Acknowledgements for BrainAtlas

Hybrid Destrieux-Desikan

The provided brain atlas is based on the cortical parcellations described by Destrieux et al. 2010 and Desikan et al. 2006. Region boundaries were identified by automatic segmentation of structural MRI images, which provides approximate localizations of the involved regions. The Hypothalamus in this Atlas is an artist's reconstruction, and is included for educational purposes only. Regions identified using anatomical features may only partly overlap with region boundaries that are defined by means of e.g. functional activation or histological examination.

Destrieux, Christophe, Bruce Fischl, Anders Dale, and Eric Halgren. "Automatic parcellation of human cortical gyri and sulci using standard anatomical nomenclature." Neuroimage 53, no. 1 (2010): 1-15.

Desikan, Rahul S., Florent Ségonne, Bruce Fischl, Brian T. Quinn, Bradford C. Dickerson, Deborah Blacker, Randy L. Buckner et al. "An automated labeling system for subdividing the human cerebral cortex on MRI scans into gyral based regions of interest." Neuroimage 31, no. 3 (2006): 968-980.

Klomp A1, Koolschijn PC, Hulshoff Pol HE, Kahn RS, Haren NE. “Hypothalamus and pituitary volume in schizophrenia: a structural MRI study.” Int J Neuropsychopharmacol. 2012 Mar;15(2):281-8.

Cytologic & Von Economo

This provided brain atlas was built primarily from the data provided in the paper "An mri von economo–koskinas atlas" by Lianne H. Scholten, Marcel A. de Reus, Siemon C. de Lange, Ruben Schmidt, and Martijn P van den Heuvel. The atlas is based on the cortical parcellations and cytologic information described by Von Economo and Koskinas based their mappings on detailed analysis and observations of several healthy brains in 1925. Region boundaries were identified manually from an unknown quantity of persons in the range of 30 - 40 years old, of unknown gender. The Von Economo atlas exists historically as a painted plaster model, but here the mapping has been applied to a modern MRI of an individual's brain for educational purposes.

For more info, please visit: http://www.dutchconnectomelab.nl/economo/

Scholtens, L. H., de Reus, M. A., de Lange, S. C., Schmidt, R., & van den Heuvel, M. P. (2018). An mri von economo–koskinas atlas. NeuroImage, 170, 249-256.

Glasser parcellated 3d model

The 3d model of the Glasser atlas was provided [in part] by the Human Connectome Project, WU-Minn Consortium (Principal Investigators: David Van Essen and Kamil Ugurbil; 1U54MH091657) funded by the 16 NIH Institutes and Centers that support the NIH Blueprint for Neuroscience Research; and by the McDonnell Center for Systems Neuroscience at Washington University.

Matthew F. Glasser, Timothy S. Coalson, Emma C. Robinson, Carl D. Hacker, John Harwell, Essa Yacoub, Kamil Ugurbil, Jesper Andersson, Christian F. Beckmann, Mark Jenkinson, Stephen M. Smith and David C. Van Essen, "A multi-modal parcellation of human cerebral cortex" Nature, 2016.
doi:10.1038/nature18933

Pathways Visualisations

The underlying data is created with usage of databases SCAIView (https://academia.scaiview.com) and NeuroMMSIg (https://neurommsig.scai.fraunhofer.de). These are based on the following works:

Dörpinghaus, Jens, Jürgen Klein, Johannes Darms, Sumit Madan, and Marc Jacobs. "Scaiview-a Semantic Search Engine for Biomedical Research Utilizing a Microservice Architecture." Paper presented at the SEMANTICS Posters&Demos, 2018.

Domingo-Fernández, Daniel, Alpha Tom Kodamullil, Anandhi Iyappan, Mufassra Naz, Mohammad Asif Emon, Tamara Raschka, Reagon Karki*, et al.* "Multimodal Mechanistic Signatures for Neurodegenerative Diseases (Neurommsig): A Web Server for Mechanism Enrichment." *Bioinformatics* 33, no. 22 (2017): 3679-81.
https://doi.org/10.1093/bioinformatics/btx399.
https://doi.org/10.1093/bioinformatics/btx399

The methods will be described here:
Stefanovski. L, K. Bülau, L. Martin, J. Courtiol, M. Diaz-Cortes, C. Langford, J. Palmer, P. Triebkorn, A. T. Kodamullil, M. Hoffmann-Apitius, and P. Ritter (1,4); for the Alzheimer's Disease Neuroimaging Database. Mapping of Alzheimer's Disease in The Virtual Brain (unpublished)

Braak Visualisations

The Braak stages correspond to the depositions stages of Amyloid-beta and Tau protein as described in Braak and Braak 1991, Braak and Braak 1997, and Braak et al. 2006.

Braak, Heiko, and Eva Braak. "Neuropathological Stageing of Alzheimer-Related Changes." *Acta neuropathologica* 82, no. 4 (1991): 239-59.

Braak, H., and E. Braak. "Frequency of Stages of Alzheimer-Related Lesions in Different Age Categories." *Neurobiol Aging* 18, no. 4 (Jul-Aug 1997): 351-7.
http://www.ncbi.nlm.nih.gov/pubmed/9330961

Braak, H., I. Alafuzoff, T. Arzberger, H. Kretzschmar, and K. Del Tredici. "Staging of Alzheimer Disease-Associated Neurofibrillary Pathology Using Paraffin Sections and Immunocytochemistry." [In eng]. *Acta Neuropathol* 112, no. 4 (Oct 2006): 389-404.
https://doi.org/10.1007/s00401-006-0127-z
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3906709/pdf/401_2006_Article_127.pdf.

Receptor Visualisations

The receptor densities displayed in this atlas are taken from autoradiographic data of the Julich Cytoarchtictectonic Atlas (JuBrain) project. It has been made available via the EBRAINS platform of the Human Brain project.
Original publication for JuBrain: Amunts, Katrin, Hartmut Mohlberg, Sebastian Bludau, and Karl Zilles. "Julich-Brain: A 3d Probabilistic Atlas of the Human Brain’s Cytoarchitecture." *Science* 369, no. 6506 (2020): 988-92.
https://doi.org/10.1126/science.abb4588.
https://science.sciencemag.org/content/sci/369/6506/988.full.pdf.
Dataset: DOI: 10.25493/TAKY-64D

The receptor density data is available here:
https://search.kg.ebrains.eu/instances/Project/6c8349cc7260ae62e3b1396831a8398f

We acknowledge K. Zilles and N. Palomero-Gallagher for the publication of the data in EBRAINS.Original publication of the data: Zilles, K., Bacha-Trams, M., Palomero-Gallagher, N., Amunts, K., & Friederici, A. D. (2015). Common molecular basis of the sentence comprehension network revealed by neurotransmitter receptor fingerprints. Cortex, 63, 79–89.

Datasets used for the maps of this interactive atlas:

Area	Reference
Area hOc1 (V1, 17, CalcS)	DOI: 10.25493/P8SD-JMH
Anterior Thalamic nucleus	DOI: 10.25493/KKTT-1TK
Area 3b (PostCG)	DOI: 10.25493/TZBY-96W
Area 45 (IFG)	DOI: 10.25493/QFSY-YWC
Area 46	DOI: 10.25493/JHA2-ACG
Area 47	DOI: 10.25493/4M1R-KCP
Area 4p (PreCG)	DOI: 10.25493/J5JR-YH0
Area 7A (SPL)	DOI: 10.25493/DQJ7-KC8
Area 9	DOI: 10.25493/97BA-87Y
Area FG1 (FusG)	DOI: 10.25493/QN6K-CHN
Area FG2 (FusG)	DOI: 10.25493/VFCW-HXZ
Area PF (IPL)	DOI: 10.25493/VSFY-EYF
Area PFcm (IPL)	DOI: 10.25493/5QDP-ARH
Area PFm (IPL)	DOI: 10.25493/FS3T-2R8
Area PFop (IPL)	DOI: 10.25493/9G1P-02S
Area PFt (IPL)	DOI: 10.25493/E7PM-FDC
Area PGa (IPL)	DOI: 10.25493/62W8-RYF
Area PGp (IPL)	DOI: 10.25493/X71T-HZ
Area TE 1.0 (HESCHL)	DOI: 10.25493/AHX0-9PU

Area TE 2.1 (STG)	DOI: 10.25493/C279-428
CA1 (Hippocampus)	DOI: 10.25493/Y7YV-6Q6
CA2 (Hippocampus)	DOI: 10.25493/4F4S-W5A
CA3 (Hippocampus)	DOI: 10.25493/XFHR-X41
DG (Hippocampus)	DOI: 10.25493/M8PK-C82
Dorsal part of Area 44 (IFG)	DOI: 10.25493/YQCR-1DQ
Dorsal part of Area hOc2 (V2, 18)	DOI: 10.25493/ZJ7E-KXZ
Dorsal part of Area hOc3 (Cuneus)	DOI: 10.25493/4ETW-9XB
Globus pallidus	DOI: 10.25493/TPRG-5VH
Mediodorsal part of the thalamic nucleus	DOI: 10.25493/GKY8-NZR
Putamen	DOI: 10.25493/4GZ1-SHH
stratum cellulare of CA (Hippocampus)	DOI: 10.25493/9DDZ-SJP
stratum moleculare of CA (Hippocampus)	DOI: 10.25493/KYZ2-4GM
ventral part of Area hOc2 (V2, 18)	DOI: 10.25493/2E5C-PVM
ventral part of Area hOc3 (LingG)	DOI: 10.25493/TBMX-BZ9
Ventral part of rea 44 (IFG)	DOI: 10.25493/P82M-PVM

Methods are described in:

- Scheperjans, F., Palomero-Gallagher, N., Grefkes, C., Schleicher, A., & Zilles, K. (2005). Transmitter receptors reveal segregation of cortical areas in the human superior parietal cortex: Relations to visual and somatosensory regions. NeuroImage, 28(2), 362–379. DOI: 10.1016/j.neuroimage.2005.06.028

- Eickhoff, S. B., Schleicher, A., Scheperjans, F., Palomero-Gallagher, N., & Zilles, K. (2007). Analysis of neurotransmitter receptor distribution patterns in the cerebral cortex. NeuroImage, 34(4), 1317–1330. DOI: 10.1016/j.neuroimage.2006.11.016
- Caspers, J., Palomero-Gallagher, N., Caspers, S., Schleicher, A., Amunts, K., & Zilles, K. (2013). Receptor architecture of visual areas in the face and word-form recognition region of the posterior fusiform gyrus. Brain Structure and Function, 220(1), 205–219. DOI: 10.1007/s00429-013-0646-z
- Amunts, K., Lenzen, M., Friederici, A. D., Schleicher, A., Morosan, P., Palomero-Gallagher, N., & Zilles, K. (2010). Broca's Region: Novel Organizational Principles and Multiple Receptor Mapping. PLoS Biology, 8(9), e1000489. DOI: 10.1371/journal.pbio.1000489
- Zilles, K., Bacha-Trams, M., Palomero-Gallagher, N., Amunts, K., & Friederici, A. D. (2015). Common molecular basis of the sentence comprehension network revealed by neurotransmitter receptor fingerprints. Cortex, 63, 79–89. DOI: 10.1016/j.cortex.2014.07.007
- Caspers, S., Schleicher, A., Bacha-Trams, M., Palomero-Gallagher, N., Amunts, K., & Zilles, K. (2012). Organization of the Human Inferior Parietal Lobule Based on Receptor Architectonics. Cerebral Cortex, 23(3), 615–628. DOI: 10.1093/cercor/bhs048
- Zilles, K. and Palomero-Gallagher, N. (2017). 2.12 - Comparative Analysis of Receptor Types That Identify Primary Cortical Sensory Areas. In *Evolution of Nervous Systems* (Second Edition), pp.225-245. DOI: 10.1016/B978-0-12-804042-3.00043-9

For more information please contact Brain Simulation Section at the Charité University Medicine Berlin, head Prof. Dr. Petra Ritter, petra.ritter@charite.de