Part 3: Human Genetics and Evolution

Elizabeth Brown
How Evolution Generates “Endless Forms, Most Beautiful”

Part 3: Human Genetics and Evolution

Marc Presler
Peter Yang
Elizabeth Brown

Image Credit: Wikimedia Commons, User: Holek
“Endless Forms, Most Beautiful”

Photo Credit Georges Biard
Natural Selection and Human Evolution

Bonobo

“Common” chimpanzee

Human

(2 million years ago)

Common Ancestor (6 million years ago)

Photo Credit USAID

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Natural Selection
and Human Evolution

3,000,000,000 positions * 1% = 30,000,000 differences
Questions?
Mystery: Natural Selection in Human Evolution

Itan et al. BMC Evolutionary Biology 2010
Pastoralism!

Alvan Fisher, *Pastoral Landscape*, 1854

Johannes Vermeer, *The Milkmaid*, 1657–1658
Pastoralism and Milk-Drinking!

- Infants drink mother’s milk:
- Milk contains a sugar, lactose.
Pastoralism and Milk-Drinking!

Milk + Baby = Happy Baby

DNA
lactase
ON

Photo Credit: Sabrina, Wikipedia
Pastoralism and Milk-Drinking!

Milk + Baby = Happy Baby

DNA

lactase ON

Milk + Adult = Unhappy Adult

DNA

lactase OFF
Pastoralism and Milk-Drinking!

Milk + Baby = Happy Baby

\[ \text{DNA} \quad \text{lactase} \quad \text{ON} \]

Milk + Adult = Happy Adult

\[ \text{DNA} \quad \text{lactase} \quad \text{ON} \]
Frequency of “Lactase Persistence”—the ability to digest lactose

Open Source: Itan et al. BMC Evolutionary Biology 2010

Everyone is Lactase Persistent

Almost Nobody is Lactase Persistent
Milk-Drinking Adaptation

- New mutation ((newUserInput)) in the genome
- Lactase persistence
Milk-Drinking Adaptation

- New mutation in the genome
- Lactase Persistence
- Increased survival and reproduction
- Mutation spread quickly throughout the population
- Strong positive selection → Populations adapted to drinking milk
Questions?
Milk-Drinking Adaptation: Paedomorphosis?
Solving the Mystery: Milk-Drinking Adaptation

DNA

lactase

ON

lactase

ON

Adaptation

Photo Credit: fda.gov
Natural Selection in Human Evolution

Itan et al. BMC Evolutionary Biology 2010
How Evolution Generates 'Endless Forms, Most Beautiful'

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