Abstract

STATUS SIGNALING AND THE CHARACTERIZATION OF A CHIRP-LIKE SIGNAL IN THE WEAKLY ELECTRIC FISH STEATOGENYS ELEGANS

by

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Sensory systems are critical to both exploratory and communicatory processes. In weakly electric fishes the electrosensory system is utilized for both of these purposes, and can thus be used to study both of these processes, which are critical to our understanding of how animals perceive and respond to their environments. One type of communication, status signaling, is widespread across taxa and frequently hormonally modulated. This hormonal modulation keeps the signal honest, wherein the status of the sender and the production of the status signal itself are both hormone dependent. We investigated exploratory and communicatory strategies of the electrosensory system in pulse-type gymnotiforms, with a focus on status communication in Steatogenys elegans and its hormonal modulation. Steatogenys elegans sometimes responds with brief increases in electric organ discharge rate coupled with decreases in amplitude when presented with interfering playback stimuli. This response is similar to the chirp EOD modulation in other weakly electric fish species. Our initial work catalogued exploratory electrosensory behavior in Steatogenys elegans along with three other pulse-type gymnotiforms (Hypopygus cf. lepturus,
Microsternarchus bilineatus, & Brachyhypopomus sp.), with the aim of determining the electrosensory repertoires of these species under solitary conditions without experimental stimulation. We then characterized the chirp in Steatogenys elegans to determine its structure and the context in which it is produced. Finally, we implanted Steatogenys elegans subjects with DHT and monitored changes in chirp propensity and characteristics, in an effort to determine if the chirp is hormonally modulated. In our exploratory behavior investigations, all species exhibited faster EOD rates with a smaller range of frequencies during night (active) periods than day (quiescent) periods. Pacemaker stability did not appear to vary throughout the day, but all species except Brachyhypopomus sp. showed more rate variability at night than during the day. All species displayed stereotyped short-term EOD behaviors such as frequency rises, yet the chirp differs from these other behaviors in its rapid and large frequency increase with an equally rapid return to baseline rate, its decrease in EOD amplitude, and its short duration of just a few pulses as compared to other short-term EOD behaviors which last 10s to 100s of pulses with more gradual changes in frequency. We found that the chirp is most readily produced in response to interfering playback stimuli, and that DHT implanted subjects produced more chirps and produced them in response to a broader range of playback stimuli. Additionally, their chirps were modulated in such a way that their frequency, duration, and amplitude characteristics were exaggerated. The chirp in Steatogenys elegans appears to be similar to the chirp in other WEF species, may serve as a hormonally dependent honest communicatory signal, and is a promising model system for investigations into status communications and their hormonal control.