

University of Groningen

Functional magnetic resonance imaging of tinnitus

Lanting, Cornelis Pieter

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version

Publisher's PDF, also known as Version of record

Publication date:

2010

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Lanting, C. P. (2010). *Functional magnetic resonance imaging of tinnitus*. s.n.

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

References

- Abdul-Baqi, K.J., 2004. Objective high-frequency tinnitus of middle-ear myoclonus. *J Laryngol Otol*, 118(3):231–233. doi: <http://dx.doi.org/10.1258/002221504322928044>.
- Abel, M.D. and Levine, R.A., 2004. Muscle contractions and auditory perception in tinnitus patients and nonclinical subjects. *Cranio*, 22(3):181–191.
- Adjamian, P., Sereda, M., and Hall, D.A., 2009. The mechanisms of tinnitus: perspectives from human functional neuroimaging. *Hear Res*, 253(1–2):15–31. doi: <http://dx.doi.org/10.1016/j.heares.2009.04.001>.
- Alain, C., Arnott, S.R., Hevenor, S., Graham, S., and Grady, C.L., 2001. "What" and "where" in the human auditory system. *Proc Natl Acad Sci U S A*, 98(0027–8424 (Print)):12301–6.
- Albuquerque, W. and Bronstein, A.M., 2004. "Doctor, I can hear my eyes": report of two cases with different mechanisms. *J Neurol Neurosurg Psychiatry*, 75(0022–3050):1363–4.
- Amunts, K., Kedo, O., Kindler, M., Pieperhoff, P., Mohlberg, H., Shah, N.J., Habel, U., Schneider, F., and Zilles, K., 2005. Cytoarchitectonic mapping of the human amygdala, hippocampal region and entorhinal cortex: intersubject variability and probability maps. *Anat Embryol (Berl)*, 210(5–6):343–52. doi: <http://dx.doi.org/10.1007/s00429-005-0025-5>.
- Andersson, G., Lyttkens, L., Hirvela, C., Furmark, T., Tillfors, M., and Fredrikson, M., 2000. Regional cerebral blood flow during tinnitus: a PET case study with lidocaine and auditory stimulation. *Acta Otolaryngol*, 120(8):967–972.
- Andersson, J.L.R., Skare, S., and Ashburner, J., 2003. How to correct susceptibility distortions in spin-echo echo-planar images: application to diffusion tensor imaging. *Neuroimage*, 20(2):870–88. doi: [http://dx.doi.org/10.1016/S1053-8119\(03\)00336-7](http://dx.doi.org/10.1016/S1053-8119(03)00336-7).
- Anwander, A., Tittgemeyer, M., von Cramon, D.Y., Friederici, A.D., and Knösche, T.R., 2007. Connectivity-Based Parcellation of Broca's Area. *Cereb Cortex*, 17(4):816–25. doi: <http://dx.doi.org/10.1093/cercor/bhk034>.
- Arnold, W., Bartenstein, P., Oestreicher, E., Romer, W., and Schwaiger, M., 1996. Focal metabolic activation in the predominant left auditory cortex in patients suffering from tinnitus: a PET study with [¹⁸F]deoxyglucose. *ORL J Otorhinolaryngol Relat Spec*, 58(4):195–199.
- Ashburner, J. and Friston, K.J., 2000. Voxel-based morphometry—the methods. *Neuroimage*, 11(1053–8119 (Print)):805–21.
- Axelsson, A. and Ringdahl, A., 1989. Tinnitus—a study of its prevalence and characteristics. *Br J Audiol*, 23(1):53–62.

- Baguley, D.M., Phillips, J., Humphriss, R.L., Jones, S., Axon, P.R., and Moffat, D.A., 2006. The prevalence and onset of gaze modulation of tinnitus and increased sensitivity to noise after translabyrinthine vestibular schwannoma excision. *Otol Neurotol*, 27(2):220–224. doi: <http://dx.doi.org/10.1097/01.mao.0000172412.87778.28>.
- Barrs, D. and Brackmann, D., 1984. Translabyrinthine nerve section: effect on tinnitus. *J Laryngol. Otol. Suppl.*, 9:287–293.
- Bartels, H., 2008. *Tinnitus, new insights into pathophysiology, diagnosis and treatment*. Ph.D. thesis, Rijksuniversiteit Groningen.
- Basser, P.J., Mattiello, J., and LeBihan, D., 1994. Estimation of the effective self-diffusion tensor from the NMR spin echo. *J Magn Reson B*, 103(3):247–54.
- Basser, P.J., Pajevic, S., Pierpaoli, C., Duda, J., and Aldroubi, A., 2000. In vivo fiber tractography using DT-MRI data. *Magn Reson Med*, 44(4):625–32.
- Basta, D., Goetze, R., and Ernst, A., 2008. Effects of salicylate application on the spontaneous activity in brain slices of the mouse cochlear nucleus, medial geniculate body and primary auditory cortex. *Hear Res*, 240(1–2):42–51. doi: <http://dx.doi.org/10.1016/j.heares.2008.02.005>.
- Baumgart, F., Kaulisch, T., Tempelmann, C., Gaschler-Markefski, B., Tegeler, C., Schindler, F., Stiller, D., and Scheich, H., 1998. Electrodynamical headphones and woofers for application in magnetic resonance imaging scanners. *Med Phys*, 25(10):2068–2070.
- Beard, A.W., 1965. Results of leucotomy operations for tinnitus. *J Psychosom Res*, 9(1):29–32.
- Beauchamp, M.S., Yasar, N.E., Frye, R.E., and Ro, T., 2008. Touch, sound and vision in human superior temporal sulcus. *Neuroimage*, 41(3):1011–20. doi: <http://dx.doi.org/10.1016/j.neuroimage.2008.03.015>.
- Beaulieu, C., 2002. The basis of anisotropic water diffusion in the nervous system - a technical review. *NMR Biomed*, 15(7–8):435–55. doi: <http://dx.doi.org/10.1002/nbm.782>.
- Behrens, T.E.J., Berg, H.J., Jbabdi, S., Rushworth, M.F.S., and Woolrich, M.W., 2007. Probabilistic diffusion tractography with multiple fibre orientations: What can we gain? *Neuroimage*, 34(1):144–155. doi: <http://dx.doi.org/10.1016/j.neuroimage.2006.09.018>.
- Behrens, T.E.J., Woolrich, M.W., Jenkinson, M., Johansen-Berg, H., Nunes, R.G., Clare, S., Matthews, P.M., Brady, J.M., and Smith, S.M., 2003. Characterization and propagation of uncertainty in diffusion-weighted MR imaging. *Magn Reson Med*, 50(5):1077–88. doi: <http://dx.doi.org/10.1002/mrm.10609>.
- Belin, P., Zatorre, R.J., Hoge, R., Evans, A.C., and Pike, B., 1999. Event-related fMRI of the auditory cortex. *Neuroimage*, 10(4):417–429. doi: <http://dx.doi.org/10.1006/nimg.1999.0480>.
- Berliner, K.I., Shelton, C., Hitselberger, W.E., and Luxford, W.M., 1992. Acoustic tumors: effect of surgical removal on tinnitus. *Am J Otol*, 13(1):13–17.
- Binder, J.R., Rao, S.M., Hammeke, T.A., Yetkin, F.Z., Jesmanowicz, A., Bandettini, P.A., Wong, E.C., Estkowski, L.D., Goldstein, M.D., and Haughton, V.M., 1994. Functional magnetic resonance imaging of human auditory cortex. *Ann Neurol*, 35(6):662–672. doi: <http://dx.doi.org/10.1002/ana.410350606>.
- Brett, M., Johnsrude, I.S., and Owen, A.M., 2002. The problem of functional localization in the human brain. *Nat Rev Neurosci*, 3(3):243–9. doi: <http://dx.doi.org/10.1038/nrn756>.
- Brodmann, K., 1909. *Brodmann's localisation in the cerebral cortex*. Springer Science+Business Media,

- Inc.
- Brozoski, T.J., Ciobanu, L., and Bauer, C.A., 2007. Central neural activity in rats with tinnitus evaluated with manganese-enhanced magnetic resonance imaging (MEMRI). *Hear Res*, 228(1-2):168–179. doi: <http://dx.doi.org/10.1016/j.heares.2007.02.003>.
- Buxton, R.B. and Frank, L.R., 1997. A model for the coupling between cerebral blood flow and oxygen metabolism during neural stimulation. *J Cereb Blood Flow Metab*, 17(1):64–72. doi: <http://dx.doi.org/10.1097/00004647-199701000-00009>.
- Cacace, A.T., Cousins, J.P., Parnes, S.M., McFarland, D.J., Semenoff, D., Holmes, T., Davenport, C., Stegbauer, K., and Lovely, T.J., 1999a. Cutaneous-evoked tinnitus. II. Review Of neuroanatomical, physiological and functional imaging studies. *Audiol Neurootol*, 4(5):258–268.
- Cacace, A.T., Cousins, J.P., Parnes, S.M., Semenoff, D., Holmes, T., McFarland, D.J., Davenport, C., Stegbauer, K., and Lovely, T.J., 1999b. Cutaneous-evoked tinnitus. I. Phenomenology, psychophysics and functional imaging. *Audiol Neurootol*, 4(5):247–257.
- Cacace, A.T., Lovely, T.J., McFarland, D.J., Parnes, S.M., and Winter, D.F., 1994a. Anomalous cross-modal plasticity following posterior fossa surgery: some speculations on gaze-evoked tinnitus. *Hear Res*, 81(1-2):22–32.
- Cacace, A.T., Lovely, T.J., Winter, D.F., Parnes, S.M., and McFarland, D.J., 1994b. Auditory perceptual and visual-spatial characteristics of gaze-evoked tinnitus. *Audiology*, 33(5):291–303.
- Cacace, A.T., 2003. Expanding the biological basis of tinnitus: crossmodal origins and the role of neuroplasticity. *Hear Res*, 175(0378-5955):112–32.
- Calvert, G.A., 2001. Crossmodal processing in the human brain: insights from functional neuroimaging studies. *Cereb Cortex*, 11(12):1110–1123.
- Calvert, G.A., Brammer, M.J., Bullmore, E.T., Campbell, R., Iversen, S.D., and David, A.S., 1999. Response amplification in sensory-specific cortices during crossmodal binding. *Neuroreport*, 10(12):2619–23.
- Calvert, G.A., Hansen, P.C., Iversen, S.D., and Brammer, M.J., 2001. Detection of audio-visual integration sites in humans by application of electrophysiological criteria to the BOLD effect. *Neuroimage*, 14(2):427–438. doi: <http://dx.doi.org/10.1006/nimg.2001.0812>.
- Chandler, J.R., 1983. Diagnosis and cure of venous hum tinnitus. *Laryngoscope*, 93(7):892–895.
- Chittka, L. and Brockmann, A., 2005. Perception space—the final frontier. *PLoS Biol*, 3(4):e137. doi: <http://dx.doi.org/10.1371/journal.pbio.0030137>.
- Chole, R.A. and Parker, W.S., 1992. Tinnitus and vertigo in patients with temporomandibular disorder. *Arch Otolaryngol Head Neck Surg*, 118(8):817–821.
- Coad, M.L., Lockwood, A., Salvi, R., and Burkard, R., 2001. Characteristics of patients with gaze-evoked tinnitus. *Otol Neurotol*, 22(5):650–654.
- Cullington, H., 2001. Tinnitus evoked by finger movement: brain plasticity after peripheral deaf-ferentation. *Neurology*, 56(7):978.
- Dalgleish, T., 2004. The emotional brain. *Nat Rev Neurosci*, 5(7):583–589. doi: <http://dx.doi.org/10.1038/nrn1432>.
- Dallos, P., 2008. Cochlear amplification, outer hair cells and prestin. *Curr Opin Neurobiol*, 18(4):370–6. doi: <http://dx.doi.org/10.1016/j.conb.2008.08.016>.
- Darlington, C.L. and Smith, P.F., 2007. Drug treatments for tinnitus. *Prog Brain Res*, 166:249–262.
-

- doi: [http://dx.doi.org/10.1016/S0079-6123\(07\)66023-3](http://dx.doi.org/10.1016/S0079-6123(07)66023-3).
- Dauguet, J., Peled, S., Berezovskii, V., Delzescaux, T., Warfield, S.K., Born, R., and Westin, C.F., 2007. Comparison of fiber tracts derived from in-vivo DTI tractography with 3D histological neural tract tracer reconstruction on a macaque brain. *Neuroimage*, 37(2):530–8. doi: <http://dx.doi.org/10.1016/j.neuroimage.2007.04.067>.
- De Groof, G., Verhoye, M., Van Meir, V., Tindemans, I., Leemans, A., and Van der Linden, A., 2006. In vivo diffusion tensor imaging (DTI) of brain subdivisions and vocal pathways in songbirds. *Neuroimage*, 29(3):754–63. doi: <http://dx.doi.org/10.1016/j.neuroimage.2005.09.022>.
- Dehmel, S., Cui, Y.L., and Shore, S.E., 2008. Cross-modal interactions of auditory and somatic inputs in the brainstem and midbrain and their imbalance in tinnitus and deafness. *Am J Audiol*, 17(2):S193–209. doi: [http://dx.doi.org/10.1044/1059-0889\(2008\)07-0045](http://dx.doi.org/10.1044/1059-0889(2008)07-0045).
- Deichmann, R., Josephs, O., Hutton, C., Corfield, D.R., and Turner, R., 2002. Compensation of susceptibility-induced BOLD sensitivity losses in echo-planar fMRI imaging. *Neuroimage*, 15(1):120–35. doi: <http://dx.doi.org/10.1006/nimg.2001.0985>.
- D’Esposito, M., Deouell, L.Y., and Gazzaley, A., 2003. Alterations in the BOLD fMRI signal with ageing and disease: a challenge for neuroimaging. *Nat Rev Neurosci*, 4(11):863–872. doi: <http://dx.doi.org/10.1038/nrn1246>.
- Detre, J.A. and Wang, J., 2002. Technical aspects and utility of fMRI using BOLD and ASL. *Clin Neurophysiol*, 113(5):621–634.
- Devlin, J.T., Raley, J., Tunbridge, E., Lanary, K., Floyer-Lea, A., Narain, C., Cohen, I., Behrens, T., Jezzard, P., Matthews, P.M., and Moore, D.R., 2003. Functional asymmetry for auditory processing in human primary auditory cortex. *J Neurosci*, 23(1529-2401):11516–22.
- Dierks, T., Linden, D.E., Jandl, M., Formisano, E., Goebel, R., Lanfermann, H., and Singer, W., 1999. Activation of Heschl’s gyrus during auditory hallucinations. *Neuron*, 22(3):615–621.
- Eggermont, J.J., 2006. Cortical tonotopic map reorganization and its implications for treatment of tinnitus. *Acta Otolaryngol Suppl*, (556):9–12. doi: <http://dx.doi.org/10.1080/03655230600895259>.
- Eggermont, J.J. and Kenmochi, M., 1998. Salicylate and quinine selectively increase spontaneous firing rates in secondary auditory cortex. *Hear Res*, 117(1-2):149–160.
- Eggermont, J.J., 2005. Tinnitus: neurobiological substrates. *Drug Discov Today*, 10(19):1283–1290. doi: [http://dx.doi.org/10.1016/S1359-6446\(05\)03542-7](http://dx.doi.org/10.1016/S1359-6446(05)03542-7).
- Eggermont, J.J., 2007a. Correlated neural activity as the driving force for functional changes in auditory cortex. *Hear Res*, 229(1-2):69–80. doi: <http://dx.doi.org/10.1016/j.heares.2007.01.008>.
- Eggermont, J.J., 2007b. Pathophysiology of tinnitus. *Prog Brain Res*, 166:19–35. doi: [http://dx.doi.org/10.1016/S0079-6123\(07\)66002-6](http://dx.doi.org/10.1016/S0079-6123(07)66002-6).
- Eggermont, J.J. and Roberts, L.E., 2004. The neuroscience of tinnitus. *Trends Neurosci*, 27(11):676–682. doi: <http://dx.doi.org/10.1016/j.tins.2004.08.010>.
- Ehret, G. and Romand, R., editors, 1997. *The Central Auditory System*. Oxford University Press.
- Eickhoff, S.B., Paus, T., Caspers, S., Grosbras, M.H., Evans, A.C., Zilles, K., and Amunts, K., 2007. Assignment of functional activations to probabilistic cytoarchitectonic areas revisited. *Neuroimage*, 36(3):511–521. doi: <http://dx.doi.org/10.1016/j.neuroimage.2007.03.060>.
- Eickhoff, S.B., Stephan, K.E., Mohlberg, H., Grefkes, C., Fink, G.R., Amunts, K., and Zilles, K.,

2005. A new SPM toolbox for combining probabilistic cytoarchitectonic maps and functional imaging data. *Neuroimage*, 25(4):1325–35. doi: <http://dx.doi.org/10.1016/j.neuroimage.2004.12.034>.
- Elliott, L.L., 1994. Functional brain imaging and hearing. *J Acoust Soc Am*, 96(3):1397–1408.
- Formby, C., Sherlock, L.P., and Gold, S.L., 2003. Adaptive plasticity of loudness induced by chronic attenuation and enhancement of the acoustic background. *J Acoust Soc Am*, 114(1):55–58.
- Formisano, E., Kim, D.S., Di Salle, F., van de Moortele, P.F., Ugurbil, K., and Goebel, R., 2003. Mirror-symmetric tonotopic maps in human primary auditory cortex. *Neuron*, 40(4):859–69.
- Fox, G.N. and Baer, M.T., 1991. Palatal myoclonus and tinnitus in children. *West J Med*, 154(1):98–102.
- Foxe, J.J., Morocz, I.A., Murray, M.M., Higgins, B.A., Javitt, D.C., and Schroeder, C.E., 2000. Multisensory auditory-somatosensory interactions in early cortical processing revealed by high-density electrical mapping. *Brain Res Cogn Brain Res*, 10(1-2):77–83.
- Foxe, J.J., Wylie, G.R., Martinez, A., Schroeder, C.E., Javitt, D.C., Guilfoyle, D., Ritter, W., and Murray, M.M., 2002. Auditory-somatosensory multisensory processing in auditory association cortex: an fMRI study. *J Neurophysiol*, 88(1):540–543.
- Friston, K.J., Holmes, A.P., and Worsley, K.J., 1999. How many subjects constitute a study? *Neuroimage*, 10(1053-8119):1–5.
- Friston, K., 1994. Functional and effective connectivity in neuroimaging: A synthesis. *Human Brain Mapping*, 2 (1-2):56–78.
- Giraud, A.L., Chery-Croze, S., Fischer, G., Fischer, C., Vighetto, A., Gregoire, M.C., Lavenne, F., and Collet, L., 1999. A selective imaging of tinnitus. *Neuroreport*, 10(1):1–5.
- Glasauer, S., 2003. Cerebellar contribution to saccades and gaze holding: a modeling approach. *Ann NY Acad Sci*, 1004:206–219.
- Glickstein, M. and Doron, K., 2008. Cerebellum: Connections and Functions. *Cerebellum*, 7(4):589–94. doi: <http://dx.doi.org/10.1007/s12311-008-0074-4>.
- Golay, X., Hendrikse, J., and Lim, T.C.C., 2004. Perfusion imaging using arterial spin labeling. *Top Magn Reson Imaging*, 15(1):10–27.
- Goldberg, J.M. and Neff, W.D., 1961. Frequency discrimination after bilateral ablation of cortical auditory areas. *J Neurophysiol*, 24:119–128.
- Goncalves, M.S., Hall, D.A., Johnsrude, I.S., and Haggard, M.P., 2001. Can meaningful effective connectivities be obtained between auditory cortical regions? *Neuroimage*, 14(6):1353–1360. doi: <http://dx.doi.org/10.1006/nimg.2001.0954>.
- Good, P., 2002. Extensions Of The Concept Of Exchangeability And Their Applications. *Journal of Modern Applied Statistical Methods*, 1(2):243–247.
- Griffiths, T.D., 2000. Musical hallucinosis in acquired deafness. Phenomenology and brain substrate. *Brain*, 123(10):2065–76.
- Gu, J., Halpin, C., Nam, E., Levine, R.A., and Melcher, J.R., 2008. Elevated Sound-Evoked fMRI Activation in the Auditory Pathway of People with Tinnitus and Hyperacusis. In *Abstracts of the 31st ARO Midwinter Research Meeting*. Association for Research in Otolaryngology.
- Gusnard, D.A., Raichle, M.E., and Raichle, M.E., 2001. Searching for a baseline: functional imaging and the resting human brain. *Nat Rev Neurosci*, 2(10):685–694. doi: <http://dx.doi.org/>
-

- 10.1038/35094500.
- Haacke, M.E., Brown, R.W., Thompson, M.R., and Venkatesan, R., 1999. *Magnetic Resonance Imaging: Physical Principles and Sequence Design*. Wiley-Liss. ISBN 0471351288.
- Hackett, T.A., De La Mothe, L.A., Ulbert, I., Karmos, G., Smiley, J., and Schroeder, C.E., 2007a. Multisensory convergence in auditory cortex, II. Thalamocortical connections of the caudal superior temporal plane. *J Comp Neurol*, 502(6):924–952. doi: <http://dx.doi.org/10.1002/cne.21326>.
- Hackett, T.A., Smiley, J.F., Ulbert, I., Karmos, G., Lakatos, P., de la Mothe, L.A., and Schroeder, C.E., 2007b. Sources of somatosensory input to the caudal belt areas of auditory cortex. *Perception*, 36(10):1419–1430.
- Hall, D.A., Haggard, M.P., Akeroyd, M.A., Palmer, A.R., Summerfield, A.Q., Elliott, M.R., Gurney, E.M., and Bowtell, R.W., 1999. "Sparse" temporal sampling in auditory fMRI. *Hum Brain Mapp*, 7(3):213–223.
- Hall, D.A., Haggard, M.P., Summerfield, A.Q., Akeroyd, M.A., Palmer, A.R., and Bowtell, R.W., 2001. Functional magnetic resonance imaging measurements of sound-level encoding in the absence of background scanner noise. *J Acoust Soc Am*, 109(4):1559–1570.
- Hall, D. and Plack, C., 2009. Pitch Processing Sites in the Human Auditory Brain. *Cereb Cortex*, 19(3):576–585. doi: <http://dx.doi.org/10.1093/cercor/bhn108>.
- Hall, D.A., Hart, H.C., and Johnsrude, I.S., 2003. Relationships between human auditory cortical structure and function. *Audiol Neurootol*, 8(1):1–18. doi: <http://dx.doi.org/10.1159/000067894>.
- Haller, S., Wetzel, S.G., Radue, E.W., and Bilecen, D., 2006. Mapping continuous neuronal activation without an ON-OFF paradigm: initial results of BOLD ceiling fMRI. *Eur J Neurosci*, 24(9):2672–2678. doi: <http://dx.doi.org/10.1111/j.1460-9568.2006.05147.x>.
- Hawley, M.L., Melcher, J.R., and Fullerton, B.C., 2005. Effects of sound bandwidth on fMRI activation in human auditory brainstem nuclei. *Hear Res*, 204(0378-5955):101–10.
- Henry, J.A., Dennis, K.C., and Schechter, M.A., 2005. General review of tinnitus: prevalence, mechanisms, effects, and management. *J Speech Lang Hear Res*, 48(5):1204–35.
- Herraiz, C., Hernandez-Calvin, F.J., Plaza, G., Toledano, A., and De los Santos, G., 2003. Multisensory interaction in tinnitus: visual evoked potentials and somatosensory stimulation. *Acta Otorrinolaringol Esp*, 54(5):329–336.
- Horwitz, B., 2003. The elusive concept of brain connectivity. *Neuroimage*, 19(2 Pt 1):466–470.
- House, J.W. and Brackmann, D.E., 1981. Tinnitus: surgical treatment. *Ciba Found Symp*, 85:204–216.
- Howsam, G.D., Sharma, A., Lambden, S.P., Fitzgerald, J., and Prinsley, P.R., 2005. Bilateral objective tinnitus secondary to congenital middle-ear myoclonus. *J Laryngol Otol*, 119(6):489–491. doi: <http://dx.doi.org/10.1258/0022215054273223>.
- Huang, C.M., Liu, G., and Huang, R., 1982. Projections from the cochlear nucleus to the cerebellum. *Brain Res*, 244(1):1–8.
- Huang, C.M., Liu, L., Pettavel, P., and Huang, R.H., 1990. Target areas of presumed auditory projections from lateral and dorsolateral pontine nuclei to posterior cerebellar vermis in rat. *Brain Res*, 536(1-2):327–30.
- Hüttenbrink, K.B., 1988. The mechanics of the middle-ear at static air pressures: the role of the ossicular joints, the function of the middle-ear muscles and the behaviour of stapedial prostheses.
-

- Acta Otolaryngol Suppl*, 451:1-35.
- Hyvarinen, A. and Oja, E., 2000. Independent component analysis: algorithms and applications. *Neural Netw*, 13(4-5):411-30.
- Itoh, K., Kamiya, H., Mitani, A., Yasui, Y., Takada, M., and Mizuno, N., 1987. Direct projections from the dorsal column nuclei and the spinal trigeminal nuclei to the cochlear nuclei in the cat. *Brain Res*, 400(1):145-150.
- Jastreboff, P.J., 1990. Phantom auditory perception (tinnitus): mechanisms of generation and perception. *Neurosci Res*, 8(4):221-54.
- Jastreboff, P.J., 2007. Tinnitus retraining therapy. *Prog Brain Res*, 166:415-423. doi: [http://dx.doi.org/10.1016/S0079-6123\(07\)66040-3](http://dx.doi.org/10.1016/S0079-6123(07)66040-3).
- Jastreboff, P.J., Brennan, J.F., and Sasaki, C.T., 1988. An animal model for tinnitus. *Laryngoscope*, 98(3):280-6.
- Jastreboff, P.J. and Sasaki, C.T., 1986. Salicylate-induced changes in spontaneous activity of single units in the inferior colliculus of the guinea pig. *J Acoust Soc Am*, 80(5):1384-1391.
- Jastreboff, P.J. and Jastreboff, M.M., 2003. Tinnitus retraining therapy for patients with tinnitus and decreased sound tolerance. *Otolaryngol Clin North Am*, 36(2):321-336.
- Jenkinson, M. and Smith, S., 2001. A global optimisation method for robust affine registration of brain images. *Med Image Anal*, 5(2):143-56.
- Jezzard, P. and Balaban, R.S., 2005. Correction for geometric distortions in echoplanar images from Bo field variations. *Magn. Reson. Med.*, 34(1):66-73.
- Jezzard, P., Matthews, P.M., and Smith, S.M., 2001. *Functional MRI - an introduction to methods*. Oxford University Press.
- Johns, R.A., DiFazio, C.A., and Longnecker, D.E., 1985. Lidocaine constricts or dilates rat arterioles in a dose-dependent manner. *Anesthesiology*, 62(2):141-144.
- Johnsrude, I.S., Giraud, A.L., and Frackowiak, R.S.J., 2002. Functional imaging of the auditory system: the use of positron emission tomography. *Audiol Neurootol*, 7(5):251-76.
- Jones, D.K., Symms, M.R., Cercignani, M., and Howard, R.J., 2005. The effect of filter size on VBM analyses of DT-MRI data. *Neuroimage*, 26(2):546-54. doi: <http://dx.doi.org/10.1016/j.neuroimage.2005.02.013>.
- Jousmaki, V. and Hari, R., 1998. Parchment-skin illusion: sound-biased touch. *Curr Biol*, 8(6):R190.
- Kaltenbach, J.A., 2000. Neurophysiologic mechanisms of tinnitus. *J Am Acad Audiol*, 11(1050-0545):125-37.
- Kaltenbach, J.A., Godfrey, D.A., Neumann, J.B., McCaslin, D.L., Afman, C.E., and Zhang, J., 1998. Changes in spontaneous neural activity in the dorsal cochlear nucleus following exposure to intense sound: relation to threshold shift. *Hear Res*, 124(1-2):78-84.
- Kaltenbach, J.A., Zhang, J., and Afman, C.E., 2000. Plasticity of spontaneous neural activity in the dorsal cochlear nucleus after intense sound exposure. *Hear Res*, 147(1-2):282-92.
- Kaltenbach, J.A., 2006. Summary of evidence pointing to a role of the dorsal cochlear nucleus in the etiology of tinnitus. *Acta Otolaryngol Suppl*, (556):20-26. doi: <http://dx.doi.org/10.1080/03655230600895309>.
- Kaltenbach, J.A., Zacharek, M.A., Zhang, J., and Frederick, S., 2004. Activity in the dorsal cochlear

- nucleus of hamsters previously tested for tinnitus following intense tone exposure. *Neurosci Lett*, 355(1-2):121-125.
- Kaltenbach, J.A., Zhang, J., and Finlayson, P., 2005. Tinnitus as a plastic phenomenon and its possible neural underpinnings in the dorsal cochlear nucleus. *Hear Res*, 206(0378-5955):200-26.
- Kaysers, C., Petkov, C., and Logothetis, N., 2009. Multisensory interactions in primate auditory cortex: fMRI and electrophysiology. *Hear Res*, (in press). doi: <http://dx.doi.org/10.1016/j.heares.2009.02.011>.
- Kaysers, C., Petkov, C.I., Augath, M., and Logothetis, N.K., 2005. Integration of touch and sound in auditory cortex. *Neuron*, 48(2):373-384. doi: <http://dx.doi.org/10.1016/j.neuron.2005.09.018>.
- Kim, J.J., Gross, J., Potashner, S.J., and Morest, D.K., 2004. Fine structure of long-term changes in the cochlear nucleus after acoustic overstimulation: chronic degeneration and new growth of synaptic endings. *J Neurosci Res*, 77(6):817-28. doi: <http://dx.doi.org/10.1002/jnr.20212>.
- Kindlmann, G., 2004. Superquadric Tensor Glyphs. In *Proceedings of IEEE TVCG/EG Symposium on Visualization 2004*, 147-154.
- Komiya, H. and Eggermont, J.J., 2000. Spontaneous firing activity of cortical neurons in adult cats with reorganized tonotopic map following pure-tone trauma. *Acta Otolaryngol*, 120(6):750-756.
- Kovacs, S., Peeters, R., Smits, M., De Ridder, D., Van Hecke, P., and Sunaert, S., 2006. Activation of cortical and subcortical auditory structures at 3 T by means of a functional magnetic resonance imaging paradigm suitable for clinical use. *Invest Radiol*, 41(2):87-96.
- Kriegeskorte, N., Simmons, W.K., Bellgowan, P.S.F., and Baker, C.I., 2009. Circular analysis in systems neuroscience: the dangers of double dipping. *Nat Neurosci*, 12(5):535-540. doi: <http://dx.doi.org/10.1038/nn.2303>.
- Krumbholz, K., Schonwiesner, M., Rubsamen, R., Zilles, K., Fink, G.R., and von Cramon, D.Y., 2005. Hierarchical processing of sound location and motion in the human brainstem and planum temporale. *Eur J Neurosci*, 21(0953-816X):230-8.
- Langers, D.R.M., 2009. Blind source separation of fMRI data by means of factor analytic transformations. *Neuroimage*, 47(1):77-87. doi: <http://dx.doi.org/10.1016/j.neuroimage.2009.04.017>.
- Langers, D.R.M., Backes, W.H., and van Dijk, P., 2003. Spectrotemporal features of the auditory cortex: the activation in response to dynamic ripples. *Neuroimage*, 20(1053-8119):265-75.
- Langers, D.R.M., Van Dijk, P., and Backes, W.H., 2005a. Interactions between hemodynamic responses to scanner acoustic noise and auditory stimuli in functional magnetic resonance imaging. *Magn Reson Med*, 53(0740-3194):49-60.
- Langers, D.R.M., van Dijk, P., and Backes, W.H., 2005b. Lateralization, connectivity and plasticity in the human central auditory system. *Neuroimage*, 28(2):490-499. doi: <http://dx.doi.org/10.1016/j.neuroimage.2005.06.024>.
- Langers, D., van Dijk, P., Schoenmaker, E., and Backes, W., 2007. fMRI activation in relation to sound intensity and loudness. *Neuroimage*, 35(2):709-718. doi: <http://dx.doi.org/10.1016/j.neuroimage.2006.12.013>.
- Langguth, B., Eichhammer, P., Kreutzer, A., Maenner, P., Marienhagen, J., Kleinjung, T., Sand, P., and Hajak, G., 2006. The impact of auditory cortex activity on characterizing and treating patients with chronic tinnitus—first results from a PET study. *Acta Otolaryngol Suppl*, (556):84-88. doi: <http://dx.doi.org/10.1080/03655230600895317>.
-

- Lanting, C.P., De Kleine, E., Bartels, H., and Van Dijk, P., 2008. Functional imaging of unilateral tinnitus using fMRI. *Acta Otolaryngol*, 128(4):415–421. doi: <http://dx.doi.org/10.1080/00016480701793743>.
- Lanting, C.P., de Kleine, E., and van Dijk, P., 2009. Neural activity underlying tinnitus generation: results from PET and fMRI. *Hear Res*, 255(1–2):1–13. doi: <http://dx.doi.org/10.1016/j.heares.2009.06.009>.
- Leaton, R.N. and Supple, Jr, W.F., 1991. Medial cerebellum and long-term habituation of acoustic startle in rats. *Behav Neurosci*, 105(6):804–16.
- Lee, S., Chang, Y., Lee, J.E., and Cho, J.H., 2003. The comparison of brain functional imaging between conductive and sensorineural hearing loss. In *Middle Ear Mechanics in Research and Otolology*, 253–259.
- Lee, Y.J., Bae, S.J., Lee, S.H., Lee, J.J., Lee, K.Y., Kim, M.N., Kim, Y.S., Baik, S.K., Woo, S., and Chang, Y., 2007. Evaluation of white matter structures in patients with tinnitus using diffusion tensor imaging. *J Clin Neurosci*, 14(6):515–9. doi: <http://dx.doi.org/10.1016/j.jocn.2006.10.002>.
- Leonard, C.M., Puranik, C., Kuldau, J.M., and Lombardino, L.J., 1998. Normal variation in the frequency and location of human auditory cortex landmarks. Heschl's gyrus: where is it? *Cereb Cortex*, 8(5):397–406.
- Levine, R.A., 1999. Somatic (craniocervical) tinnitus and the dorsal cochlear nucleus hypothesis. *Am J Otolaryngol*, 20(6):351–362.
- Levine, R.A., Abel, M., and Cheng, H., 2003. CNS somatosensory-auditory interactions elicit or modulate tinnitus. *Exp Brain Res*, 153(4):643–648. doi: <http://dx.doi.org/10.1007/s00221-003-1747-3>.
- Levine, R.A., Nam, E.C., Oron, Y., and Melcher, J.R., 2007. Evidence for a tinnitus subgroup responsive to somatosensory based treatment modalities. *Prog Brain Res*, 166:195–207. doi: [http://dx.doi.org/10.1016/S0079-6123\(07\)66017-8](http://dx.doi.org/10.1016/S0079-6123(07)66017-8).
- Levine, R.A., Nam, E.C., and Melcher, J., 2008. Somatosensory pulsatile tinnitus syndrome: somatic testing identifies a pulsatile tinnitus subtype that implicates the somatosensory system. *Trends Amplif*, 12(3):242–253. doi: <http://dx.doi.org/10.1177/1084713808321185>.
- Liyanaage, S.H., Singh, A., Savundra, P., and Kalan, A., 2006. Pulsatile tinnitus. *J Laryngol Otol*, 120(2):93–97. doi: <http://dx.doi.org/10.1017/S0022215105001714>.
- Llinas, R., Urbano, F.J., Leznik, E., Ramirez, R.R., and van Marle, H.J.F., 2005. Rhythmic and dysrhythmic thalamocortical dynamics: GABA systems and the edge effect. *Trends Neurosci*, 28(6):325–333. doi: <http://dx.doi.org/10.1016/j.tins.2005.04.006>.
- Lockwood, A.H., Salvi, R.J., Coad, M.L., Arnold, S.A., Wack, D.S., Murphy, B.W., and Burkard, R.F., 1999. The functional anatomy of the normal human auditory system: responses to 0.5 and 4.0 kHz tones at varied intensities. *Cereb Cortex*, 9(1):65–76.
- Lockwood, A.H., Salvi, R.J., Coad, M.L., Towsley, M.L., Wack, D.S., and Murphy, B.W., 1998. The functional neuroanatomy of tinnitus: evidence for limbic system links and neural plasticity. *Neurology*, 50(1):114–120.
- Lockwood, A.H., Wack, D.S., Burkard, R.F., Coad, M.L., Reyes, S.A., Arnold, S.A., and Salvi, R.J., 2001. The functional anatomy of gaze-evoked tinnitus and sustained lateral gaze. *Neurology*, 56(4):472–480.
-

- Lockwood, A.H., Salvi, R.J., and Burkard, R.F., 2002. Tinnitus. *N Engl J Med*, 347(12):904–910. doi: <http://dx.doi.org/10.1056/NEJMr013395>.
- Logothetis, N.K., Pauls, J., Augath, M., Trinath, T., and Oeltermann, A., 2001. Neurophysiological investigation of the basis of the fMRI signal. *Nature*, 412(6843):150–157. doi: <http://dx.doi.org/10.1038/35084005>.
- Logothetis, N.K., 2008. What we can do and what we cannot do with fMRI. *Nature*, 453(7197):869–878. doi: <http://dx.doi.org/10.1038/nature06976>.
- Lu, H., Golay, X., Pekar, J.J., and Van Zijl, P.C.M., 2003. Functional magnetic resonance imaging based on changes in vascular space occupancy. *Magn Reson Med*, 50(2):263–274. doi: <http://dx.doi.org/10.1002/mrm.10519>.
- Lutz, J., Hemminger, F., Stahl, R., Dietrich, O., Hempel, M., Reiser, M., and Jäger, L., 2007. Evidence of subcortical and cortical aging of the acoustic pathway: a diffusion tensor imaging (DTI) study. *Acad Radiol*, 14(6):692–700. doi: <http://dx.doi.org/10.1016/j.acra.2007.02.014>.
- Marrelec, G., Kim, J., Doyon, J., and Horwitz, B., 2009. Large-scale neural model validation of partial correlation analysis for effective connectivity investigation in functional MRI. *Hum Brain Mapp*, 30(3):941–50. doi: <http://dx.doi.org/10.1002/hbm.20555>.
- Marrelec, G., Horwitz, B., Kim, J., Péligrini-Issac, M., Benali, H., and Doyon, J., 2007. Using partial correlation to enhance structural equation modeling of functional MRI data. *Magn Reson Imaging*, 25(8):1181–9. doi: <http://dx.doi.org/10.1016/j.mri.2007.02.012>.
- Marrelec, G., Krainik, A., Duffau, H., Péligrini-Issac, M., Lehericy, S., Doyon, J., and Benali, H., 2006. Partial correlation for functional brain interactivity investigation in functional MRI. *Neuroimage*, 32(1):228–37. doi: <http://dx.doi.org/10.1016/j.neuroimage.2005.12.057>.
- Martin, J.H., 2003. *Neuroanatomy: Text and Atlas*. McGraw-Hill.
- Maschke, M., Drepper, J., Kindsvater, K., Kolb, F.P., Diener, H.C., and Timmann, D., 2000. Involvement of the human medial cerebellum in long-term habituation of the acoustic startle response. *Exp Brain Res*, 133(3):359–67.
- U.S. National Library of Medicine, 2009. National Library of Medicine - Medical Subject Headings. URL http://www.nlm.nih.gov/cgi/mesh/2009/MB_cgi?field=uid&term=D014012.
- Melcher, J.R., Levine, R.A., Norris, B., and Bergevin, C., 2005. Abnormal fMRI activation in the inferior colliculi (IC) of tinnitus subjects. In *VIIIth international tinnitus seminar*.
- Melcher, J.R., Sigalovsky, I.S., Guinan, J.J.J., and Levine, R.A., 2000. Lateralized tinnitus studied with functional magnetic resonance imaging: abnormal inferior colliculus activation. *J Neurophysiol*, 83(2):1058–72.
- Melcher, J.R., Levine, R.A., Bergevin, C., and Norris, B., 2009. The Auditory Midbrain of People with Tinnitus: Abnormal Sound-Evoked Activity Revisited. *Hear Res (in press)*. doi: <http://dx.doi.org/10.1016/j.heares.2009.08.005>.
- Melding, P.S., Goodey, R.J., and Thorne, P.R., 1978. The use of intravenous lignocaine in the diagnosis and treatment of tinnitus. *J Laryngol Otol*, 92(2):115–121.
- Mirz, F., Gjedde, A., Ishizu, K., and Pedersen, C.B., 2000a. Cortical networks subserving the perception of tinnitus—a PET study. *Acta Otolaryngol Suppl*, 543:241–243.
- Mirz, F., Gjedde, A., Sodkilde-Jrgensen, H., and Pedersen, C.B., 2000b. Functional brain imaging of tinnitus-like perception induced by aversive auditory stimuli. *Neuroreport*, 11(3):633–637.
-

- Mirz, F., Pedersen, B., Ishizu, K., Johannsen, P., Ovesen, T., Stodkilde-Jorgensen, H., and Gjedde, A., 1999. Positron emission tomography of cortical centers of tinnitus. *Hear Res*, 134(1-2):133-144.
- Møller, A.R., 2006a. *Hearing, Anatomy, Physiology, and disorders of the auditory system*. Academic Press, 2nd edition edition.
- Møller, A.R., Møller, M.B., and Yokota, M., 1992. Some forms of tinnitus may involve the extralemniscal auditory pathway. *Laryngoscope*, 102(10):1165-1171.
- Møller, A.R., 2003. Pathophysiology of tinnitus. *Otolaryngol Clin North Am*, 36(2):249-266.
- Møller, A.R., 2006b. *Neural Plasticity and Disorders of the Nervous System*. Cambridge University Press.
- Møller, A.R., 2006c. Neural plasticity in tinnitus. *Prog Brain Res*, 157:365-372. doi: [http://dx.doi.org/10.1016/S0079-6123\(06\)57022-0](http://dx.doi.org/10.1016/S0079-6123(06)57022-0).
- Møller, A.R., 2007. Tinnitus: presence and future. *Prog Brain Res*, 166:3-16. doi: [http://dx.doi.org/10.1016/S0079-6123\(07\)66001-4](http://dx.doi.org/10.1016/S0079-6123(07)66001-4).
- Møller, A.R. and Rollins, P.R., 2002. The non-classical auditory pathways are involved in hearing in children but not in adults. *Neurosci Lett*, 319(1):41-44.
- Morgane, P.J. and Mokler, D.J., 2006. The limbic brain: continuing resolution. *Neurosci Biobehav Rev*, 30(2):119-125. doi: <http://dx.doi.org/10.1016/j.neubiorev.2005.04.020>.
- Morosan, P., Rademacher, J., Schleicher, A., Amunts, K., Schormann, T., and Zilles, K., 2001. Human primary auditory cortex: cytoarchitectonic subdivisions and mapping into a spatial reference system. *Neuroimage*, 13(4):684-701. doi: <http://dx.doi.org/10.1006/nimg.2000.0715>.
- Muhlnickel, W., Elbert, T., Taub, E., and Flor, H., 1998. Reorganization of auditory cortex in tinnitus. *Proc Natl Acad Sci U S A*, 95(0027-8424):10340-3.
- Neumann, J., Lohmann, G., Zysset, S., and von Cramon, D.Y., 2003. Within-subject variability of BOLD response dynamics. *Neuroimage*, 19(3):784-796.
- Nicolas-Puel, C., Akbaraly, T., Lloyd, R., Berr, C., Uziel, A., Rebillard, G., and Puel, J.L., 2006. Characteristics of tinnitus in a population of 555 patients: specificities of tinnitus induced by noise trauma. *Int Tinnitus J*, 12(1):64-70.
- Noreña, A.J. and Eggermont, J.J., 2003. Changes in spontaneous neural activity immediately after an acoustic trauma: implications for neural correlates of tinnitus. *Hear Res*, 183(1-2):137-53.
- Ogawa, S., Lee, T.M., Kay, A.R., and Tank, D.W., 1990. Brain Magnetic Resonance Imaging with Contrast Dependent on Blood Oxygenation. *Proc. Natl. Acad. Sci. U. S. A.*, 87:9868-9872.
- Oldfield, R.C., 1971. The assessment and analysis of handedness: the Edinburgh inventory. *Neuropsychologia*, 9(1):97-113.
- Osaki, Y., Nishimura, H., Takasawa, M., Imaizumi, M., Kawashima, T., Iwaki, T., Oku, N., Hashikawa, K., Doi, K., Nishimura, T., Hatazawa, J., and Kubo, T., 2005. Neural mechanism of residual inhibition of tinnitus in cochlear implant users. *Neuroreport*, 16(15):1625-1628.
- Park, H.J., Kubicki, M., Shenton, M.E., Guimond, A., McCarley, R.W., Maier, S.E., Kikinis, R., Jolesz, F.A., and Westin, C.F., 2003. Spatial normalization of diffusion tensor MRI using multiple channels. *Neuroimage*, 20(4):1995-2009.
- Paul, A.K., Lobarinas, E., Simmons, R., Wack, D., Luisi, J.C., Sperryak, J., Mazurchuk, R., Abdel-Nabi, H., and Salvi, R., 2009. Metabolic imaging of rat brain during pharmacologically-induced

- tinnitus. *Neuroimage*, 44(2):312–318. doi: <http://dx.doi.org/10.1016/j.neuroimage.2008.09.024>.
- Pekkola, J., Ojanen, V., Autti, T., Jaaskelainen, I.P., Mottonen, R., Tarkiainen, A., and Sams, M., 2005. Primary auditory cortex activation by visual speech: an fMRI study at 3 T. *Neuroreport*, 16(2):125–128.
- Petacchi, A., Laird, A.R., Fox, P.T., and Bower, J.M., 2005. Cerebellum and auditory function: an ALE meta-analysis of functional neuroimaging studies. *Hum Brain Mapp*, 25(1):118–128. doi: <http://dx.doi.org/10.1002/hbm.20137>.
- Petersen, E.T., Zimine, I., Ho, Y.C.L., and Golay, X., 2006. Non-invasive measurement of perfusion: a critical review of arterial spin labelling techniques. *Br J Radiol*, 79(944):688–701. doi: <http://dx.doi.org/10.1259/bjr/67705974>.
- Pierpaoli, C., Jezzard, P., Basser, P.J., Barnett, A., and Di Chiro, G., 1996. Diffusion tensor MR imaging of the human brain. *Radiology*, 201(3):637–48.
- Pinchoff, R.J., Burkard, R.F., Salvi, R.J., Coad, M.L., and Lockwood, A.H., 1998. Modulation of tinnitus by voluntary jaw movements. *Am J Otol*, 19(6):785–789.
- Plewnia, C., Reimold, M., Najib, A., Brehm, B., Reischl, G., Plontke, S.K., and Gerloff, C., 2007. Dose-dependent attenuation of auditory phantom perception (tinnitus) by PET-guided repetitive transcranial magnetic stimulation. *Hum Brain Mapp*, 28(3):238–246. doi: <http://dx.doi.org/10.1002/hbm.20270>.
- Probst, R., Lonsbury-Martin, B.L., and Martin, G.K., 1991. A review of otoacoustic emissions. *J Acoust. Soc. Am.*, 89:2027–2067.
- Rademacher, J., Morosan, P., Schormann, T., Schleicher, A., Werner, C., Freund, H.J., and Zilles, K., 2001. Probabilistic mapping and volume measurement of human primary auditory cortex. *Neuroimage*, 13(4):669–683. doi: <http://dx.doi.org/10.1006/nimg.2000.0714>.
- Raichle, M.E., 1998. Behind the scenes of functional brain imaging: a historical and physiological perspective. *Proc Natl Acad Sci U S A*, 95(3):765–72.
- Raichle, M.E. and Mintun, M.A., 2006. Brain work and brain imaging. *Annu Rev Neurosci*, 29:449–476. doi: <http://dx.doi.org/10.1146/annurev.neuro.29.051605.112819>.
- Rajan, R. and Irvine, D.R., 1998. Neuronal responses across cortical field A1 in plasticity induced by peripheral auditory organ damage. *Audiol Neurootol*, 3(2-3):123–144.
- Rauch, A., Rainer, G., Augath, M., Oeltermann, A., and Logothetis, N.K., 2008. Pharmacological MRI combined with electrophysiology in non-human primates: effects of Lidocaine on primary visual cortex. *Neuroimage*, 40(2):590–600. doi: <http://dx.doi.org/10.1016/j.neuroimage.2007.12.009>.
- Reyes, S.A., Salvi, R.J., Burkard, R.F., Coad, M.L., Wack, D.S., Galantowicz, P.J., and Lockwood, A.H., 2002. Brain imaging of the effects of lidocaine on tinnitus. *Hear Res*, 171(1-2):43–50.
- Roberts, L.E., 2007. Residual inhibition. *Prog Brain Res*, 166:487–495. doi: [http://dx.doi.org/10.1016/S0079-6123\(07\)66047-6](http://dx.doi.org/10.1016/S0079-6123(07)66047-6).
- Rubinstein, B., 1993. Tinnitus and craniomandibular disorders—is there a link? *Swed Dent J Suppl*, 95:1–46.
- Ruytjens, L., Willemsen, A.T.M., Van Dijk, P., Wit, H.P., and Albers, F.W.J., 2006. Functional imaging of the central auditory system using PET. *Acta Otolaryngol*, 126(12):1236–1244. doi: <http://dx.doi.org/10.1080/00016480600801373>.
-

- Ruytjens, L., Albers, F., van Dijk, P., Wit, H., and Willemsen, A., 2007a. Activation in primary auditory cortex during silent lipreading is determined by sex. *Audiol Neurootol*, 12(6):371–377. doi: <http://dx.doi.org/10.1159/000106480>.
- Ruytjens, L., Georgiadis, J.R., Holstege, G., Wit, H.P., Albers, F.W.J., and Willemsen, A.T.M., 2007b. Functional sex differences in human primary auditory cortex. *Eur J Nucl Med Mol Imaging*, 34(12):2073–2081. doi: <http://dx.doi.org/10.1007/s00259-007-0517-z>.
- Salvi, R.J., Saunders, S.S., Gratton, M.A., Arehole, S., and Powers, N., 1990. Enhanced evoked response amplitudes in the inferior colliculus of the chinchilla following acoustic trauma. *Hear Res*, 50(1-2):245–257.
- Salvi, R.J., Wang, J., and Ding, D., 2000. Auditory plasticity and hyperactivity following cochlear damage. *Hear Res*, 147(1-2):261–274.
- Schmahmann, J.D., 1991. An emerging concept. The cerebellar contribution to higher function. *Arch Neurol*, 48(11):1178–1187.
- Schmahmann, J.D. and Pandya, D.N., 2006. *Fiber pathways of the brain*. Oxford University Press.
- Schroeder, C.E., Lindsley, R.W., Specht, C., Marcovici, A., Smiley, J.F., and Javitt, D.C., 2001. Somatosensory input to auditory association cortex in the macaque monkey. *J Neurophysiol*, 85(3):1322–1327.
- Schurmann, M., Caetano, G., Hlushchuk, Y., Jousmaki, V., and Hari, R., 2006. Touch activates human auditory cortex. *Neuroimage*, 30(4):1325–1331. doi: <http://dx.doi.org/10.1016/j.neuroimage.2005.11.020>.
- Seki, S. and Eggermont, J.J., 2003. Changes in spontaneous firing rate and neural synchrony in cat primary auditory cortex after localized tone-induced hearing loss. *Hear Res*, 180(1-2):28–38.
- Shore, S.E., Koehler, S., Oldakowski, M., Hughes, L.F., and Syed, S., 2008. Dorsal cochlear nucleus responses to somatosensory stimulation are enhanced after noise-induced hearing loss. *Eur J Neurosci*, 27(1):155–168. doi: <http://dx.doi.org/10.1111/j.1460-9568.2007.05983.x>.
- Shore, S.E., Vass, Z., Wys, N.L., and Altschuler, R.A., 2000. Trigeminal ganglion innervates the auditory brainstem. *J Comp Neurol*, 419(3):271–285.
- Shore, S.E. and Zhou, J., 2006. Somatosensory influence on the cochlear nucleus and beyond. *Hear Res*, 216-217:90–99. doi: <http://dx.doi.org/10.1016/j.heares.2006.01.006>.
- Shulman, A., Strashun, A., Afriyie, M., Aronson, F., Abel, W., and Goldstein, B., 1995. SPECT Imaging of Brain and Tinnitus-Neurologic/Neurologic Implications. *Int Tinnitus J*, 1(1):13–29.
- Silbersweig, D.A. and Stern, E., 1998. Towards a functional neuroanatomy of conscious perception and its modulation by volition: implications of human auditory neuroimaging studies. *Philos Trans R Soc Lond B Biol Sci*, 353(1377):1883–1888. doi: <http://dx.doi.org/10.1098/rstb.1998.0340>.
- Smiley, J.F., Hackett, T.A., Ulbert, I., Karmas, G., Lakatos, P., Javitt, D.C., and Schroeder, C.E., 2007. Multisensory convergence in auditory cortex, I. Cortical connections of the caudal superior temporal plane in macaque monkeys. *J Comp Neurol*, 502(6):894–923. doi: <http://dx.doi.org/10.1002/cne.21325>.
- Smith, S.M., 2002. Fast robust automated brain extraction. *Hum Brain Mapp*, 17(3):143–55. doi: <http://dx.doi.org/10.1002/hbm.10062>.
-

- Smith, S.M., Jenkinson, M., Johansen-Berg, H., Rueckert, D., Nichols, T.E., Mackay, C.E., Watkins, K.E., Ciccarelli, O., Cader, M.Z., Matthews, P.M., and Behrens, T.E.J., 2006. Tract-based spatial statistics: voxelwise analysis of multi-subject diffusion data. *Neuroimage*, 31(4):1487–505. doi: <http://dx.doi.org/10.1016/j.neuroimage.2006.02.024>.
- Smith, S.M., Jenkinson, M., Woolrich, M.W., Beckmann, C.F., Behrens, T.E.J., Johansen-Berg, H., Bannister, P.R., De Luca, M., Drobnjak, I., Flitney, D.E., Niazy, R.K., Saunders, J., Vickers, J., Zhang, Y., De Stefano, N., Brady, J.M., and Matthews, P.M., 2004. Advances in functional and structural MR image analysis and implementation as FSL. *Neuroimage*, 23 Suppl 1:S208–19. doi: <http://dx.doi.org/10.1016/j.neuroimage.2004.07.051>.
- Smits, M., Kovacs, S., de Ridder, D., Peeters, R.R., van Hecke, P., and Sunaert, S., 2007. Lateralization of functional magnetic resonance imaging (fMRI) activation in the auditory pathway of patients with lateralized tinnitus. *Neuroradiology*, 49(8):669–679. doi: <http://dx.doi.org/10.1007/s00234-007-0231-3>.
- Sonmez, G., Basekim, C.C., Ozturk, E., Gungor, A., and Kizilkaya, E., 2007. Imaging of pulsatile tinnitus: a review of 74 patients. *Clin Imaging*, 31(2):102–108. doi: <http://dx.doi.org/10.1016/j.clinimag.2006.12.024>.
- Staffen, W., Biesinger, E., Trinka, E., and Ladurner, G., 1999. The effect of lidocaine on chronic tinnitus: a quantitative cerebral perfusion study. *Audiology*, 38(1):53–57.
- Stein, B.E. and Meredith, M.A., 1993. *Merging of the senses*. MIT Press, Cambridge, MA.
- Stouffer, J.L. and Tyler, R.S., 1990. Characterization of tinnitus by tinnitus patients. *J Speech Hear Disord*, 55(3):439–453.
- Talairach, J. and Tournoux, P., 1988. *Co-planar stereotaxic atlas of the human brain: 3-dimensional proportional system: an approach to cerebral imaging*. Thieme, Stuttgart.
- Talavage, T.M., Sereno, M.I., Melcher, J.R., Ledden, P.J., Rosen, B.R., and Dale, A.M., 2004. Tonotopic organization in human auditory cortex revealed by progressions of frequency sensitivity. *J Neurophysiol*, 91(0022-3077):1282–96.
- Terry, A.M., Jones, D.M., Davis, B.R., and Slater, R., 1983. Parametric studies of tinnitus masking and residual inhibition. *Br J Audiol*, 17(4):245–256.
- Thirion, B., Pinel, P., Mériaux, S., Roche, A., Dehaene, S., and Poline, J.B., 2007. Analysis of a large fMRI cohort: Statistical and methodological issues for group analyses. *Neuroimage*, 35(1):105–20. doi: <http://dx.doi.org/10.1016/j.neuroimage.2006.11.054>.
- Timmann, D., Musso, C., Kolb, F.P., Rijntjes, M., Jüptner, M., Müller, S.P., Diener, H.C., and Weiller, C., 1998. Involvement of the human cerebellum during habituation of the acoustic startle response: a PET study. *J Neurol Neurosurg Psychiatry*, 65(5):771–3.
- Trellakis, S., Lautermann, J., and Lehnerdt, G., 2007. Lidocaine: neurobiological targets and effects on the auditory system. *Prog Brain Res*, 166:303–322. doi: [http://dx.doi.org/10.1016/S0079-6123\(07\)66028-2](http://dx.doi.org/10.1016/S0079-6123(07)66028-2).
- Turner, R., Howseman, A., Rees, G.E., Josephs, O., and Friston, K., 1998. Functional magnetic resonance imaging of the human brain: data acquisition and analysis. *Exp Brain Res*, 123(1-2):5–12.
- Upadhyay, J., Ducros, M., Knaus, T.A., Lindgren, K.A., Silver, A., Tager-Flusberg, H., and Kim, D.S., 2007. Function and connectivity in human primary auditory cortex: a combined fMRI and

- DTI study at 3 Tesla. *Cereb Cortex*, 17(10):2420–32. doi: <http://dx.doi.org/10.1093/cercor/bhl150>.
- Upadhyay, J., Silver, A., Knaus, T.A., Lindgren, K.A., Ducros, M., Kim, D.S., and Tager-Flusberg, H., 2008. Effective and structural connectivity in the human auditory cortex. *J Neurosci*, 28(13):3341–3349. doi: <http://dx.doi.org/10.1523/JNEUROSCI.4434-07.2008>.
- Van Wanrooij, M.M. and Van Opstal, A.J., 2004. Contribution of head shadow and pinna cues to chronic monaural sound localization. *J Neurosci*, 24(17):4163–71. doi: <http://dx.doi.org/10.1523/JNEUROSCI.0048-04.2004>.
- Vernon, J.A. and Meikle, M.B., 2003. Tinnitus: clinical measurement. *Otolaryngol Clin North Am*, 36(2):293–305, vi.
- Wang, H., Tian, J., Yin, D., Jiang, S., Yang, W., Han, D., Yao, S., and Shao, M., 2001. Regional glucose metabolic increases in left auditory cortex in tinnitus patients: a preliminary study with positron emission tomography. *Chin Med J (Engl)*, 114(8):848–851.
- Wang, J., Ding, D., and Salvi, R.J., 2002. Functional reorganization in chinchilla inferior colliculus associated with chronic and acute cochlear damage. *Hear Res*, 168(1–2):238–249.
- Weber, B., Spath, N., Wyss, M., Wild, D., Burger, C., Stanley, R., and Buck, A., 2003. Quantitative cerebral blood flow measurements in the rat using a beta-probe and H₂ 15O. *J Cereb Blood Flow Metab*, 23(12):1455–1460. doi: <http://dx.doi.org/10.1097/01.WCB.0000095799.98378.7D>.
- Weissman, J.L. and Hirsch, B.E., 2000. Imaging of tinnitus: a review. *Radiology*, 216(2):342–349.
- Weisz, N., Moratti, S., Meinzer, M., Dohrmann, K., and Elbert, T., 2005a. Tinnitus perception and distress is related to abnormal spontaneous brain activity as measured by magnetoencephalography. *PLoS Med*, 2(6):e153. doi: <http://dx.doi.org/10.1371/journal.pmed.0020153>.
- Weisz, N., Wienbruch, C., Dohrmann, K., and Elbert, T., 2005b. Neuromagnetic indicators of auditory cortical reorganization of tinnitus. *Brain*, 128(Pt 11):2722–2731. doi: <http://dx.doi.org/10.1093/brain/awh588>.
- Werring, D.J., Clark, C.A., Barker, G.J., Thompson, A.J., and Miller, D.H., 1999. Diffusion tensor imaging of lesions and normal-appearing white matter in multiple sclerosis. *Neurology*, 52(8):1626–32.
- Werring, D.J., Toosy, A.T., Clark, C.A., Parker, G.J., Barker, G.J., Miller, D.H., and Thompson, A.J., 2000. Diffusion tensor imaging can detect and quantify corticospinal tract degeneration after stroke. *J Neurol Neurosurg Psychiatry*, 69(2):269–72.
- Woolsey, T.A., 2003. *The Brain Atlas : a visual guide to the human central nervous system*. John Wiley & Sons.
- Yoo, D.S., Choi, W.Y., Lee, S.Y., Jeong, J.W., Lee, J.W., Kim, S., and Chang, Y., 2006. Quantitative analysis of white matter on DTI images of patients with tinnitus: preliminary report. *Conf Proc IEEE Eng Med Biol Soc*, 1:1870–2. doi: <http://dx.doi.org/10.1109/IEMBS.2006.260350>.
- Yost, W.A., 2000. *Fundamentals of Hearing – an introduction*. Elsevier Academic Press, fourth edition edition.
- Zhang, J.S., Kaltenbach, J.A., Godfrey, D.A., and Wang, J., 2006. Origin of hyperactivity in the hamster dorsal cochlear nucleus following intense sound exposure. *J Neurosci Res*, 84(4):819–831. doi: <http://dx.doi.org/10.1002/jnr.20985>.
- Zheng, J., Shen, W., He, D.Z., Long, K.B., Madison, L.D., and Dallos, P., 2000. Prestin is the

motor protein of cochlear outer hair cells. *Nature*, 405(6783):149–55. doi: <http://dx.doi.org/10.1038/35012009>.

Zhou, J. and Shore, S., 2006. Convergence of spinal trigeminal and cochlear nucleus projections in the inferior colliculus of the guinea pig. *J Comp Neurol*, 495(1):100–112. doi: <http://dx.doi.org/10.1002/cne.20863>.