A melanocortin modulates the amplitude and repolarization time of electrocyte action potentials in male electric fish, *Brachyhypopomus pinnicaudatus*

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828.16

1 What is the local modulator of action potential waveform in electrogenic cells?

CONCLUSIONS:

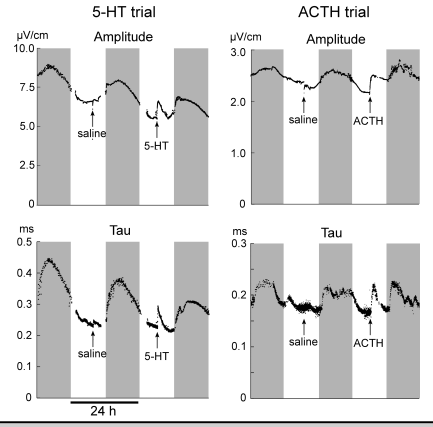
1. The melanocortin peptide, adrenocorticotropic hormone (ACTH) increases the amplitude and repolarization time of the intra- and extracellular action potentials (APs) of single electrocytes. ACTH increases the amplitude of the extracellular potential, but decreases slightly the intracellular AP.
2. Serotonin (5-HT) has no effect upon electrocyte APs.
3. These data suggest that modulations of electrocyte AP occur via a melanocortin receptor.

2 Background

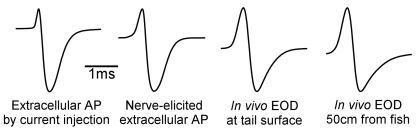
The weakly electric fish *Brachyhypopomus pinnicaudatus* generates **E**lectric **O**rgan **D**ischarges (**EODs**) for electrolocation and communication. The EOD is produced by the summed action potentials of electrogenic cells (electrocytes) in the animal's electric organ.

The EOD amplitude and duration are modulated rapidly in response to social and environmental conditions, presumably through rapid modulation of electrocyte AP waveform.

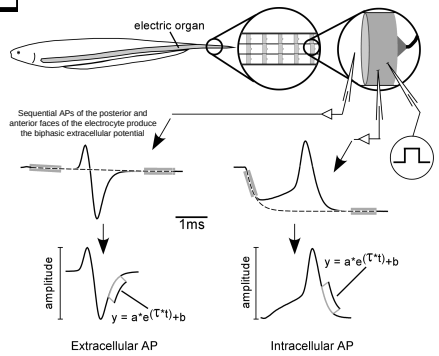
In vivo peripheral injections of serotonin (5-HT) and adrenocorticotropic hormone (ACTH) cause rapid, transient increases in EOD amplitude and ***tau*** (the time constant of repolarization). The factor acting locally upon electrocytes is unknown.



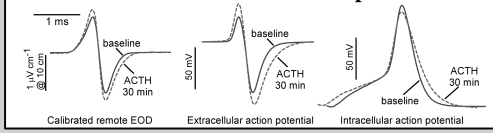
3 Extracellular action potentials of single electrocytes sum to produce the EOD

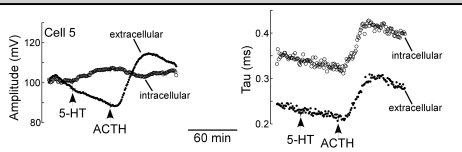


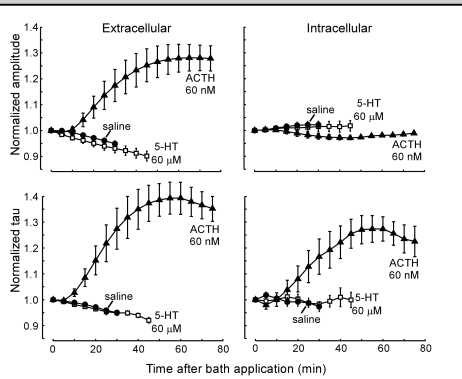
4 Action potential recording and analysis



5 ACTH rapidly and transiently modulates the extra- and intracellular potentials



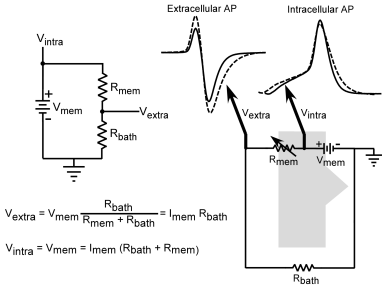




6 Modeling the membrane as a voltage divider explains stability of the intracellular peak potential as the extracellular potential varies

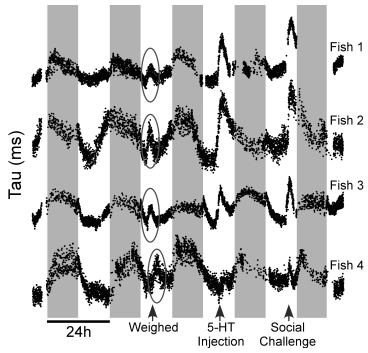
Membrane and bath resistances in series form a voltage divider. An ACTH mediated drop in membrane resistance will increase the extracellular, but not the intracellular potential.

We predict that whole cell voltage clamp will reveal that ACTH causes an increase in peak inward sodium current. This model, however, does not address changes in EOD duration, which may result from other changes in ion channel kinetics.



7 Consistent with the role of ACTH in mediating the stress response, fish enhance their EODs when captured and weighed

We have optimized our injection procedure to minimize the stress response – note minimal response to saline injections in Panel 2.



Poster URL: http:// www.fiu.edu/~stoddard/pkspapers.html

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