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Representation of Harmonic Sounds in the Helix of the Lateral Lemniscus

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The percept of pitch of harmonic sounds is based on temporal processing. This explains also our ability to recognize harmonic relationships between different sounds, because as a result of a neuronal correlation analysis in the auditory midbrain neurons are tuned not only to a certain pitch but to a certain degree also to integer multiples of that pitch. The responses to harmonics of a pitch are suppressed within 30 ms after signal onset by inhibition with the likely source being the ventral nucleus of the lateral lemniscus (VNLL). An investigation of spatial representation of periodicity information with the 2-Deoxyglucose method in gerbils showed that low pitch is represented dorsally and high pitch ventrally along the length-axis of the VNLL. Three-dimensional computer reconstructions of the VNLL (program AMIRA) gave evidence for a helical periodicity map with 7 to 8 turns, reminiscent of the pitch helix known from music psychology. Moreover, the spatial organization of the VNLL suggests that it is organized as a double-helix representing musical octaves and fifths. Reconstructions of the VNLL of Nissl-stained human brains gave evidence of a similar organization and therefore of a similar functional role of the VNLL for pitch processing in humans.