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What is new in Neuroscience?

New techniques make it possible to study morphology and function of the nervous system in healthy humans and individuals with diseases. Other technological developments make it possible to determine the strength of connections in the brain and the spinal cord. Symptoms of disease were earlier believed to be caused by pathology of specific parts of the nervous system, but it has become evident that many parts of the brain may be involved in causing the symptoms of each one of many diseases. Symptoms of diseases were earlier believed to be related to detectable morphological changes. It is now known that symptoms of many neurological diseases may be caused by changes in connections between parts of the central nervous system, changes that do not have morphological correlates that can be detected by available clinical diagnostic methods. Neuroplasticity that makes it possible to learn new skills and adapt to changing demands also has dark sides; maladaptive plasticity plays an important role in many common diseases such as chronic neuropathic pain, tinnitus, spasticity, and probably also fibromyalgia and the chronic fatigue syndrome. There is now evidence that the role of harmful (maladaptive) neuroplasticity is greater than earlier presumed. Altered functional connections in the brain are related to the pathology of diseases such as chronic neuropathic pain and severe tinnitus, age-related symptoms and signs. The cholinergic system of the forebrain (the nucleus of Meynert) that promotes activation of neuroplasticity can be activated through the vagus nerve. Electrical stimulation of the vagus nerve may thereby promote plastic changes, and it may reverse the symptoms and sign of some plasticity diseases when paired with appropriate sensory stimuli. There is recent evidence that both the innate and the adaptive immune systems can influence neural functions and that the nervous system can affect the immune system. The vagal immune reflex is an example. The immune system can modulate many forms of pain and immunoglobulin is now being considered for treatment of certain pain conditions. Stress can suppress the immune system. Signals from the gut affect many neural functions, for example, receptors in the distal portion of the small intestine can affect pain circuits in the brain. Epidemiological studies have shown that the risk of giving birth to a child with autism spectrum disorder or spina bifida (neural tube defects) can be lowered significantly if the mother takes a B-vitamin (folic acid) before and during pregnancy, indicating that the root cause of these diseases are errors in the early development of the brain that occurs in early stage of pregnancy. This is an example of how the occurrence of serious diseases that have no known cure can be reduced by administration of a harmless supplement. Unfortunately, only a few people take advantage of that.

Speaker Biography

Aage R Møller is known internationally for his innovative research on sensory systems and neural plasticity and for developing methods for reducing the risk of neurological deficits in neurosurgical operations. His work has helped establish UT Dallas as a leader in tinnitus-related research. His lengthy research career has focused on four primary areas: The basic function of the ear, sound transmission in the middle ear and cochlea, the neural code of complex sounds and neural plasticity. He eventually moved on to research in humans aimed at studying disorders of the year and the nervous system, such as tinnitus. He began his research career at the famed Karolinska Institut in Sweden. In 1978, he was invited to join the University of Pittsburgh. There he did innovative research in the area of neurosurgery and intraoperative neurophysiology; he developed methods for reducing the risks of serious neurological deficits after neurosurgical operations. He was one of the founders of a new specialty; intraoperative neurophysiological monitoring and he did innovative research that lead to better understanding of several neurological diseases. When he joined UT Dallas in 1997, he became interested in abnormalities in the nervous system function among individuals with autism. He developed teaching programs in the biology of pain; sensory systems, neuroplasticity and he established the first university program in teaching IONM in a graduate program. During his time at UT Dallas, he was named the university's "President's Teaching Excellence Award," won Teacher of the Year for the School of Behavioral and Brain Sciences, and was named distinguished Lecturer in Cognition and Neuroscience. He earned his PhD in Medical Science at the Karolinska Institut in Stockholm, Sweden.

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