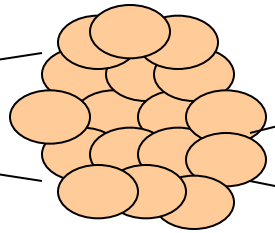
Domestic Dogs:

- By comparative analysis of their DNA to wolves and jackals, we can determine which species are most closely related

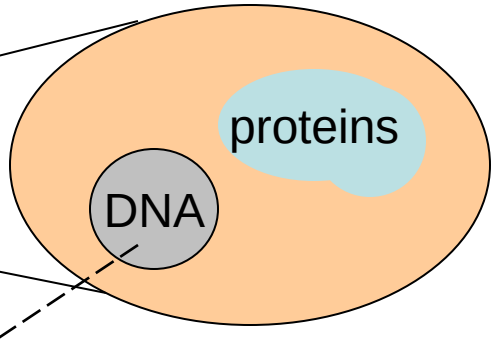


DNA is the Source of Heritable Information in the Cell

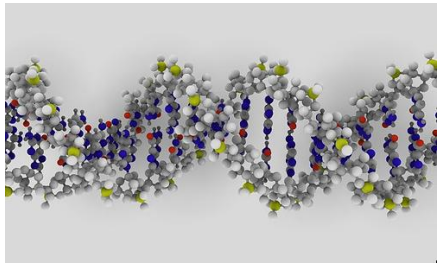
organism

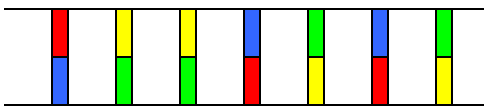


tissue



cell

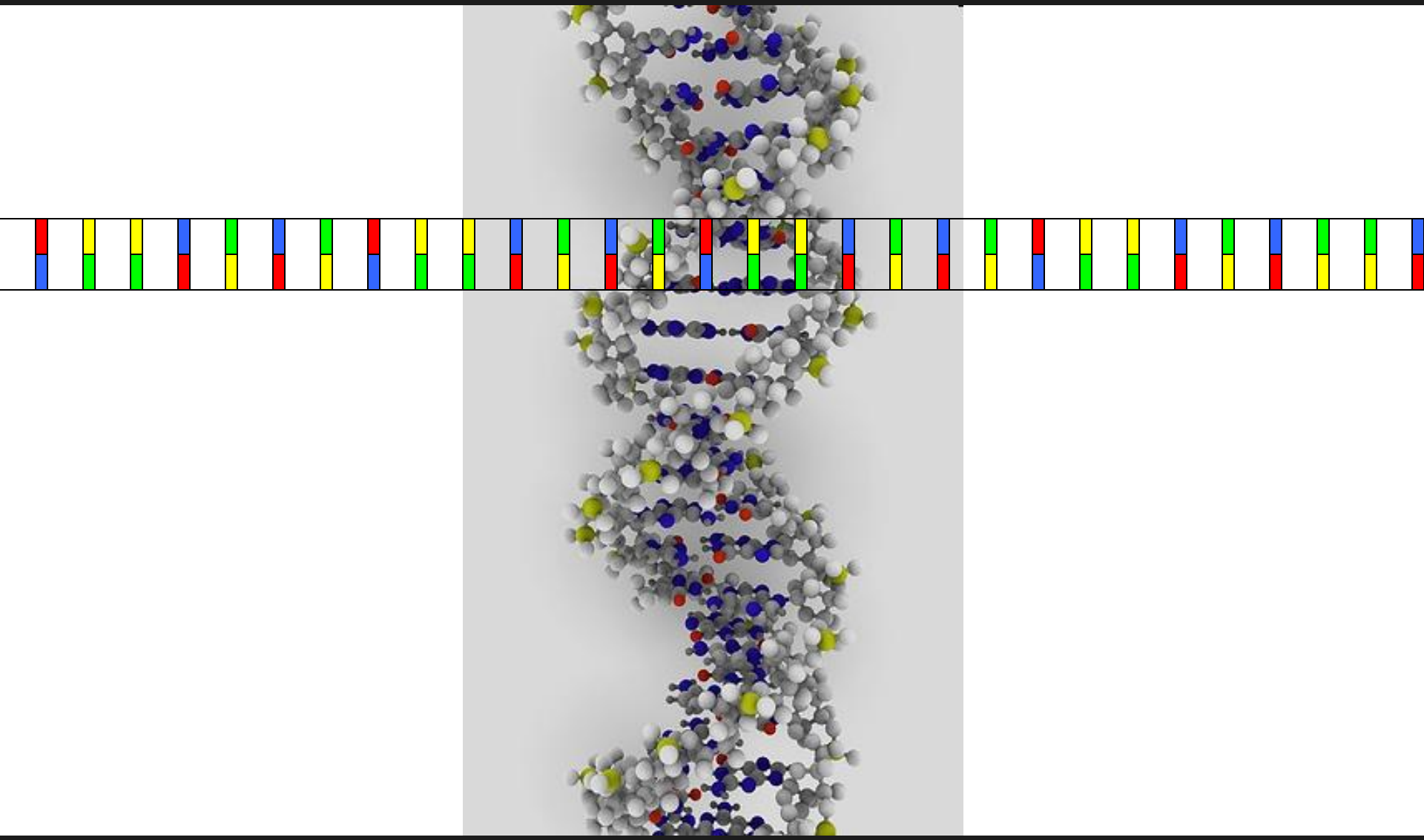




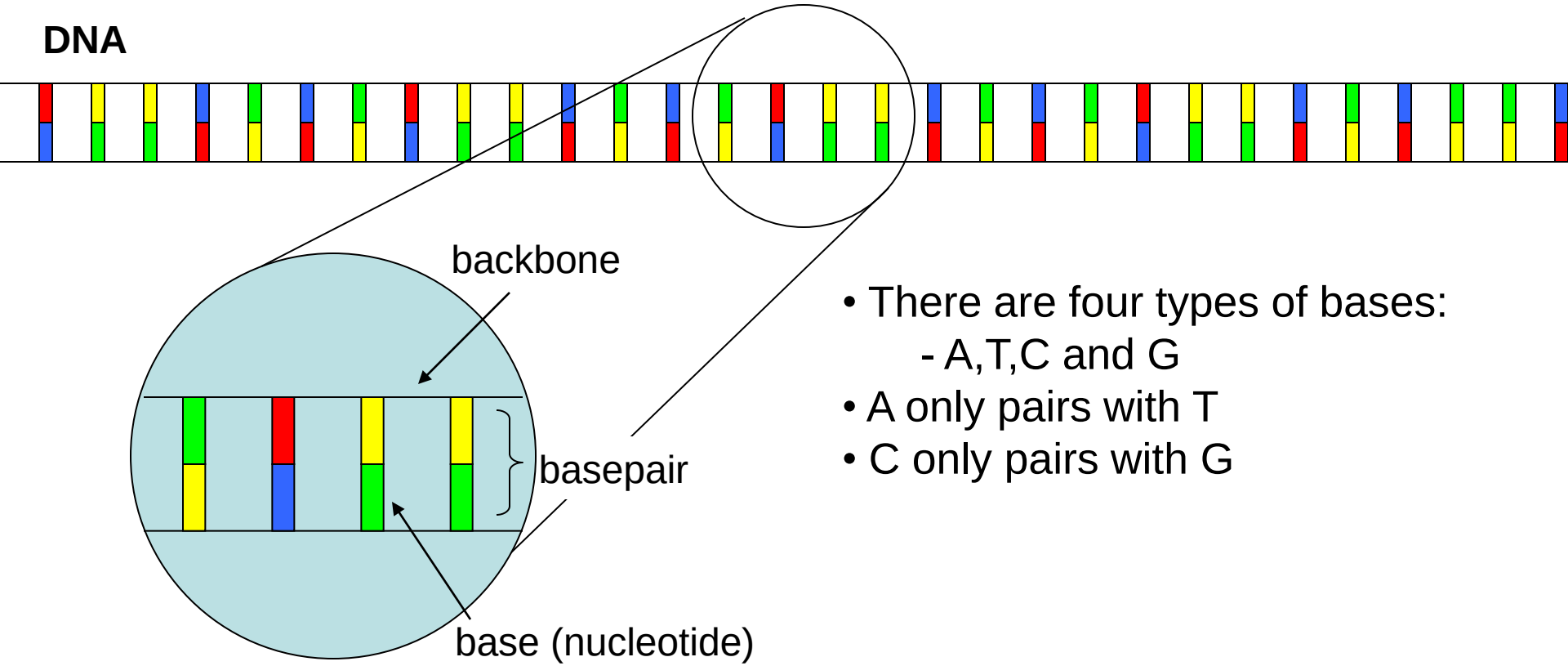
DNA sequence

Contains all the information necessary to build and maintain the cell

Composition of DNA

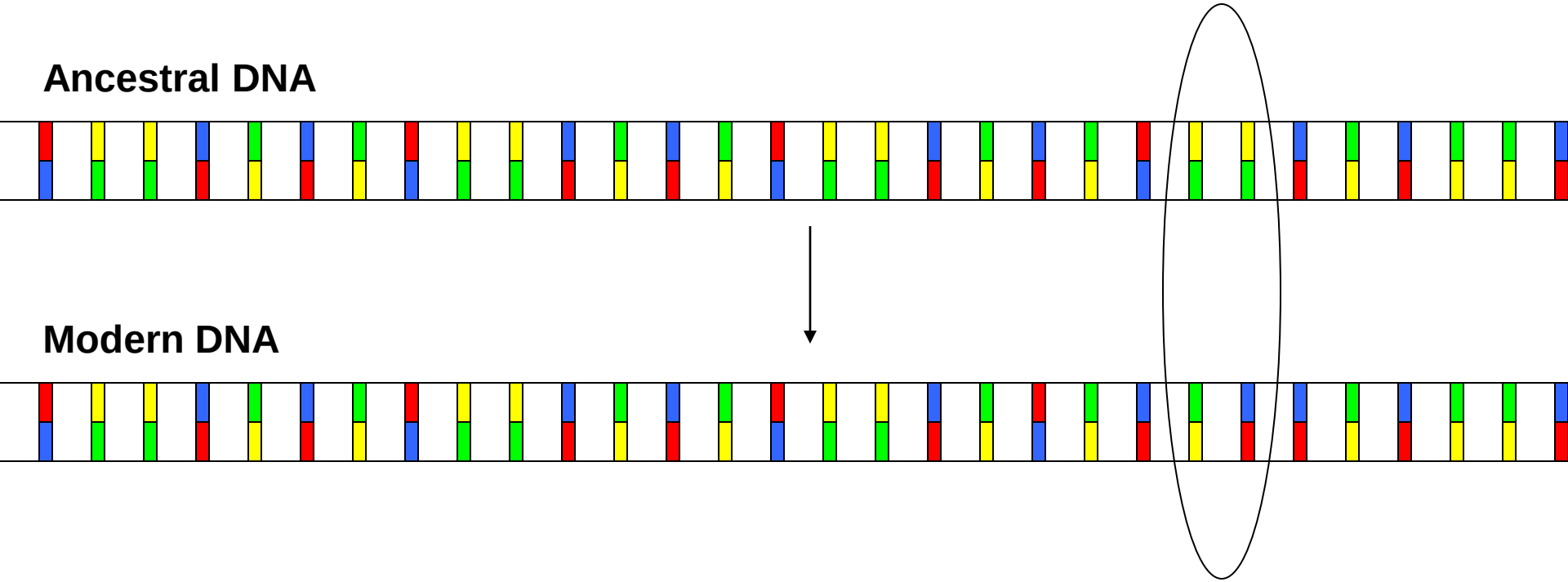


Composition of DNA



- There are four types of bases:
  - A,T,C and G
- A only pairs with T
- C only pairs with G

DNA Sequence Changes Over Time



DNA Sequence Changes Over Time

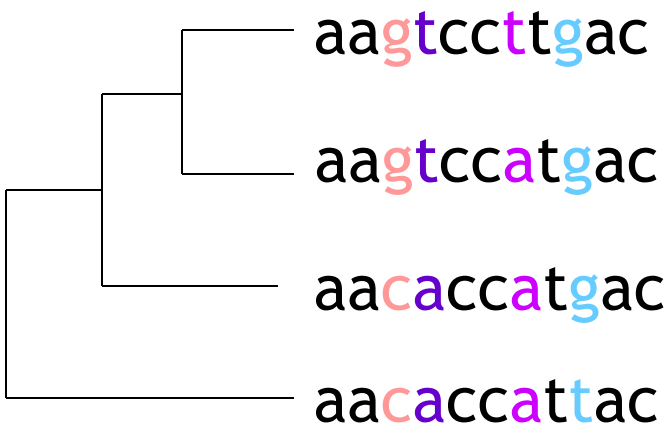
aagtccttgac

aacaccatgac

aacaccattac

aagtccatgac

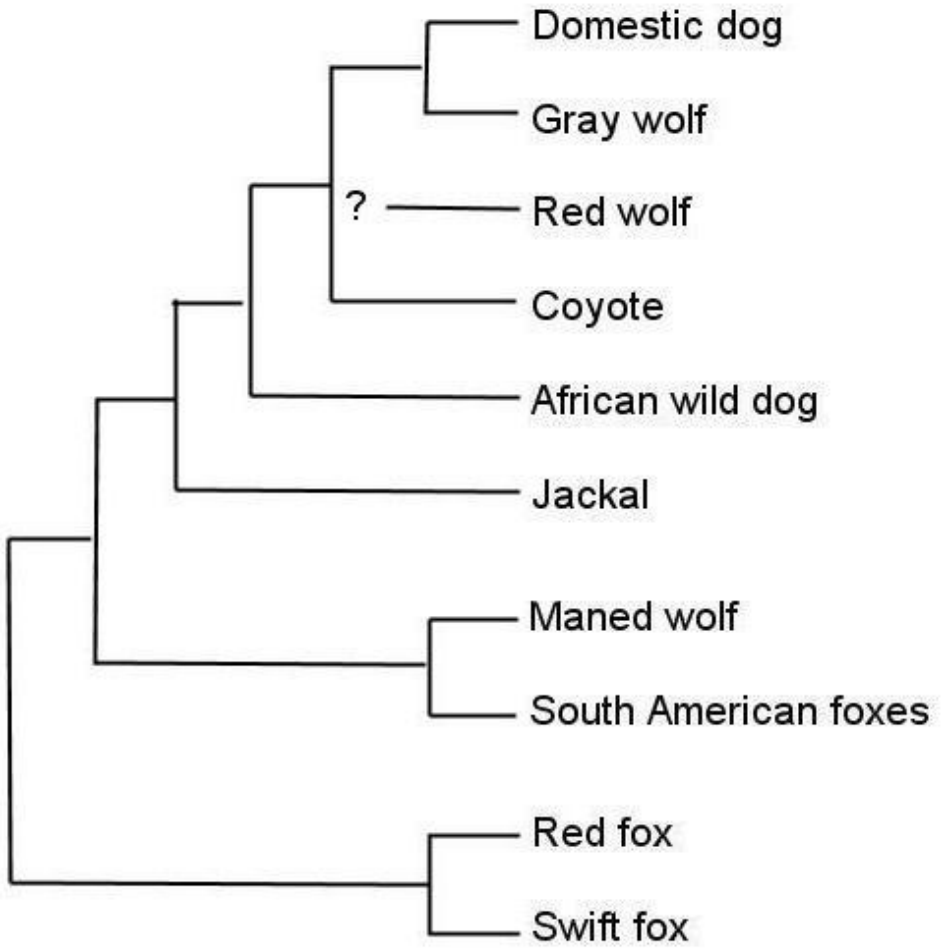
DNA Sequence Changes Over Time



Therefore, comparison of DNA sequences between individuals, populations, or species can indicate how long ago they shared a common ancestor

Wolves Became Dogs

Genetic Evidence



Redrawn from Wayne, 1993. Molecular evolution of the dog family

Where and When?

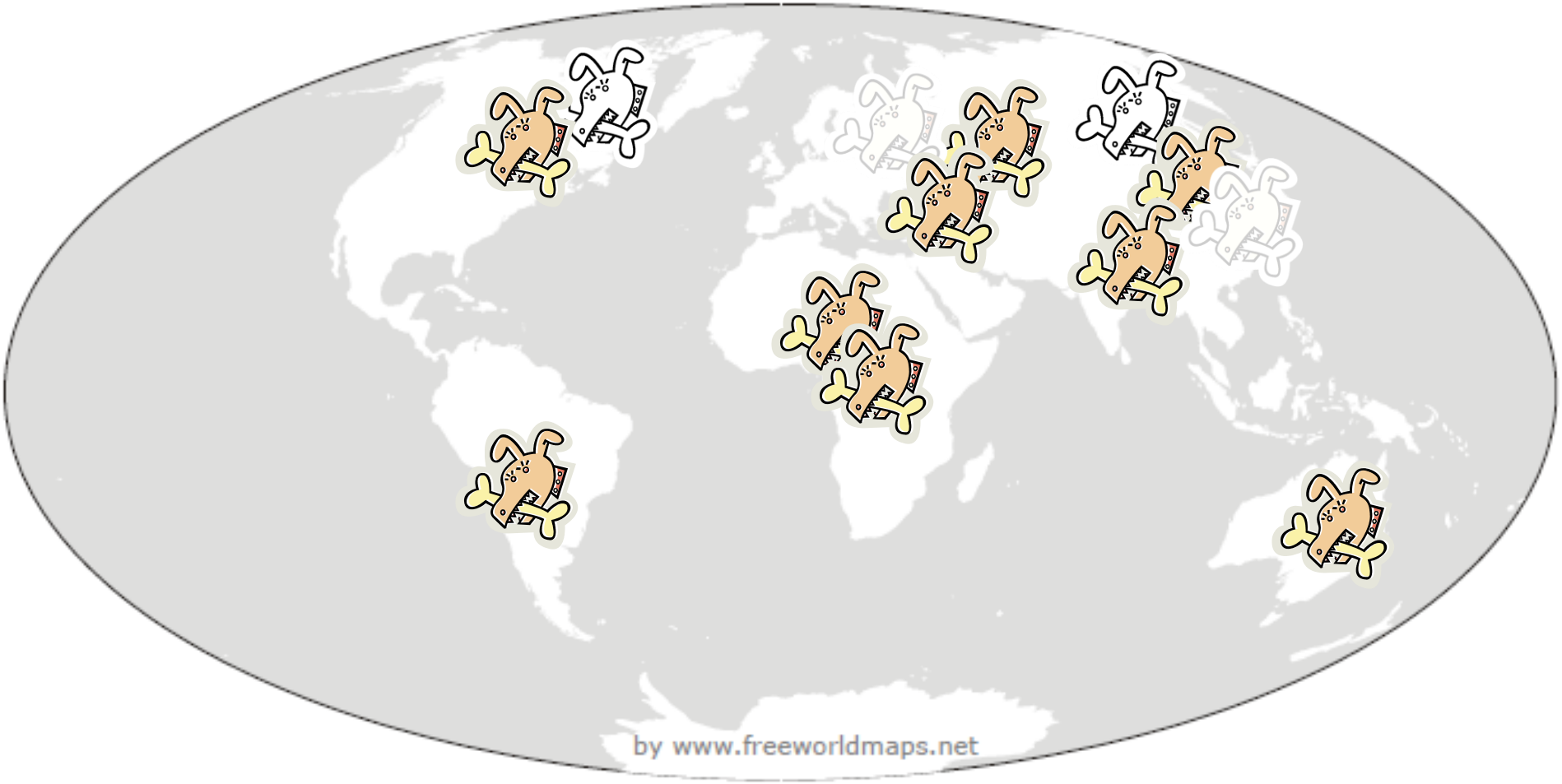
Genetic Evidence

Scientists examined DNA from 654 dogs, and found the largest amount of variation in E. Asian population –

What does this mean?

Where and When?

The location of the population with the most variation tends to be the most ancestral



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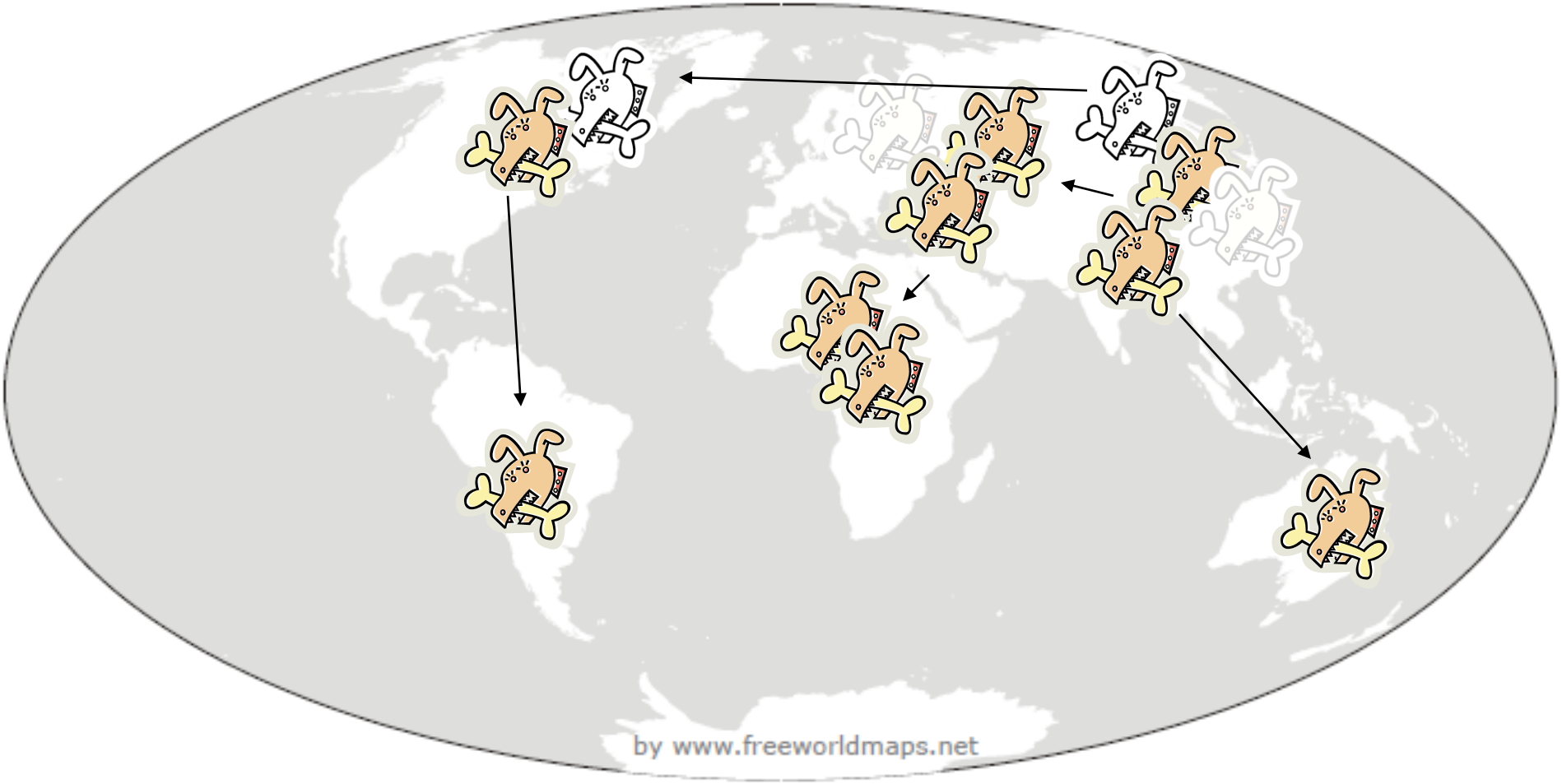


Where and When?

as early as 30,000BC

Archaelogical Evidence

12,000 years ago, Israel

Why Were Wolves Domesticated?

Social

Companionship

Protection

Food

Hunting

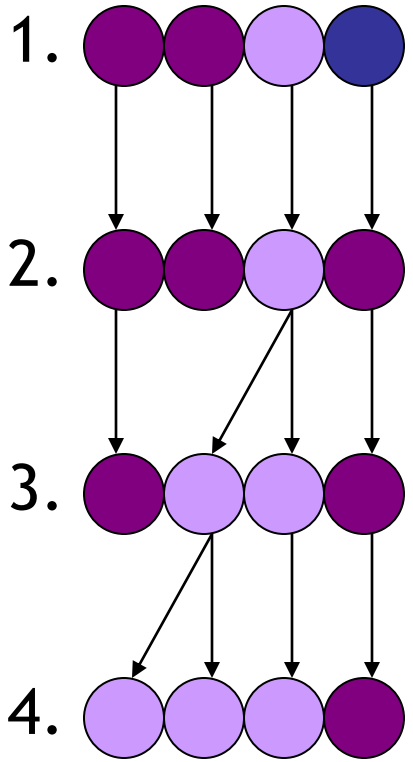
Smart Predators

Herding

How did it happen? Selection

Natural Selection:

1. There is variation within a population
2. Some variations are heritable
3. In every generation, individuals with more favorable heritable variations tend to reproduce more
4. The frequency of these favorable heritable variations therefore increases within the population



Natural or Artifical Selection?

We domesticated dogs?

Dogs domesticated themselves?

How might it have happened?

Dimitry K. Belyaev

How might it have happened?

Experiment:

1. Approach young pups and offer food by hand
2. Observe behavior

- Class III are afraid or aggressive
- Class II are indifferent
- Class I are friendly
- Class IE are eager for human contact

3. 10% tamest are used for next generation

How might it have happened?

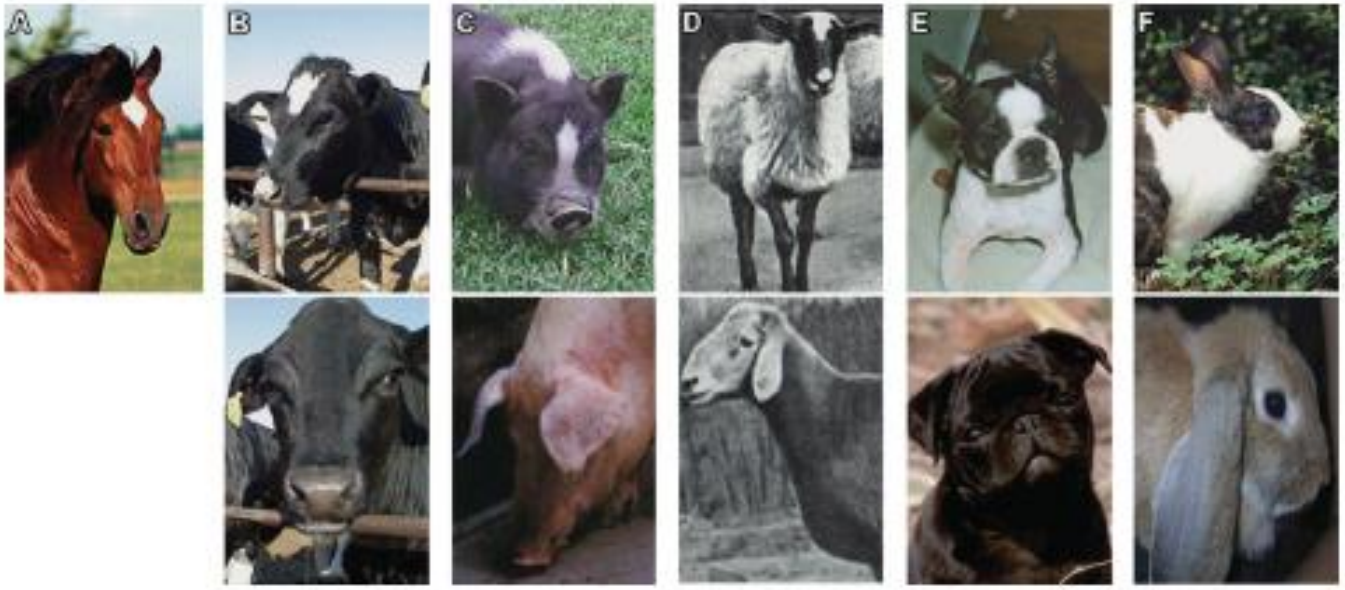
Generation	Notes
4	Tail wagging appears
6	Class IE – eagerly seeking human contact (1.8%)
30	49% are Class IE
Now	Nearly all are Class IE

Physical changes: white patches, floppy ears, curled tails

Domestication in General

Domesticated species:

- Lose of normal behavioral response to humans (Hormonal responses to stress are reduced)
- Physical appearance – white spotting, floppy ears, curled tails, dwarf and giant varieties
- Pedomorphosis – retention of juvenile traits by adults



Conclusion

- Dogs evolved from wolves around 15,000 years ago, most likely in East Asia

- Selection of non-fearing animals is sufficient to create “domesticated” canids in an experimental setting within 60 years