

研究论文

偏离最佳频率的声信号对几内亚长翼蝠下丘神经元的前掩蔽

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摘要:

为探讨偏离神经元最佳频率(best frequency, BF)的声刺激对下丘神经元的前掩蔽效应, 实验选用5只听力正常的几内亚长翼蝠(*Miniopterus magnater*), 记录它们的下丘神经元对偏离BF的掩蔽声和探测声(BF)的反应。结果发现, 当掩蔽声向高或低频方向偏离神经元的BF时, 掩蔽效应逐渐降低。根据计算出的掩蔽效应指数“R”下降50%时高、低频边的半带宽(half-band width), 可将受前掩蔽影响的神经元分为低频边长效掩蔽型、高频边长效掩蔽型和双边等效或均衡掩蔽型。结果显示, 所有神经元的高频边半带宽(half-band width_{high})与低频边半带宽(half-band width_{low})之间存在线性相关($n=24, r=0.47, P<0.05$); 50%神经元的half-band width_{low}显著大于half-band width_{high}($n=12, P<0.001$), 25%神经元的half-band width_{high}显著大于half-band width_{low}($n=6, P<0.05$), 其余25%神经元的half-band width_{high}与half-band width_{low}之间无显著差异($n=6, P>0.05$)。尽管掩蔽效应指数在偏离BF的高、低频边具有相关性, 但偏离BF的低频声对多数神经元具有更强的掩蔽效应。基于这些结果推测, 由偏离BF声刺激所产生的强掩蔽效应, 或许能为蝙蝠的发声抑制理论和有回声环境中的听觉抑制效应提供实验证据。

关键词: 偏离最佳频率声 前掩蔽 下丘神经元 几内亚长翼蝠

Forward Masking Induced by Off-Best Frequency Sound on Inferior Collicular Neurons of *Miniopterus magnater*

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Abstract:

To investigate the forward masking induced by off-best frequency (BF) sound on the responses of inferior collicular (IC) neurons to probe, the experiment was performed on 5 bats (*Miniopterus magnater*) with normal hearing and the responses of inferior collicular neurons to masker (off-BF sound) and probe (BF sound) were recorded extracellularly. It was observed that the forward masking decreased gradually with masker frequency toward low and high frequency sides. The neurons could be categorized into three types, i.e. low frequency side long-masking, high frequency side long-masking, and both side equal-masking neurons according to half-band widths of low (half-band width_{low}) and high (half-band width_{high}) frequency sides on the forward masking index "R" curve at 50% forward masking. There was linear correlated between half-band widths of low and high frequency sides in all neurons ($n = 24, r = 0.47, P<0.05$). Among these neurons, half-band width_{low} in 50% of the neurons was remarkable more than half-band width_{high} ($n = 12, P<0.001$), half-band width_{high} in 25% of the neurons was remarkable more than half-band width_{low} ($n = 6, P<0.05$), and half-band widths of low and high frequency sides in the remaining 25% of neurons were equal ($n = 6, P>0.05$). Although forward masking index "R" appeared a relevance between off-BFs toward high and low frequency sides, off-BF sound toward low frequency side had more powerful masking than toward high frequency side. These results suggested that forward masking caused by off-BF sound could be the base of depression induced by bat vocalization and auditory precedence effect in the environment with echo.

Keywords: Off-best frequency sound Forward masking Inferior collicular neurons *Miniopterus magnater*

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