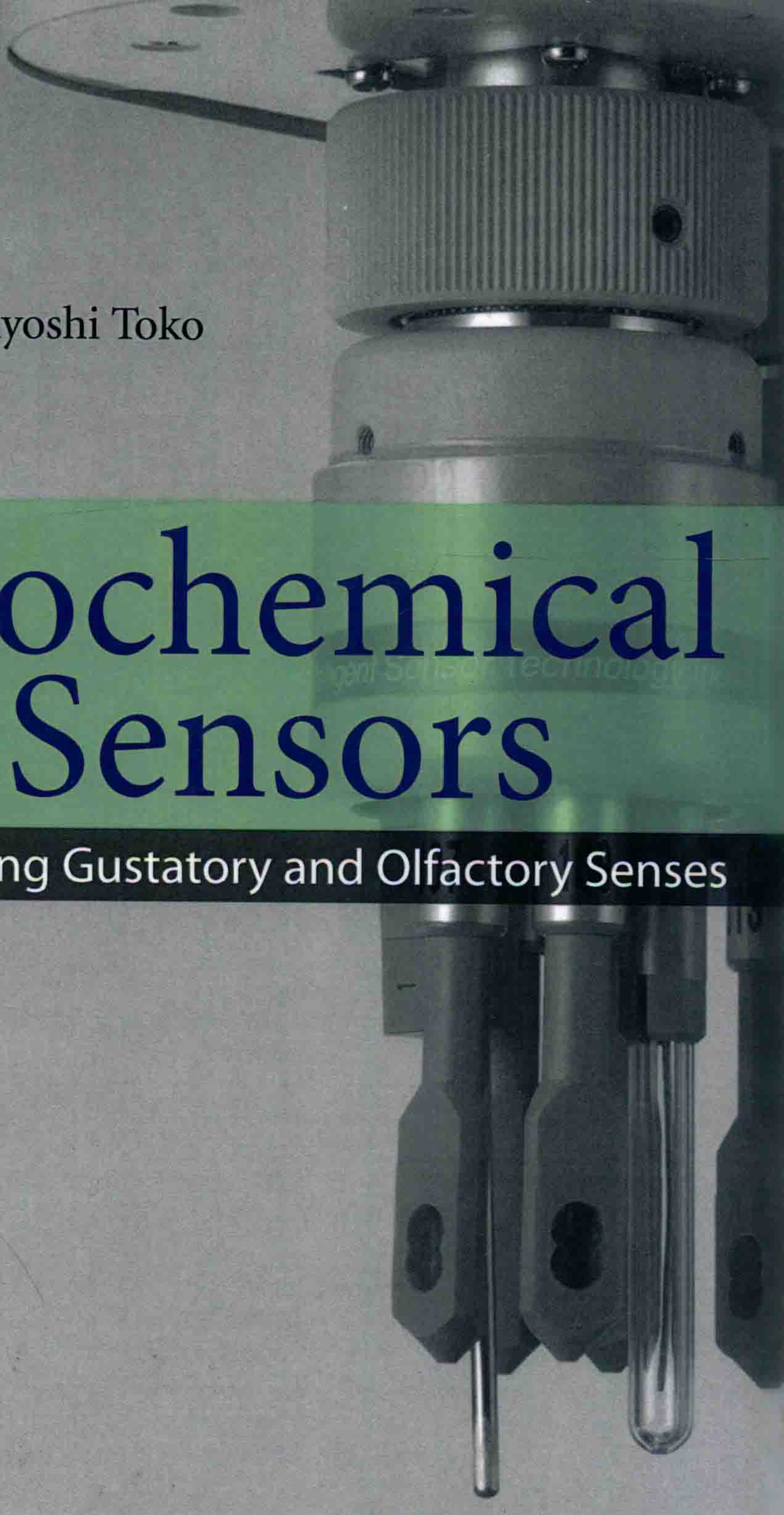
edited by Kiyoshi Toko

Biochemical Sensors

Mimicking Gustatory and Olfactory Senses



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Biochemical Sensors: Mimicking Gustatory and Olfactory Senses

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Biochemical Sensors

Preface

Gustatory and olfactory senses receive chemical substances. Recent developments in biochemical and genetic sciences have clarified these mechanisms. As a result, sensor technologies to mimic the mechanisms have appeared and progressed. A taste sensor, i.e., an electronic tongue with global selectivity, can discriminate taste and also quantify it by providing the "scale of taste"; it has begun to be used in food and medical companies all over the world. Global selectivity means the ability to decompose the characteristics of a chemical substance into those of each type of taste and to quantify the taste. As for electronic noses, several types of devices have been developed so far. They are used in many fields such as foods, perfumery, medicine, robotics, as well as safety and security, including protection from terrorism and disaster. Electronic tongues and noses are fabricated using nanotechnology, materials science, biotechnology, biomedical engineering, electronic engineering, information science, chemistry, and biology; i.e., they are nothing but the products of interdisciplinary research.

This book comprehensively treats sensors for gustatory and olfactory senses, and also related topics such as gas sensors, chemical sensors, molecular-recognition devices, BioMEMS, μTAS, and lab-on-a-chip. Recent development of these sensors has been very rapid. Other kinds of sensors corresponding to the senses of touch, sight, and hearing are already completed and spread. Sensor development, which is related to the above chemical senses and biological viewpoints, is active on the basis of that situation.

Part 1 focuses on the taste sensor and describes its basic principles and applications to foods and medicines. Each gustatory receptor for the five basic tastes simultaneously receives multiple chemical substances and shows a semi-selective property; as a result, the taste of foods is decomposed into each type of taste by each taste receptor, which does not discriminate between individual chemical substances. The taste sensor is a kind of electronic tongue developed by mimicking the mechanism of the human tongue. Part 1 provides many application examples such as tea, coffee, meat, wine, soup, and several kinds of medicines.

Part 2 reviews electronic noses and highlights the recent developments in related topics such as odor recorder and molecular-wire-type sensor, and concrete application examples. Part 3 presents application examples of the taste sensor, gas sensors, and surface-plasmon-resonance biosensors to the field concerned with safety and security, and also related molecular-recognition devices and the lab-on-a-chip system.

All individual chapters are written by leading experts in the corresponding fields. This book is a practical and user-friendly textbook for researchers and postgraduate students in academics and industry areas who are involved in food and medical production and science, and also in scientific fields such as sensor technology, nanotechnology, materials science, and bioengineering.

I wish to thank all the contributing authors of this book. I would like to give sincere thanks to Ms. H. Chiba and Dr. H. Cui for their editorial help. I also wish to express my endless gratitude to my wife, Kayano, for her warm support.

Kiyoshi Toko
Spring 2013

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