

What is the most compelling AND accessible evidence for (human) evolution one can deliver at the high school level?

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ABSTRACT: The Human Evolution Lab Suite (HELS) features a set of open-access labs that supplements existing biology curricula. These labs present compelling and student-accessible evidence for human evolution, designed for delivery by an instructor applying the lesson plans. Cutting-edge fossil/anatomical, physiologic, behavioral, and genetic evidence is woven together to produce a compelling confluence of evidence for hominid (human) evolution, packaged in inquiry-based learning pedagogy, rendering the material accessible to the high school biology student.

MATERIALS AND METHODS

labs:

1. Human Origins

take skull-based measurements on 11 hominid skulls to determine their degree of cranial capacity, orthognathism, bipedalism

2. Dimorphism in Hominids

investigate the interplay between behavioral traits (by conducting ethograms) and sexual dimorphism in bonobo/chimp/human (by inspecting 3D-printed skulls)

3. neanderthal ♥ sapiens

witness an ancient love-hate soap opera and model the ultimate conquest of the super cooperator species

4. Encephalization in Homo

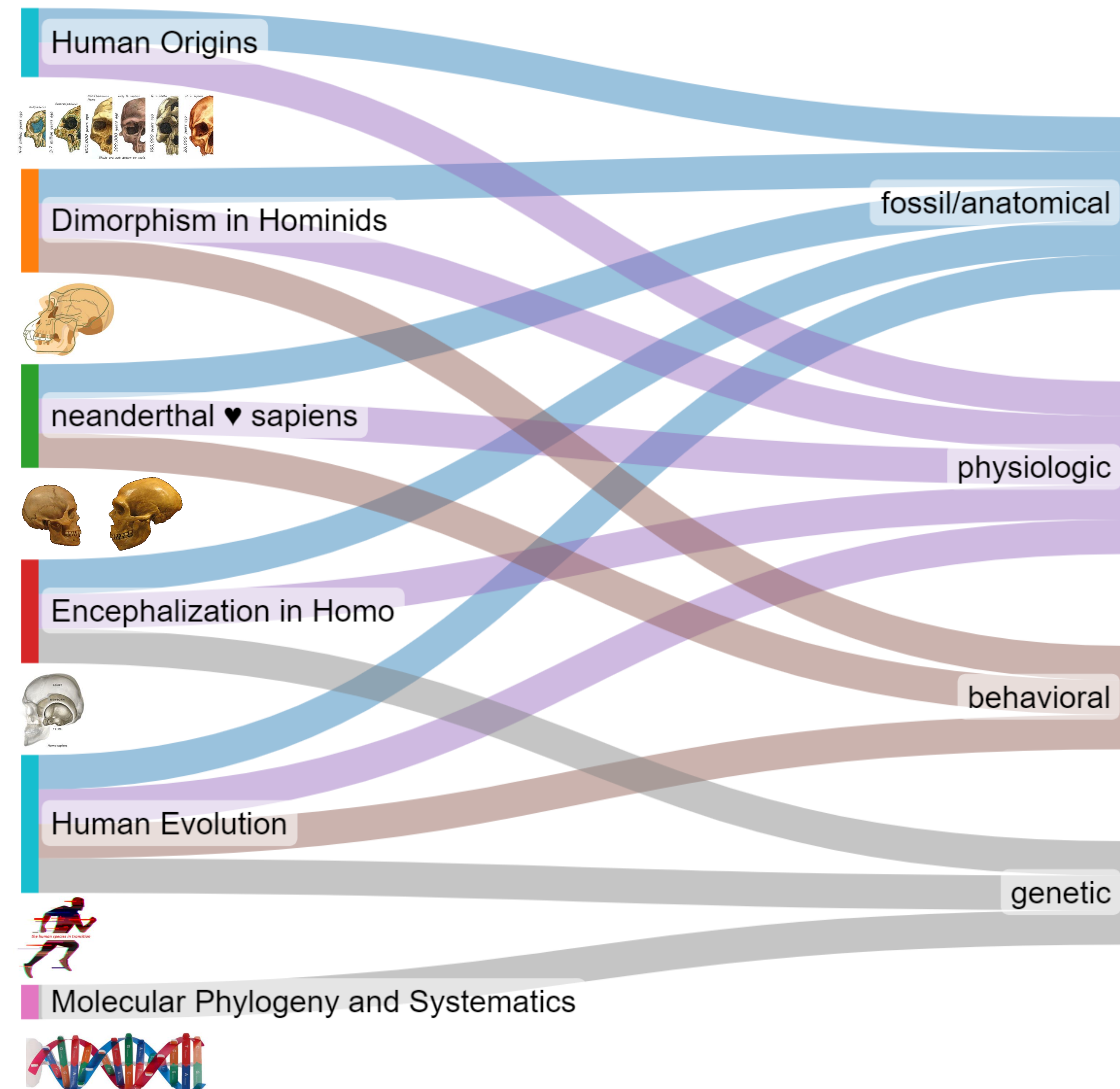
unpack the genotype-phenotype interaction on brain development and enlargement

5. Human Evolution

carry out observations and measurements of 5 traits (incl. vestigial) emblematic of evolution (students examine traits on own bodies)

6. Molecular Phylogeny and Systematics

analyze DNA sequences, protein sequences, and chromosomal maps to trace the ancestry of five species (homo, pan, gorilla, pongo, macaca)



evidence type:

... evidence, in the form of individual (mineralised) specimens, represents snapshots of (past) life – the record of which is vast and expanding.

... evidence considers functions and mechanisms in a living system (incl. vestigial organs).

... evidence, a phenotype subset, are traits that also influence evolution of a species.

... evidence concerns the genotype level, investigating e.g. mutations that lead to evolution in a species.

fields:

anatomy and paleoanthropology

evolutionary physiology / comparative physiology

primatology

molecular biology and phylogenetics

RESULTS

Based on a post-“*Be a Paleoanthropologist For a Day!*” lab survey, the teacher respondents held that the students were thereafter in a position to:

1. Associate fossilized hominin skulls with evolution.
2. Grasp “adaptive speciation”.
3. Picture “descent with modification” and “incremental change”.
4. Comprehend “common ancestry”.
5. Understand “survival of the fittest”.

DISCUSSION

The interweaving fossil/anatomical, physiologic, behavioral, and genetic strands of evidence, brought to bear through these labs, have every potential to embed in the student-scientist a deep, visceral understanding of evolution, and how its processes produced us in present form. Students are empowered to say:

“I don’t believe in evolution! I observe evolution, I understand how evolution works, and I not only accept but I endorse modern evolutionary theory.”

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