# 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. Susanne J. Sterbing-D’Angelo and Cynthia F. Moss

9 Flies, Optic Flow and Multisensory Stabilization Reflexes. 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. Jacqueline F. Webb

11 Evolution of Polarized Hair Cells in Aquatic Vertebrates and Their Connection to Directionally Sensitive Neurons. Bernd Fritzsch and Hernán López-Schier

12 Patterning the Posterior Lateral Line in Teleosts: Evolution of Development. Alain Ghysen, Hironori Wada and Christine Dambly-Chaudière


Part IV Biomechanics and Physiology of Flow Sensors

14 Techniques for Studying Neuromast Function in Zebrafish. 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. 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. J. Leo van Hemmen

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 Qualtieri, 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
Flow Sensing in Air and Water
Behavioral, Neural and Engineering Principles of Operation
Bleckmann, H.; Mogdans, J.; Coombs, S.L. (Eds.)
2014, XIII, 562 p. 200 illus., 77 illus. in color., Hardcover
ISBN: 978-3-642-41445-9