NATURE *VS* NURTURE IN HANDEDNESS

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INTRODUCTION

- Handedness, one of the three forms of limb-use asymmetries in nature (Fig. 1), can be defined as consistency of hand preference across individuals and across tasks.

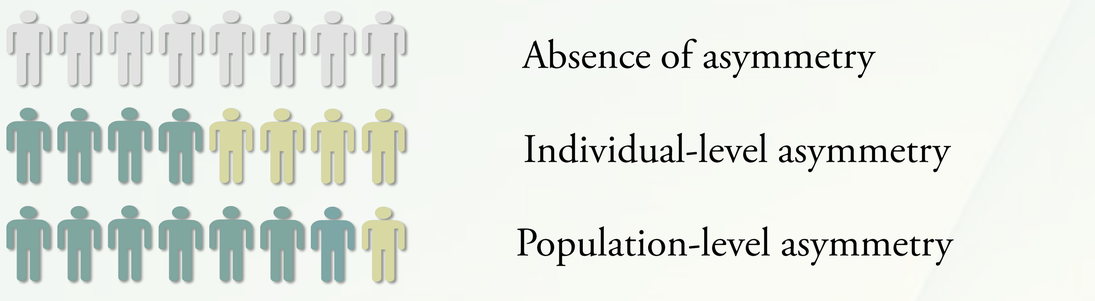


Figure 1: Forms of limb preference, where individuals can be either right-handers, left-handers, or none.

METHODS

- Advanced searches in bibliometric databases like Google Scholar, Scopus, Web of Science … using a selection of keywords with Boolean operators, with a particular emphasis on results published in the last 10 years.
- Multiple sources: >160 articles, 3 books, 13 thesis, 5 videos…
- Interdisciplinarity: Biology, Archaeology, Psychology…

OBJECTIVE: To provide a synthesis on the origin and evolution of handedness in humans, regarding both its social and biological components (with a special focus on the latter).

RESULTS I: HUMAN HANDEDNESS (HH)

A bias of up to 10 % for left-handers is commonly reported.

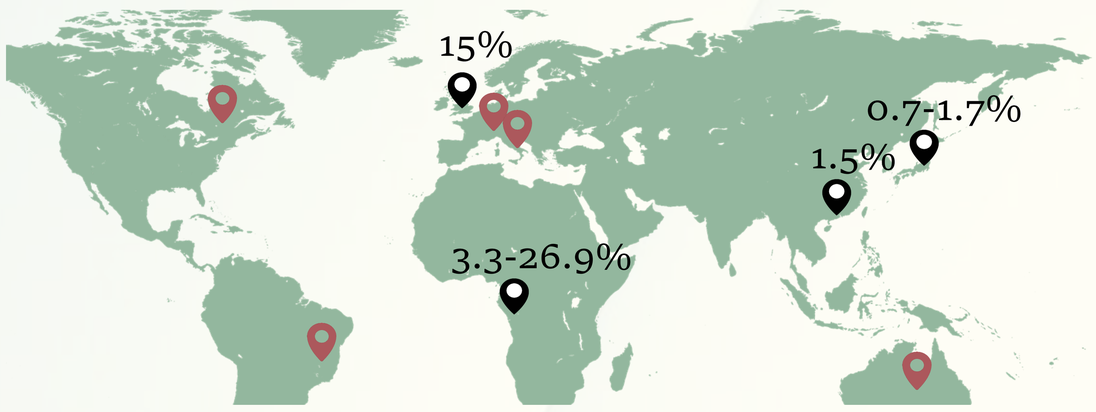


Figure 2: Variation in the frequencies of left-handers across the world (**black**) and reviewed cases of "generational effects" (pink), where frequencies increased after social pressure against them receded.

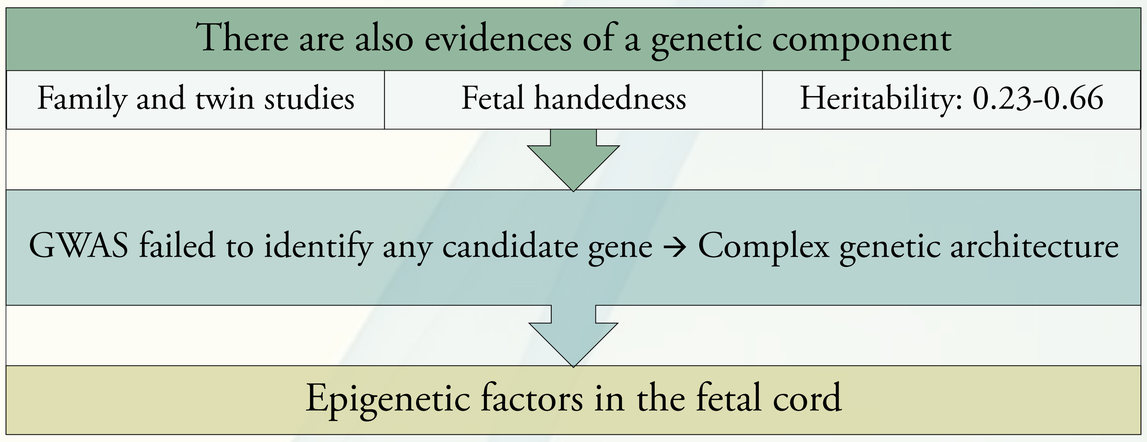


Figure 3: Schematic representation of current research on the molecular causes of handedness

RESULTS II: THE PHYLOHENY OF HANDEDNESS

- Most mammals and bipedal marsupials, display handedness.
- The evolutionary origin of human handedness (☆) is uncertain: "tool-use hypothesis" vs "postural origins hypothesis", etc.

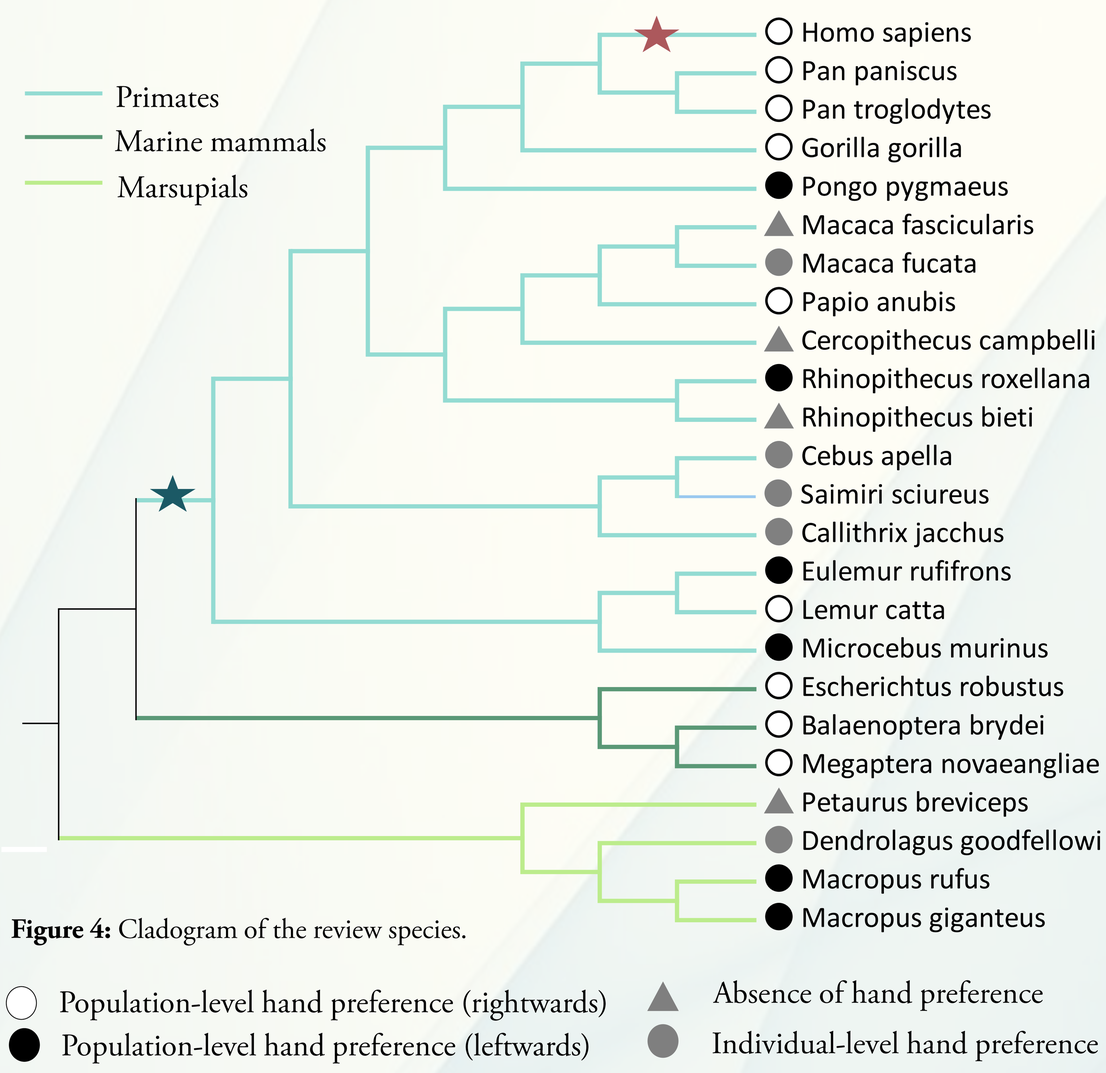
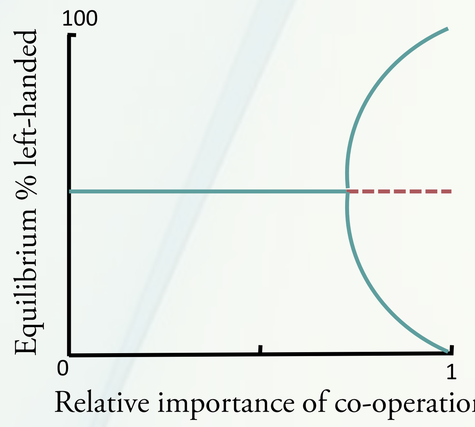


Figure 4: Cladogram of the review species.

○ Population-level hand preference (rightwards)
● Population-level hand preference (leftwards)
▲ Absence of hand preference
● Individual-level hand preference

RESULTS III: THE EVOLUTION OF HH

- Human handedness can be traced back to at least 500.000 years.
- **Fighting hypothesis:** handedness is an evolutionary stable strategy resulting from the balance between:



- Competition: Frequency-dependent advantage for left-handers.
- Cooperation: Social coordination favours right-handers.

Figure 5: Percentages of left-handed individuals in the equilibrium as a function of societal cooperativity. Solid green lines indicate stable equilibria, dashed pink unstable equilibria.

CONCLUSIONS

- Both nature and nurture play a key role in human handedness, yet its precise genetic basis remains elusive.
- Handedness is a common feature in most mammals, and evolved independently multiple times in other lineages.
- Discrepancies in available literature on primate laterality prevent to elucidate the evolutionary origin of human handedness.
- A model balancing intra-specific competition and cooperation could explain the maintenance of a minority of left-handers.
- Multidisciplinary approaches are needed to cast light on this topic.

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