

Contents

Part I Spatio-Temporal Structure of Natural Water and Air Flow Stimuli

1 Natural Hydrodynamic Stimuli 3
Wolf Hanke

2 Laser-Based Optical Methods for the Sensory Ecology of Flow Sensing: From Classical PIV to Micro-PIV and Beyond 31
Thomas Steinmann and Jérôme Casas

Part II Flow Sensing and Animal Behavior

3 The Role of Flow and the Lateral Line in the Multisensory Guidance of Orienting Behaviors 65
Sheryl Coombs and John Montgomery

4 Hydrodynamic Imaging by Blind Mexican Cavefish. 103
Shane P. Windsor

5 Flow Sensing in Sharks: Lateral Line Contributions to Navigation and Prey Capture 127
Jayne M. Gardiner and Jelle Atema

6 Hydrodynamic Perception in Seals and Sea Lions 147
Guido Dehnhardt, Wolf Hanke, Sven Wieskotten, Yvonne Krüger and Lars Miersch

7 The Slightest Whiff of Air: Airflow Sensing in Arthropods. 169
Friedrich G. Barth

8	Air Flow Sensing in Bats	197
	Susanne J. Sterbing-D'Angelo and Cynthia F. Moss	
9	Flies, Optic Flow and Multisensory Stabilization Reflexes	215
	Holger G. Krapp	

Part III Evolution and Development of Flow Sensors

10	Lateral Line Morphology and Development and Implications for the Ontogeny of Flow Sensing in Fishes	247
	Jacqueline F. Webb	
11	Evolution of Polarized Hair Cells in Aquatic Vertebrates and Their Connection to Directionally Sensitive Neurons	271
	Bernd Fritzsche and Hernán López-Schier	
12	Patterning the Posterior Lateral Line in Teleosts: Evolution of Development	295
	Alain Ghysen, Hironori Wada and Christine Dambly-Chaudière	
13	Functional Architecture of Lateral Line Afferent Neurons in Larval Zebrafish	319
	James C. Liao	

Part IV Biomechanics and Physiology of Flow Sensors

14	Techniques for Studying Neuromast Function in Zebrafish	335
	Primož Pirih, Gaston C. Sendin and Sietse M. van Netten	
15	Neuronal Basis of Source Localisation and the Processing of Bulk Water Flow with the Fish Lateral Line	371
	Horst Bleckmann and Joachim Mogdans	

Part V Modelling of Flow Sensing and Artificial Flow Sensors

16	Hydrodynamic Object Formation: Perception, Neuronal Representation, and Multimodal Integration	399
	J. Leo van Hemmen	
17	Crickets as Bio-Inspiration for MEMS-Based Flow-Sensing	459
	Gijs J. M. Krijnen, Harmen Droogendijk, Ahmad M. K. Dagamseh, Ram K. Jaganatharaja and Jérôme Casas	

18	Complex Flow Detection by Fast Processing of Sensory Hair Arrays	489
	Christoph Brücker and Ulrich Rist	
19	Stress-Driven Artificial Hair Cell for Flow Sensing	499
	Francesco Rizzi, Antonio Quattieri, Lily D. Chambers, Gianmichele Epifani, William M. Megill and M. De Vittorio	
20	Snookie: An Autonomous Underwater Vehicle with Artificial Lateral-Line System	521
	Andreas N. Vollmayr, Stefan Sosnowski, Sebastian Urban, Sandra Hirche and J. Leo van Hemmen	