Vassar College Undergraduate Summer Research Institute (URSI) Symposium 2021

The Gibbon Brain Project

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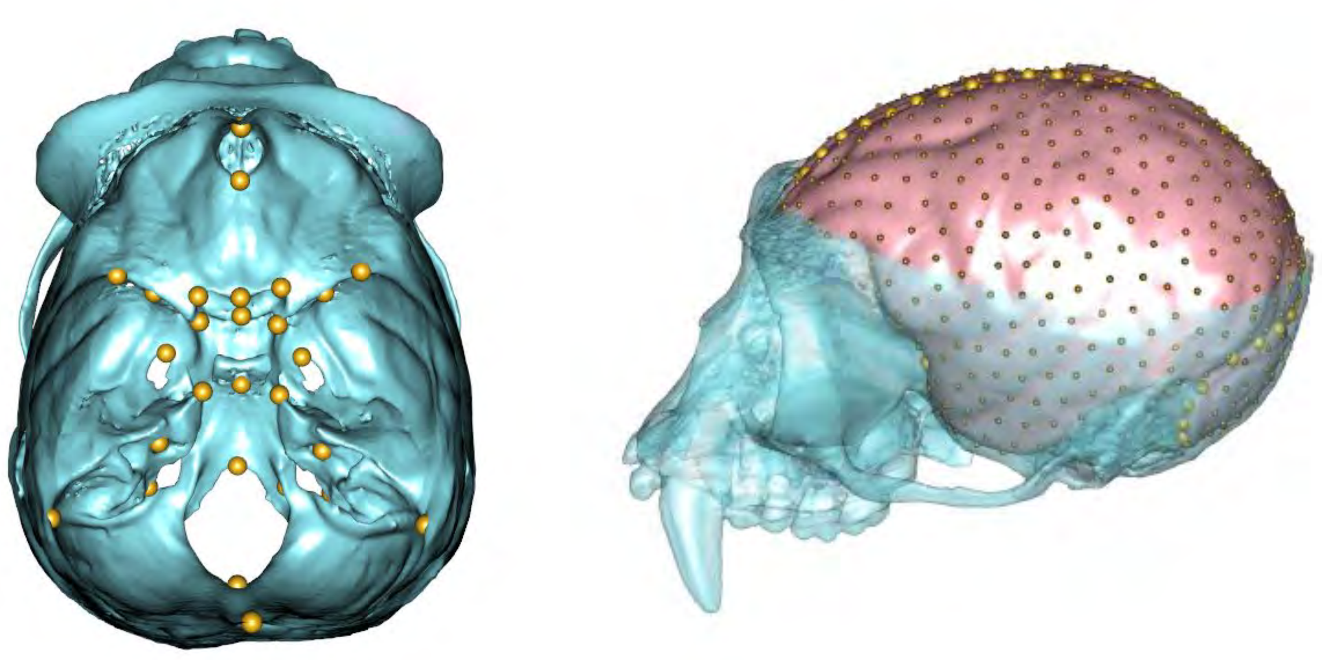
Introduction

Gibbons (*Hylobatidae*), the lesser apes, are the closest hominids to the last common ancestor of monkeys and apes (including humans), evolving and speciating in Asia around the same time period as human ancestors in Africa. Despite this similarity in timing of speciation, Gibbons remain overlooked as models in anthropological research on human evolution

Previous studies have not reached a consensus on the evolutionary path of gibbons. We used the basicranium and endocranium to investigate morphological variations and taxonomic relationships across all four gibbon genera: *Hylobates*, *Hoolock*, *Nomascus*, and *Symphalangus*.

Methodology

Using 3D meshes and computed tomography (CT) scans from the Morphosource database, each skull was landmarked with 30 basicranium landmarks based on previous studies' landmark sets, using Artec and Amira/Avizo software. The skulls were then used to create an endocast in R, which was digitally fitted with 926 landmarks encapsulating the individual's entire endocranial anatomy using Viewbox 4 software.



Discussion

Our cladograms classify Nomascus and Hylobates as sister taxa, as well as grouping Symphalangus and Hoolock together.

The cladogram generated using basicranium data is most similar to a study done using mitochondrial ND3-ND4 data (Takacs et al., 2005).

The cladogram generated using endocranium data is most similar to a study done using vocal data (Geissmann, 2003).

References

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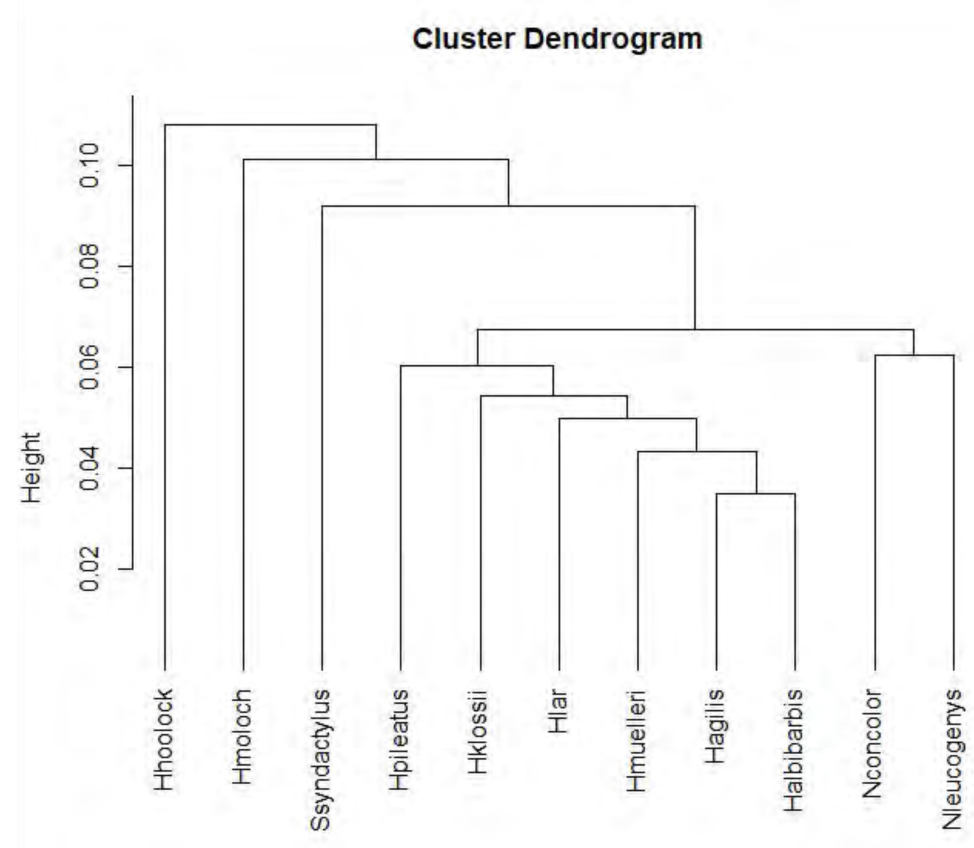
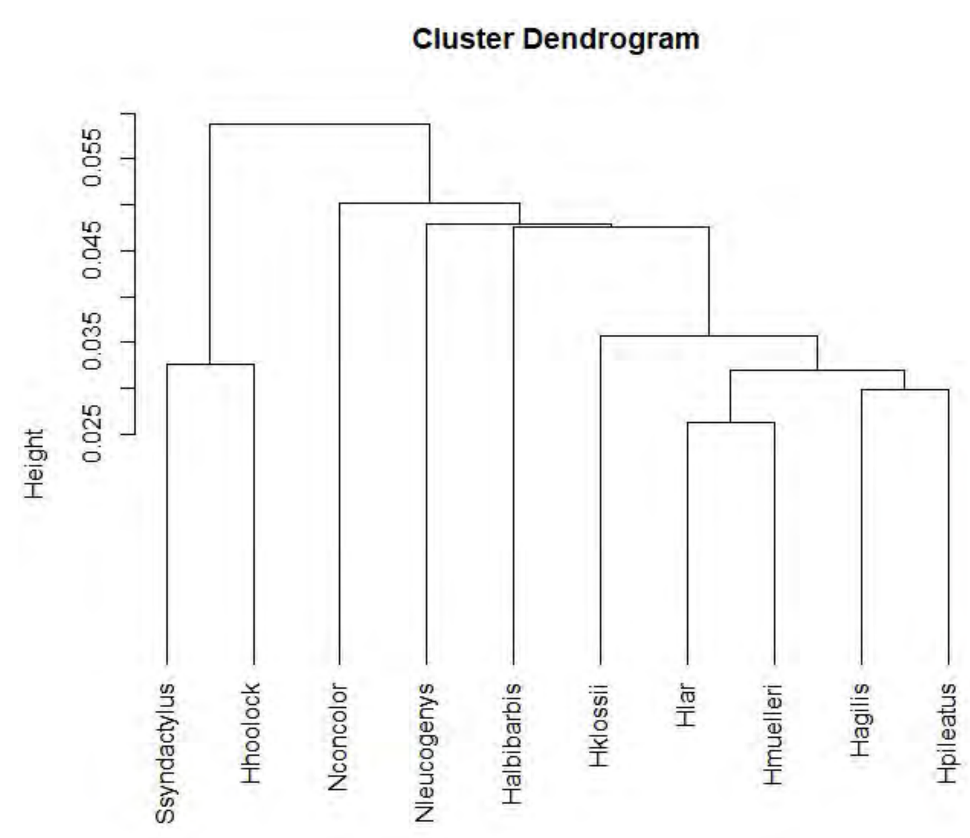
Takacs Z, Morales JC, Geissmann T, Melnick DJ. A complete species-level phylogeny of the Hylobatidae based on mitochondrial ND3-ND4 gene sequences. Molecular Phylogenetics and Evolution. 2005 Sep;36(3):456-467.

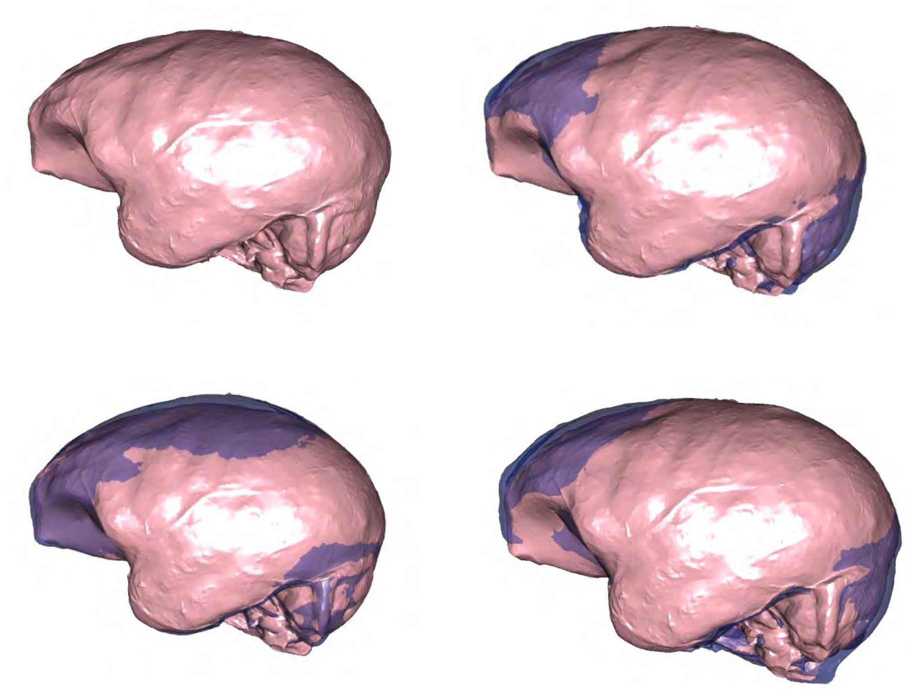
Results



Cluster dendrogram of gibbon species using basicranium data



Cluster dendrogram of gibbon species using endocranium data



Top Left: *Hylobates* consensus

Top Right: *Symphalangus* consensus superimposed on *Hylobates*

Bottom Left: *Nomascus* consensus superimposed on *Hylobates*

Bottom Right: *Hoolock* consensus superimposed on *Hylobates*

Conclusion

While our results agree with some findings of previous studies, the evolutionary history of gibbons remains unclear.

Our data generally does not corroborate recent genetic studies on gibbon evolution, which would suggest that basicranial and brain evolution are independent of neutral genetic evolution and are a result of natural selection.

Since size variation is also important to understanding relationships, we would like to analyze the data again with size data included in the analysis.

In future studies, we would like to include other hominid species as outgroups in order to give a basis for ancestral conditions.

Acknowledgements

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