FP6-016039

CILIA

Customized Intelligent Life-Inspired Arrays

Integrated Project

Information Society Technologies
Future & Emerging Technologies
Proactive Initiative BIO-I3

DELIVERABLE: D2.2.11 – Executive Summary

REPRESENTATION OF WATER FLOW AND VELOCITY BY BRAINSTEM NEURONS

Actual submission date:	February 28, 2009		
Start day of project:	September 1st, 2005	**Duration:**	48 months

CILIA ("**C**ustomized **I**ntelligent **L**ife-**I**nspired **A**rrays") is a project funded by the European Union. For more information on the project, its partners and contributors please see http://www.cilia-bionics.org/ .

EXECUTIVE SUMMARY

Literature suggests that fluctuations within a water flow may be used by the central lateral line to determine direction and velocity of an impinging water flow by comparing inputs from the array of peripheral receptors (neuromasts). To test this hypothesis, we recorded the neuronal activity from brainstem neurons in a water flow and analyzed how the activity depended on the velocity and direction of flow, i.e. whether flow was passing the fish from anterior to posterior or opposite. If brainstem neurons indeed determine flow velocity and direction by comparing inputs from two or more neuromasts that are organized in series on the fish surface, then neurons should be found that are velocity- and/or direction-sensitive, i.e. they should respond preferentially to particular flow velocities and directions.

The methods were similar to those applied in our studies on the activity of lateral line nerve fibers in water flow (see D2.1.6). In short, we systematically investigated the neuronal activity of brainstem neurons in response to different constant-velocity flows and to a flow of continuously increasing velocity.

The data show that different MON neurons can exhibit quite variable responses to water flow. Moreover, most responses were different from those described for primary afferent fibers. We found neurons that responded with an increase in discharge rate to both flow directions, neurons that responded with a decrease to both flow directions. Other neurons exhibit an increase and/or decrease in discharge rate depending on flow direction, i.e. they differed in their responses to the presented flow directions. However, neurons with a clear preference for a distinct flow velocity or a small range of flow velocities were not found. Thus, MON neurons apparently do not encode water velocities and directions in the same way as primary lateral line afferent fibres.