TITLE:
3D models related to the publication: Morphogenesis of the inner ear at different stages of normal human development

AUTHOR(S):
Toyoda, Saki; Shiraki, Naoto; Yamada, Shigehito; Uwabe, Chigako; Imai, Hirohiko; Matsuda, Tetsuya; Yoneyama, Akio; Takeda, Tohoru; Takakuwa, Tetsuya

CITATION:

ISSUE DATE:
2015-10-22

URL:
http://hdl.handle.net/2433/226524

RIGHT:
© Copyright Tetsuya Takakuwa 2015; All 3D data presented on this website are licensed under a Creative Commons Attribution-NonCommercial 4.0 International License. This implicates that they can be re-used in other scientific publications provided that you cite the associated publication, refer to their M3 unique identification code(s) and thank the institutions curating the physical specimens out of which the 3D representations have been produced in your publication.
3D models related to the publication: Morphogenesis of the inner ear at different stages of normal human development

TOYODA S1, SHIRAKI N1, YAMADA S1,2, UWABE C1, IMAI H3, MATSUDA T3, YONEYAMA A4, TAKEDA T1, TAKAKUWA T1*

1 Human Health Science, Graduate School of Medicine, Kyoto University, Kyoto 606-8507, Japan
2 Congenital Anomaly Research Center, Graduate School of Medicine, Kyoto University, Kyoto 606-8501, Japan
3 Department of Systems Science, Graduate School of Informatics, Kyoto University, Kyoto 606-8507, Japan
4 Allied Health Science, Kitazato University, Kanagawa 252-0373, Japan

*corresponding author: Dr. Tetsuya Takakuwa (tez@hs.med.kyoto-u.ac.jp)


Key words: human inner ear, human embryo, magnetic resonance imaging, phase-contrast

Submitted 14.10.2015, Accepted 14.10.2015. doi: 10.18563/m3.1.3.e6
© Copyright Tetsuya Takakuwa 2015

SPECIMEN LIST

The morphogenesis of the human inner ear membranous labyrinth was visualized using images derived from human embryo specimens between Carnegie stage (CS) 17 and post embryonic phase from the Kyoto Collection, which were acquired with a phase-contrast X-ray CT (PCXT) and a magnetic resonance (MR) microscope.

<table>
<thead>
<tr>
<th>Specimen ids</th>
<th>Species</th>
<th>Developmental stage (Crown Rump Length)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M3#36_KC-CS17IER29248</td>
<td>Homo sapiens</td>
<td>Carnegie stage 17 (07.0 mm)</td>
</tr>
<tr>
<td>M3#37_KC-CS18IER17746</td>
<td>Homo sapiens</td>
<td>Carnegie stage 18 (12.0 mm)</td>
</tr>
<tr>
<td>M3#38_KC-CS19IER16127</td>
<td>Homo sapiens</td>
<td>Carnegie stage 19 (13.0 mm)</td>
</tr>
<tr>
<td>M3#39_KC-CS20IER20268</td>
<td>Homo sapiens</td>
<td>Carnegie stage 20 (13.7 mm)</td>
</tr>
<tr>
<td>M3#40_KC-CS21IER28066</td>
<td>Homo sapiens</td>
<td>Carnegie stage 21 (16.7 mm)</td>
</tr>
<tr>
<td>M3#41_KC-CS22IER35233</td>
<td>Homo sapiens</td>
<td>Carnegie stage 22 (22.0 mm)</td>
</tr>
<tr>
<td>M3#42_KC-CS23IER15919</td>
<td>Homo sapiens</td>
<td>Carnegie stage 23 (32.3 mm)</td>
</tr>
<tr>
<td>M3#43_KC-FIER52730</td>
<td>Homo sapiens</td>
<td>Post embryonic phase (43.5 mm)</td>
</tr>
</tbody>
</table>

METHODS

Well-preserved human embryos between Carnegie stage (CS) 17 and the postembryonic phase during trimester 1 (approximately 6–10 weeks after fertilization) were selected from Kyoto Collection for MR microscopic imaging and phase-contrast X-ray CT (Nishimura et al., 1968; Shiota et al., 2007; O’Rahilly & Müller, 1987).

The 3D PCXT image acquisition conditions are described elsewhere (Yoneyama et al., 2011). Briefly, specimens were visualized with a phase-contrast imaging system fitted with a crystal X-ray interferometer. The system was set up at the vertical wiggler beam line (PF BL14C) of the Photon Factory in Tsukuba, Japan.

MR images were acquired using a 7T MR system (BioSpec 70/20 USR; Bruker Biospin MRI GmbH; Ettlingen, Germany) with a 35-mm-diameter 1H quadrature transmit-receive volume coil (T9988; Bruker Biospin MRI GmbH).

PCXT and MRI data from selected embryos were analyzed precisely as serial 2D and reconstructed 3D images. The structure of the inner ear was reconstructed in all samples using Amira software version 5.4.5 (Visage Imaging; Berlin, Germany). The 3D surface models were then processed with ISE-MeshTools (Lebrun, 2014); each model was orientated, tagged and labelled using this software. All tagged surfaces are provided in .vtk format, and labels in .flg format. The 3D surface models are also provided in .ply format, and can therefore be opened with a wider range of freeware.

This study was approved by The Committee of Medical Ethics of Kyoto University Graduate School of Medicine, Kyoto, Japan (E986).


ACKNOWLEDGEMENTS

This study was supported by Grant Nos. 25461642, 24119002, 26220004, 15H01119, 15K08134, 15H05270, 15H01121, and 15K15014 from the Japan Society for the Promotion of Science.

This work has been performed under the approval of the Photon Factory Program Advisory Committee (Proposal No. 2013G514, 2012G138, 2014G018, and 2015G574).

BIBLIOGRAPHY
