

MORPHOLOGY OF THE BONY VESTIBULE IN NEANDERTHALS AND THE SIMA DE LOS HUESOS HOMININS: A COMPARATIVE MORPHOMETRIC ANALYSIS

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Extended Data & Bibliography

1. Landmark and semilandmark definitions

Landmarks and semilandmarks were selected according to Smith et al. (2023).

Nº	Anatomical description	Functional justification
1	Posteriormost point of where the lateral bony ampulla meets the bony vestibule.	Provides a superolateral boundary to the utricle, as the lateral ampulla arises from the utricular walls.
2	Superior edge of the posteriormost point on the inferior crest of the supraovalic fossa.	Indicates the posterolateral tethering of the membranous labyrinth (ML) and utricle.
3	Inferior edge of where the utricular nerve enters the vestibule.	Indicates the inferomedial boundary of the neural substrate of the utricular macula.
4	Inferior edge of the superiormost point of the utricular crest.	Indicates the superiormost bound of the curved anterior sector of the utricular macula.
5	Point at which the elliptical recess meets the spherical recess along the vestibular crest.	Medial boundary of ML attachment.
6	Inferiormost point where the posterior bony ampulla meets the vestibular aqueduct (aqueductal point).	Most reliable attachment site of the ML to the bony vestibular wall.
7	Anteriormost point of the oval window.	Anterior boundary of the oval window; approximates the anterolateral boundary of the bony saccule based on the anterior ML attachment.
8	Posteriormost point of the spherical recess.	Directly overlies the posterior tip of the saccular macula.
9	Superiormost point of the spherical recess.	Approximates the medial attachment of the ML directly superior to the saccule.
10	Most antero-inferior point of the spherical recess.	Approximation of the anterior and inferior boundaries of the spherical recess, in closest proximity to the oval window and the basal turn of the cochlea.
SemiLM1	Contour of the spherical recess (20 semilandmarks).	Captures circumference, orientation, and curvature of spherical recess
SemiLM2	Contour of the oval window (20 semilandmarks).	Captures circumference, orientation, and curvature of oval window, and thus the positioning of the stapedial footplate.

2. Interlandmark Euclidean Distances (IEDs)

Original distances defined by the authors from the landmark configuration above.

IED	Landmarks	Morphological interpretation
IED_2-5	LM2 - LM5	Distance between the inferior crest of the supraovalic fossa (LM2) and the point at which the elliptical recess meets the spherical recess along the vestibular crest (LM5); proxy for the width of the utricular region.
IED_3-4	LM3 - LM4	Distance between the utricular nerve entry point (LM3) and the apex of the utricular crest (LM4); proxy for the height of the anterior border of the elliptical recess.
IED_3-5	LM3 - LM5	Distance between the utricular nerve entry point (LM3) and the point at which the elliptical recess meets the spherical recess along the vestibular crest (LM5); proxy for the length of the inferior margin of the elliptical recess.
IED_4-5	LM4 - LM5	Distance between the apex of the utricular crest (LM4) and the point at which the elliptical recess meets the spherical recess along the vestibular crest (LM5); proxy for the length of the superior margin of the elliptical recess.
IED_6-8	LM6 - LM8	Distance between the aqueductal point (LM6) and the posterior portion of the spherical recess (LM8); proxy for the spatial relationship between the vestibular aqueduct and the spherical recess.
IED_7-10	LM7 - LM10	Distance between the anteriormost point of the oval window (LM7) and the antero-inferior boundary of the spherical recess (LM10); proxy for the spatial relationship between the oval window and the spherical recess.

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