Auditory frequency-following responses in rat ipsilateral inferior colliculus

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Auditory frequency-following responses (FFRs) are sustained potentials based on phase-locked neural activity preserving low-frequency information. Some neurons in rat inferior colliculus are excited by stimuli at either ear. This study shows that FFRs in inferior colliculus can be elicited by presenting pure tone bursts with frequencies from 225 to 4025 Hz at the ipsilateral ear in anesthetized rats. Moreover, chemical block of glutamate transmissions in the contralateral inferior colliculus markedly reduced the ipsilaterally driven FFRs, which, however, were significantly enhanced by blocking the contralateral dorsal nucleus of the lateral lemniscus. Thus, FFRs in inferior colliculus to ipsilateral stimulation were facilitated by excitatory projections from the contralateral inferior colliculus but suppressed by inhibitory projections from the contralateral dorsal nucleus of the lateral lemniscus. *NeuroReport* 19:1377–1380

Keywords: dorsal nucleus of lateral lemniscus, frequency-following response, γ-aminobutyric acid, glutamate, inferior colliculus, kynurenic acid

Introduction

T - (FFR) 1,2 . H FFR - 3 5 , 6 , R ' 7 8 . H , FFR . T , . A , FFR , - - - - 9 . M , - - FFR 10,11 . H , - FFR , - . T , GABA 12 15 . E

- - (KYNA) .

Methods

Animal preparation

E 24 S D (300 400) B V R E A T L . (B , C). T : 1 (n=12) 2 (n=12). A 12- (7:00) - 1 . A . T B L A C , - C C A C , P U A H N - R S N (1995).

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10/ , (ED1).
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Drug administration and electrophysiological recording

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J , USA). A 1−2 μ KYNA (1 M) L ’

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(1000 ×), (0.1−5 H),
(N=500).

Experiment 1: effects of blocking the contralateral inferior colliculus

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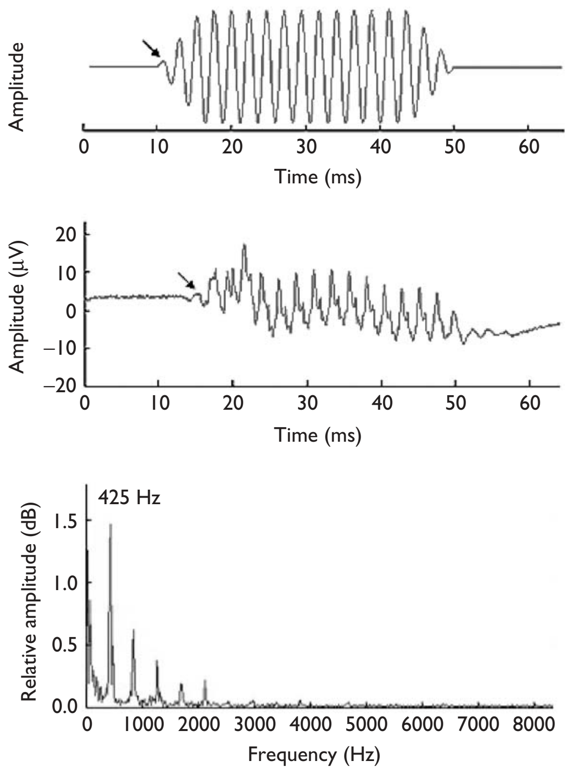

Fig. 1 Example of frequency-following response (FFR) recorded in the central nucleus of the inferior colliculus to a 425-Hz pure tone. Top panel: stimulus waveform (the arrow indicates the onset point of the sound); middle panel: response waveform (the arrow indicates the starting point of FFRs); bottom panel: spectrum of FFRs (displayed in the frequency domain). The results of spectral analyses at each peak stimulus frequency were used to quantify the FFR frequency response range as well as the effects of drug administration.

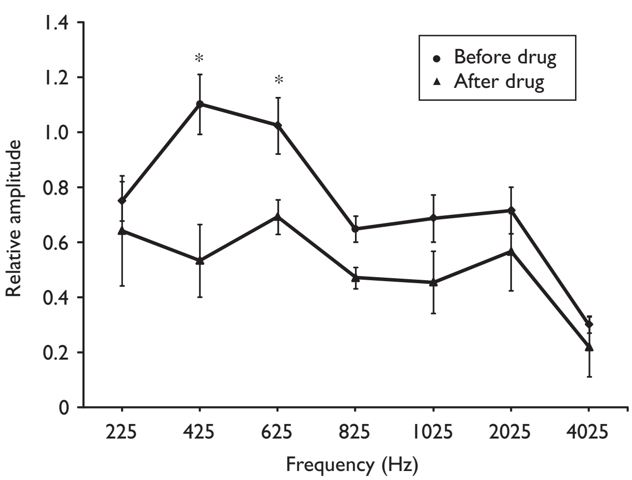

Fig. 2 Frequency-following response (FFR) amplitudes in ipsilateral central nucleus of the inferior colliculus before (filled circles) and after (filled triangles) administration of kynurenic acid (KYNA) into contralateral inferior colliculus. Results are presented for the frequency range (225–4025 Hz) with detectable FFR waveforms. $*P < 0.05$.

2025 H . I , L ’
FFR
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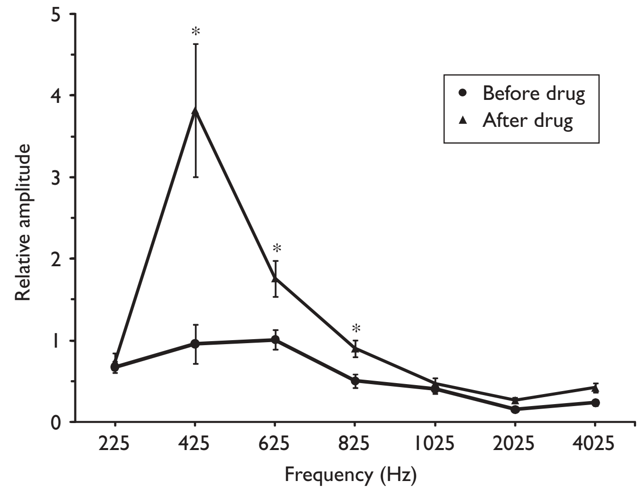

Fig. 3 Frequency-following response amplitudes in the ipsilateral central nucleus of the inferior colliculus before (filled circles) and after (filled triangles) administration of kynurenic acid into contralateral dorsal nucleus of the lateral lemniscus. $*P < 0.05$.

Discussion

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15,24 .
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I ,
, , GABA ,

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I 2, KYNA -
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FFR
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FFR .

Conclusion

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4 H ,
. T FFR
. T
FFR
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FFR ,
25
14 , .

Acknowledgements

T N N S F C (30670704; 60605016; 60535030; 60435010), N H T R D P C (2006AA01Z196, 2006AA010103), T -C T P F - T S E C , 985’ P U .

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