

Preface

We have five senses: vision, hearing, touch, smell, and taste. Although some other senses including balance, pain, itch, and temperature senses have been reported, the five senses remain major classical senses. Among these five senses, three of them: vision, hearing, and touch, recognize physical stimuli, and the other two senses recognize chemical stimuli. The science and technology concerned with vision and hearing have been advanced enormously, while the understanding of the chemical senses, especially the sense of smell, has been very limited.

The stimulus energy for the sense of vision and hearing is light and sound, respectively. The camera, video camera, and recorder create recorded signals which can be even delivered to remote places. Using this technology we can watch the Olympic game on TV at home. The sense of touch has been also integrated with information technology in the form of the tablet PC.

On the contrary, there is no such a device which can capture smell or taste. The sense of smell is even more complicate and mysterious than the sense of taste. Electronic noses have been intended to mimic the signal processing of the sense of smell; however, elemental receptor materials of the conventional electronic noses are totally different from human olfactory receptors. If we consider that the sense of smell is a chemical sense, the same receptor materials as those in the human nose should be employed to accurately realize the human sense of smell.

In the last two decades, much has been learned about the smell sensing mechanism in biological systems. With knowledge about the biological olfactory system and the techniques for the expression of biological receptor proteins, we are able to utilize biological materials and systems to mimic the biological olfactory system. In addition to the advances in biological and biotechnological area, nanotechnology has progressed to a great degree. The “bioelectronic nose”, the device which has a similar function to the human smell sensing system, can be realized by combining the olfactory cells or receptors with nanotechnology.

The bioelectronic nose is a good example of the integration of biotechnology and nanotechnology. This book combines contributions from basic biological sciences of the olfactory system, biotechnology for the production of olfactory biological elements, and nanotechnology for the development of various sensing devices. The purpose of this book is to provide the reader with a concept, basic sciences, fundamental technologies, applications, and perspectives of the bioelectronics nose.

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