AN INTEGRATED 4-CHANNEL CURRENT STIMULATOR FOR MICROMACHINED NEURAL PROBES

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Soon Kwan An, Seik Park, Sung June Kim
School of Electrical Engineering and Nano Bioelectronics and Systems ERC, Seoul National University, Seoul

Micromachined silicon neural probes have been developed because they have many advantages over conventional metal wire bundles. Active circuitry can be monolithically integrated with neural probes so that recording and stimulating electrical signals for interfacing with the nervous system can be done. Recording electrical activity from many neurons in the brain is helpful in improving our understanding of the complex operation of neural structures and of brain function.
Stimulating neurons are also of great importance for restoring function in the disabled. In this paper, we report on the development of the 4-channel integrated stimulator circuit.
The stimulator circuit was designed and fabricated using 1.5 μm standard CMOS process of ISRC (Interuniversity Semiconductor Research Center) in Seoul National University. This stimulator consists of a controllable current sources for generating the stimulation currents, and a 4 to 1 multiplexer for channel selection. The controllable current sources was designed to be able to perform current sourcing and sinking operations according to the external control signals so both bipolar and monopolar stimulation schemes are possible. It can deliver bipolar current ranging $-310\,\mu$A to $310\,\mu$A with $10\,\mu$A resolution. The designed stimulator can be used as a stimulator chip or monolithically integrated with micromachined silicon neural probes. The semiconductor neural probe with integrated stimulator is expected to be an useful tool for neural prosthesis.

Key Words: Neural probe, Stimulator, CMOS, Neural prosthesis

GENDER DIFFERENCES AND GONADAL HORMONES ON NICOTINE-INDUCED CHANGES OF POPULATION SPIKE AMPLITUDE IN GERBILS

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Chung-Kil Won, Hyoung-Ha Lee, Dong-Woo Kim, Dong-Hoon Kim, Boe-Gwun Chun
Department of Pharmacology, College of Medicine Korea University, Seoul

The effect of nicotine on the population spike (PS) in the hippocampal CA1 region evoked by electrical stimulation of the dentate gyrus have been compared in male and female gerbils. In the male gerbils, single Nic0.5 injection (0.17 mg/kg nicotine base) slightly decreased in the hippocampal CA1 region. But single Nic0.5 produced a marked increase of the PS amplitude in male gerbils on the 4th day after repeated pretreatment of Nic0.5 for 7 days. However, unlike in non-castrated males, single Nic0.5 treatment produced the marked increase of the evoked PS amplitude in the castrated males. Furthermore, repeated pretreatment with flutamide (25 mg/kg, s.c.) for 7 days also markedly increase the PS amplitude in response to single Nic0.5 treatment. Castration-induced increase of the PS amplitude in response to Nic0.5 treatment was little affected by repeated pretreatment with testosterone (4 mg/kg, s.c.) for 7 days. However, the repeated treatment of flutamide did not affect the increase of evoked PS amplitude by combined treatment with Nic0.5 for 7 days. In the female gerbils, single Nic0.5 injection induced markedly increase of the PS amplitude and the nicotine effect was not changed by 17beta-estradial (0.1 mg/kg, s.c.) for 7 days. These results suggest that the increase of evoked PS amplitude in the hippocampus CA1 region induced by repeated nicotine treatment is not associated with changes of gonadal steroid metabolism. But the testicular testosterone may be suppressing the increase of evoked PS amplitude in response to single nicotine treatment.

Key Words: Nicotine, Population spike, Hippocampus, Gender difference, Gonadal hormone