FUNDING PROGRAM FOR NEXT GENERATION WORLD-LEADING RESEARCHERS

Project Title: Establishment of the basic technology for system integration in micro implants of auditory central nervous systems	
Name: Takashi TATENO	**Institution**: Hokkaido University

1. Background of research Approximately 1,200 babies are born with congenital deafness each year in Japan. Early treatment of deafness is important to facilitate the development of communication skills. Indeed, auditory implants have proven effective for many individuals who are profoundly deaf or hard-of-hearing, particularly if, for example, the cochlear or auditory brainstem implants are employed when the patient is young. Because most currently available auditory implant devices are produced in foreign countries and imported to Japan, domestically manufactured products and new technologies are desired. In addition, as a leader in microfabrication and fine process technologies, Japan is well-positioned to develop high-performance microdevices that can be used in auditory implants.

2. Research objectives In this project, we aim to produce microdevices that stimulate nerves in the central nervous systems of individuals with severely impaired peripheral auditory systems and/or auditory nerve fibers. To this end, we will build a foundation for developing new techniques to integrate micromechanical devices that serve as acoustic sensors and mechanoelectrical transducers, electronic devices that process subsequent signals, and cellular interfaces consisting of stimulation electrodes into small implantable devices.

3. Research characteristics (incl. originality and creativity) We will develop biomimetic mechanical devices that serve as acoustic sensors and mimic biologic processes or micro-structures. We will also develop a multichannel amplifier for small biologic signals and a multisite stimulator to activate neurons in the central nervous system using very large-scale integration (VLSI) technology. By applying technologies used in microelectromechanical systems (MEMS), we will produce an implantable device that compensates for problems in the peripheral auditory and early central nervous systems. Particularly, we will use many of the techniques that we have developed over the years, such as using the same architectures of devices for small signal amplification during neural recordings and electric stimulation of neurons in the brain.

4. Anticipated effects and future applications of research This research is likely to result in new technologies for auditory implants and provide basic insights into system integration with microdevices. In addition, the techniques developed in this project can provide a new tool in basic neuroscience researches to record neural activity in vivo and stimulate neurons effectively. We especially expect these techniques will help young people who are born hard-of-hearing develop better communication skills. We will also attempt to support domestic Japanese industry, including future manufacturing of sensory implants and multi-site recording/stimulating systems for neural electrical activity.