

Bayesian brain model

Bayesian approaches to **brain function** investigate the capacity of the nervous system to operate in situations of uncertainty in a fashion that is close to the optimal prescribed by **Bayesian statistics**.

This term is used in behavioural sciences and neuroscience and studies associated with this term often strive to explain the brain's cognitive abilities based on statistical principles. It is frequently assumed that the nervous system maintains internal probabilistic models that are updated by neural processing of sensory information using methods approximating those of Bayesian probability.

Recent studies have adopted the **Bayesian brain model** to explain the generation of tinnitus in subjects with auditory deafferentation. That is, as the human brain works in a Bayesian manner to reduce environmental uncertainty, missing auditory information due to hearing loss may cause auditory phantom percepts, i.e., tinnitus. This type of deafferentation-induced auditory phantom percept should be preceded by auditory experience because the fill-in phenomenon, namely tinnitus, is based upon auditory prediction and the resultant prediction error. For example, a recent animal study observed the absence of tinnitus in cats with congenital single-sided deafness (SSD; Eggermont and Kral, Hear Res 2016). However, no human studies have investigated the presence and characteristics of tinnitus in subjects with congenital SSD. Thus, the present study sought to reveal differences in the generation of tinnitus between subjects with congenital SSD and those with acquired SSD to evaluate the replicability of previous animal studies. This study enrolled 20 subjects with congenital SSD and 44 subjects with acquired SSD and examined the presence and characteristics of tinnitus in the groups. None of the 20 subjects with congenital SSD perceived tinnitus on the affected side, whereas 30 of 44 subjects with acquired SSD experienced tinnitus on the affected side. Additionally, there were significant positive correlations between tinnitus characteristics and the audiometric characteristics of the SSD. In accordance with the findings of the recent animal study, tinnitus was absent in subjects with congenital SSD, but relatively frequent in subjects with acquired SSD, which suggests that the development of tinnitus should be preceded by auditory experience. In other words, subjects with profound congenital peripheral deafferentation do not develop auditory phantom percepts because no auditory predictions are available from the Bayesian brain ¹⁾.

¹⁾

Lee SY, Nam DW, Koo JW, De Ridder D, Vanneste S, Song JJ. No auditory experience, no tinnitus: Lessons from subjects with congenital- and acquired single-sided deafness. Hear Res. 2017 Aug 15;354:9-15. doi: 10.1016/j.heares.2017.08.002. [Epub ahead of print] PubMed PMID: 28826043.

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Last update: **2025/05/13 02:11**

