Sensors and Materials, 4, 3 (1992) 135–144
MYU, Tokyo

S & M 0105

Taste Detection Using Chaos in Excitable Lipid Membrane

Yoshinori Saida, Tetsuya Matsuno, Kiyoshi Toko* and Kaoru Yamafuji

Department of Electronics, Faculty of Engineering, Kyushu University 36, Fukuoka 812, Japan

(Received July 3, 1992; accepted August 1, 1992)

Key words: artificial lipid membrane, self-sustained oscillation, attractor, chaos, taste sensing

An artificial excitable membrane composed of a porous filter and dioleyl phosphate exhibits a self-sustained oscillation of the membrane potential in the presence of a salt-concentration difference, pressure difference and DC electric current across the membrane. When AC electric current was superimposed on the DC current, chaotic (irregular) oscillations appeared. The effect of taste substances on the chaotic state was investigated. Characterization of the dynamic behavior of the membrane potential using chaotic attractors was shown to be an effective method of measuring taste.

1. Introduction

In biological systems taste substances are received by biological membranes, changing the membrane potentials. This leads to self-sustained oscillations of electric potentials in neurons. The spatiotemporal firing pattern of the neurons is transmitted to the cortex, and the brain recognizes the taste. We have used artificial lipid membranes as a transducer of chemical information to electric signals, and constructed a taste-sensing system with a multichannel electrode composed of eight kinds of artificial lipid membranes.[1,2] Since different kinds of lipid membranes show different responses to taste substances, the taste is distinguished by the response pattern composed of static electric potentials of membranes of this sensor.

*To whom all correspondence should be addressed.