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EDITORIAL

Foreword for the special issue on Neural Coding

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How is the environment represented in the brain? How do brains learn and adapt? What is the code through which neurons communicate? How do animals make decisions? How does the brain generate appropriate behavior? What is the neuronal basis of cognition? How does intelligence emerge? Can biological systems teach artificial systems? Can animal learning inspire machine learning? These crucial questions are at the core of the quest for understanding brain function and of the endeavor to build artificial intelligent systems.

Over the past decades, the field of *Neural Coding* has evolved rapidly. The original focus, which was on the efficient representation and transmission of information in single neurons and neuronal populations, has broadened to a wide scope of information processing in synapses, single neurons, and neuronal networks. Timely topics include for instance the transformation from dense to sparse codes, the emergence of percepts at higher brain centers, adaptation and memory formation as a form of re-coding of information, and the formation of behavioral decisions based on evidence and experience.

The series of twelve *International Neural Coding Workshops* starting in 1996 have had a pioneering role in bridging the domains of the practically disjoint disciplines of neurobiology, mathematics, physics, computer science, and robotics, and introducing theoretical ideas and methods to neuroscience research. This concept of combining theoretical with experimental and clinical approaches has proven highly successful and nowadays plays a pivotal role in the modern neurosciences. The *12th International Neural Coding Workshop*, held at the University of Cologne in September 2016 (http://neural-coding-2016.uni-koeln.de), stood in tradition of this spirit, bringing together researchers of many diverse disciplines and drawing a comprehensive and timely picture of the exciting field of *Neural Coding*.

This Special Issue of *Biological Cybernetics* presents a selection of peer-reviewed contributions including five original studies presented at the workshop and five perspective-type articles, prospects. Each Prospect provides a state of the art introduction to a particular topic combined with novel results and an outlook on future developments.

It is our great pleasure to thank Prof. Leo van Hemmen for his encouraging and generous support. In view of its long tradition, *Biological Cybernetics* is actually ideal for hosting this Special Issue.

We are looking forward to continuing the series of International Neural Coding Workshops, the next one being scheduled for fall 2018 in Torino, Italy (http://www.neuralcoding2018.unito.it).

This article belongs to a Special Issue on Neural Coding.

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