Anlaysis of multiple organ interactions by recordings and manipulations of vagus nerve spiking activity

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The vagus nerve serves as a central pathway for communication between the central and peripheral organs. Despite traditional knowledge of vagus nerve functions, detailed neurophysiological dynamics of the vagus nerve in naïve behavior remain to be understood. In this study, we developed a new method to record spiking patterns from the cervical vagus nerve while simultaneously monitoring central and peripheral organ bioelectrical signals in a freely moving rat. When the rats transiently elevated locomotor activity, the frequency of vagus nerve spikes was correspondingly increased, and this activity was retained for several seconds after the increase in running speed terminated. During stopping, the vagus nerve spike patterns differed considerably depending on external contexts and peripheral activity states associated with cortical arousal levels. These observations are a new step for uncovering the physiological dynamics of the vagus nerve modulating the visceral organs such as cardiovascular, respiratory, and gastrointestinal systems. Moreover, I will present some preliminary data including a new method to operate the spiking activity of vagal fibers using transgenic mouse lines, which will be useful for further understanding central-peripheral organ interactions.