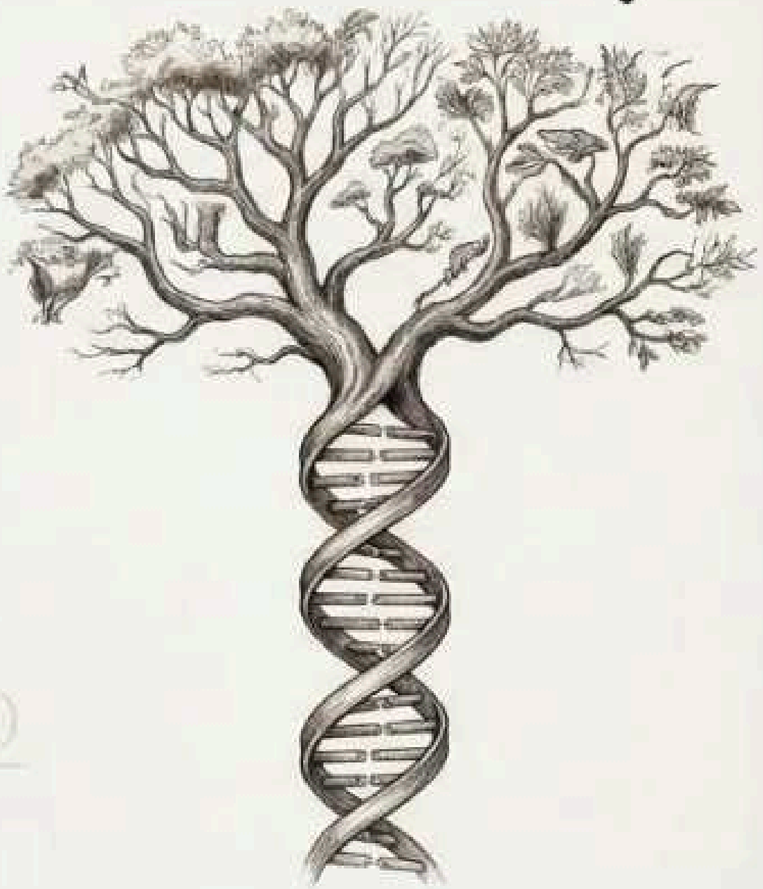
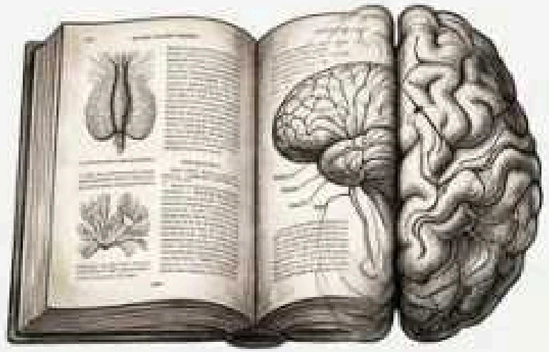
BIO 340 B: Evolutionary Inference
Course Overview: Uncovering the Unseen Past

Anderson Academy



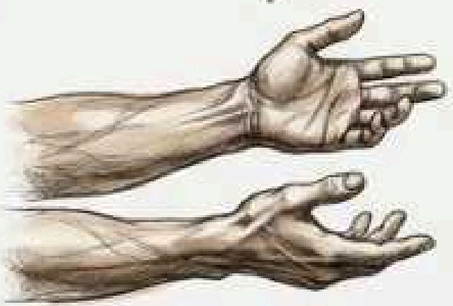
The Social Contract

¶ 0.1



Learn

Access to this Anderson Academy library course is free.



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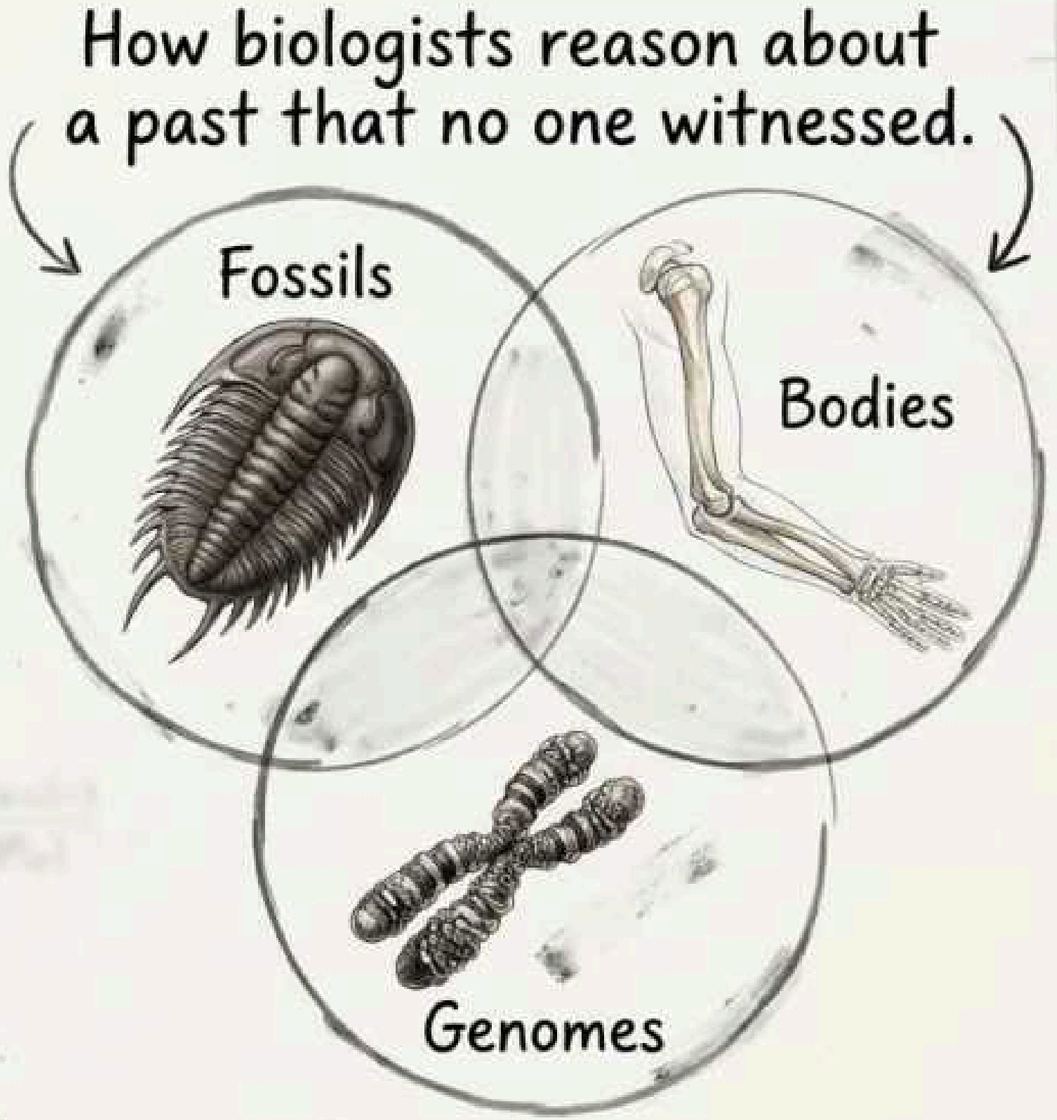
X (Twitter): @garyanderson

Mission Parameters: BIO 340 B

Anderson Academy:
A four-year library of university-level courses.

B = Brief

→ (An overview + 6 short lectures = ~1 hour total.)



Bridging Deep Time

¶ 0.3

Whales descend from land mammals.



Birds are living dinosaurs.



Humans and chimpanzees shared an ancestor millions of years ago.



Evolutionary Inference connects present evidence to past events and processes.



Deep Evolutionary Time

Evolution happened mostly over millions of years, before any human could watch.

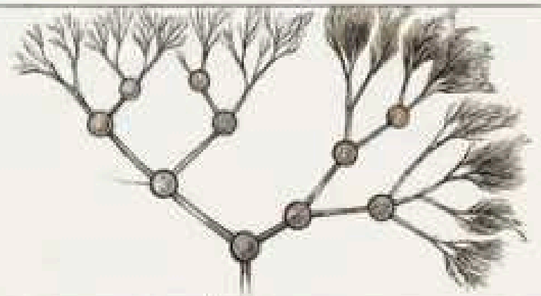
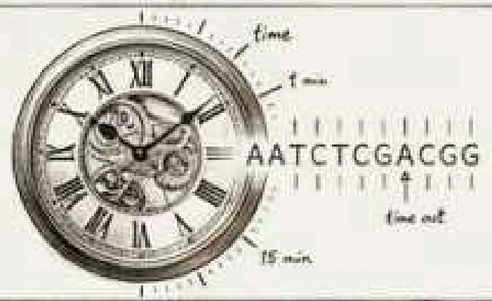
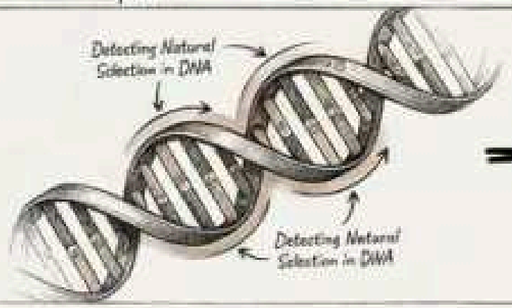
Human Observation



The Methods Are Where the Science Lives

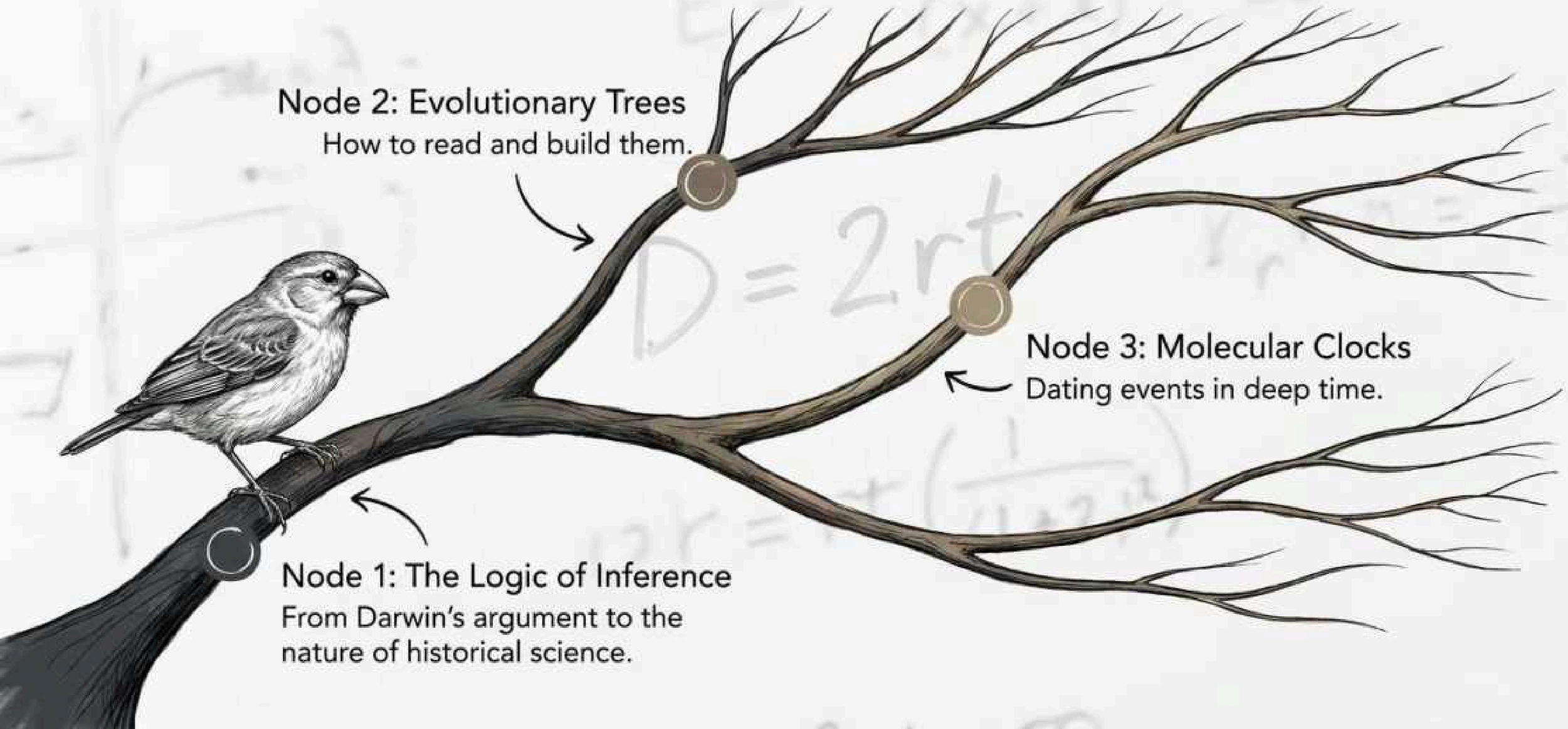
¶ 0.4

Understanding the method lets you judge the claims.

The Academic Method		The Real-World Application	
Building a Family Tree		Tracing Viruses (Medicine)	
Calibrating a Molecular Clock		Identifying Species (Conservation)	
Detecting Natural Selection in DNA		Identifying People (Law / Genetics)	

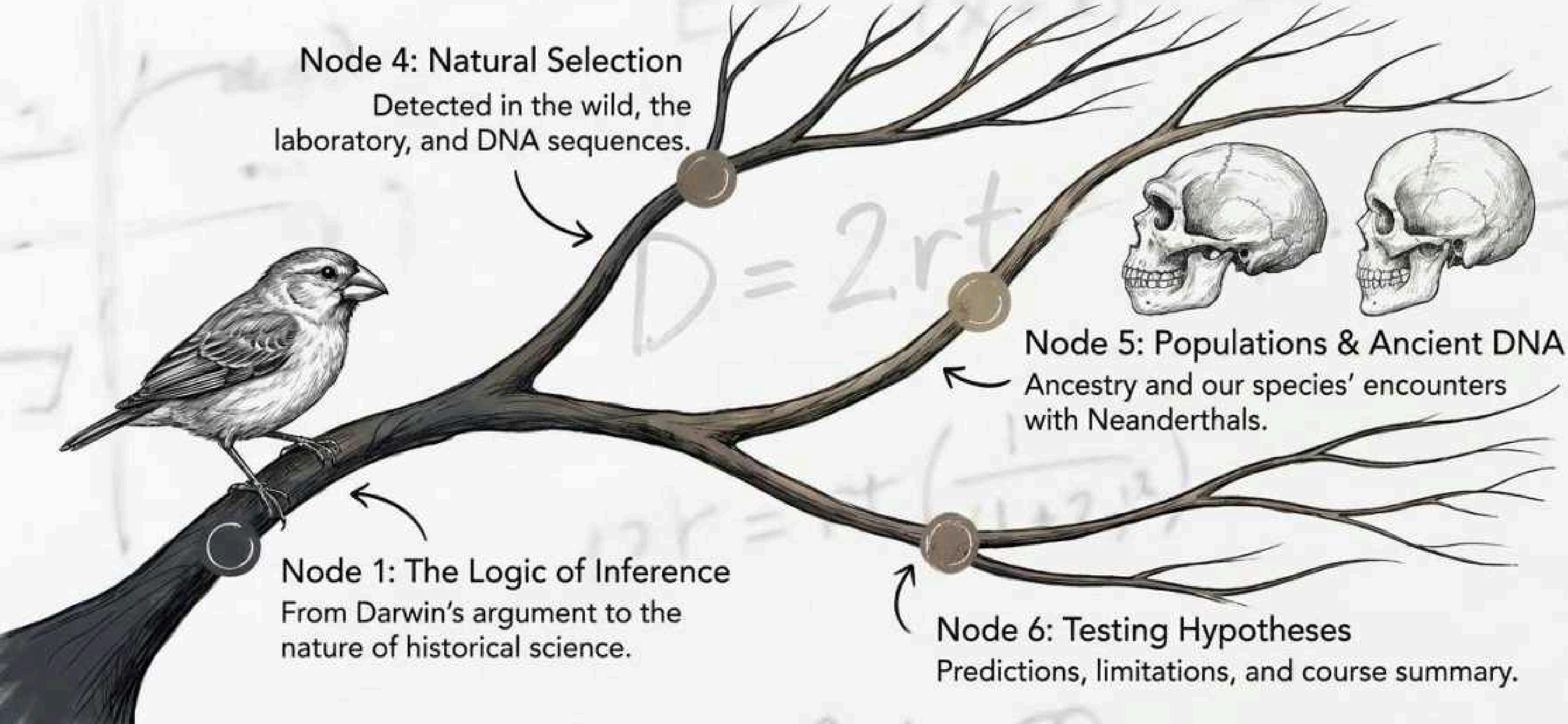
Course Roadmap (Lectures 1-3)

¶0.5



Course Roadmap (Lectures 4-6)

¶ 0.6



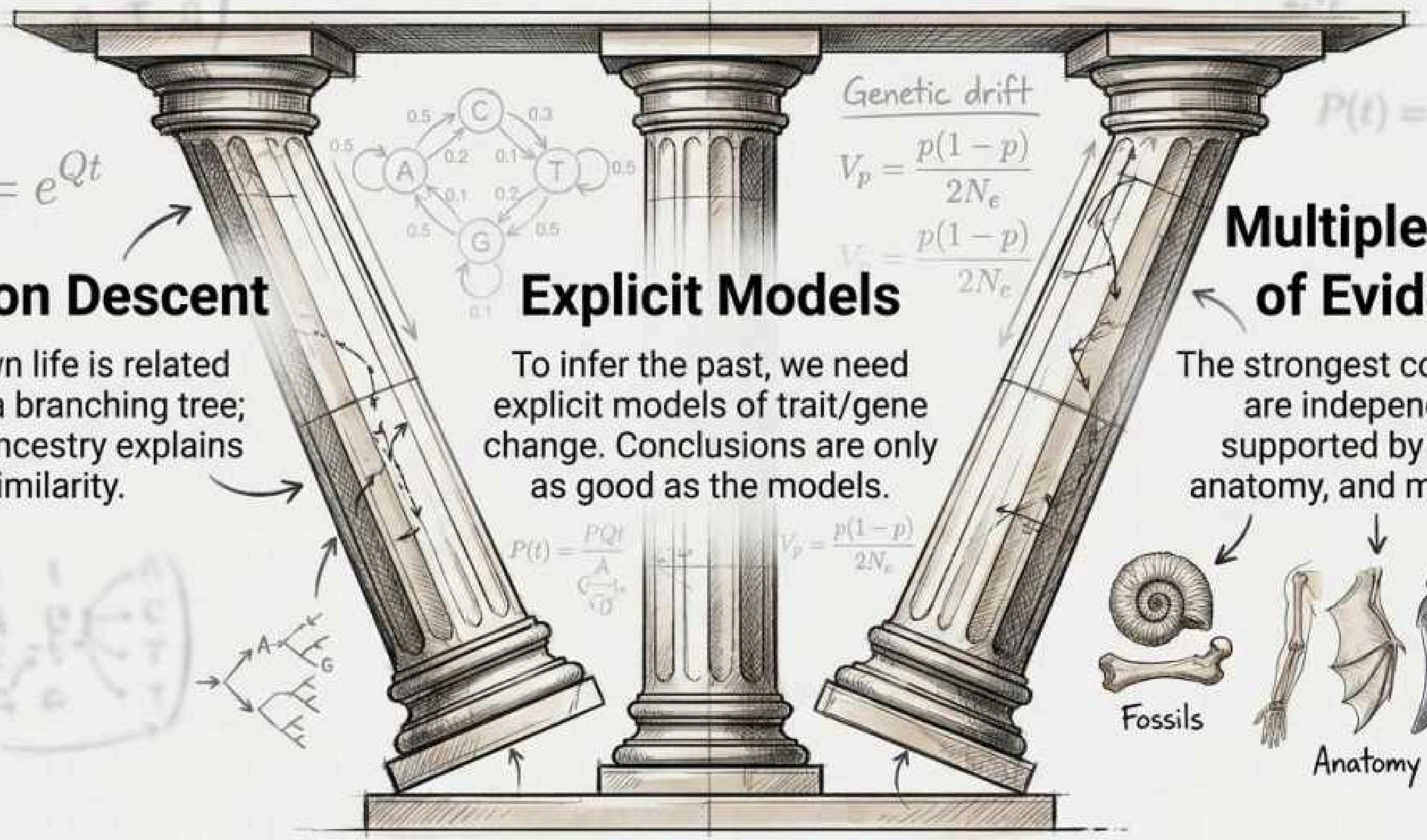
Node 4: Natural Selection
Detected in the wild, the laboratory, and DNA sequences.

Node 5: Populations & Ancient DNA
Ancestry and our species' encounters with Neanderthals.

Node 1: The Logic of Inference
From Darwin's argument to the nature of historical science.

Node 6: Testing Hypotheses
Predictions, limitations, and course summary.

Three Foundational Ideas



Common Descent

All known life is related through a branching tree; shared ancestry explains similarity.

Explicit Models

To infer the past, we need explicit models of trait/gene change. Conclusions are only as good as the models.

Multiple Lines of Evidence

The strongest conclusions are independently supported by fossils, anatomy, and molecules.

Prerequisites & Toolkit

¶0.8

Required Preparation

BIO 210 B (Genetics) &
BIO 220 B (Ecology and Evolution). Basics of evolution and genetics are assumed.

Helpful Addition

MATH 340 B (Probability Theory). A little probability helps.

No formulas to write down! Every method will be explained in words.

$$f(x) = \int_{0-1}^{1.\infty} f(x)\, dv(r)\, dx = \sum_{k=0}^{n} \sum_{\kappa=1}^{\infty} vP(x,x)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}, \quad P(A|B) = P(A) = \sum_{j=0}^{n} x_j \frac{P(A \cap B)}{P(B)},$$

$$= \sum_{i=0}^{\infty} x_i\, P(X=x), \; E(X) = P(X) - \sum_{i=1}^{m} P(X=x),$$

$$P(A|B) = E(A) : \sum_{k=0}^{n} P(A) \cap B), \quad E[X] = \sum_{x=1}^{m} xP(X=x)$$

$$E[X] = \sum_{x=x} xP(X=x) \qquad Var(X) = E[X^2] - (E[X])^2$$

$$Var(X) = E[X^2] - (E[X])^2$$

The Skeptical Detective's Loop

The history of the field is full of conclusions revised when assumptions were tested.
Pause after each method and ask:



Step 1:
What evidence does it use?

Step 2:
What assumptions does it make?

Step 3:
How could it go wrong?

Thinking this way will make you a sharper reader of science.