

## **Biomagnetic measurement of lumbar, cervical, and peripheral nerves using magnetospinography**

Creating new solutions using a system of open innovation between Tokyo Medical and Dental University, Kanazawa Institute of Technology and Ricoh

**TOKYO, Japan** – July 24, 2019 –Ricoh Company, Ltd., (Tokyo, Japan) today announced that Ricoh, Tokyo Medical and Dental University and Kanazawa Institute of Technology have succeeded in measuring the magnetic field of the lumbar spinal nerves in addition to the cervical spinal cords using a magnetospinography system. Furthermore, the magnetic fields from peripheral nerves at the palm and brachial plexus were also successfully observed using the system. This achievement is expected to expand the clinical application of magnetospinography and is a giant step towards clinical use.

A magnetospinography system is a device that noninvasively measures and visualizes faint magnetic fields caused by nerve activity in the spinal cord and peripheral nerves. Ricoh, Tokyo Medical and Dental University and Kanazawa Institute of Technology have been carrying out joint development of this magnetospinography system with a view to creating a new solution that combines technology developments in hardware, software and diagnostic methods. Some of the results were prominently featured in the official journal of International Federation of Clinical Neurophysiology, *Clinical Neurophysiology*.

### <Background of the study>

In addition to diagnostic imaging using Magnetic Resonance Imaging (MRI), which images anatomical structure, electrophysiological diagnostic methods are often important for diseases of the nervous system e.g. in the spinal cord. Conventional electrophysiological modalities are incapable of accurate determination of lesion sites as it is difficult to evaluate the electrical activity of the spinal cord and nerves that are located deep inside and surrounded by bone, or soft tissue, from the surface of the body.

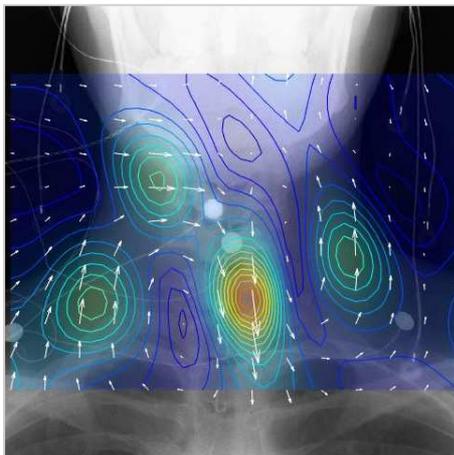
### <Overview of the achievements>

A combination of the technology developments in hardware, software, and diagnostic methods has enabled the measurement of the magnetic fields in the cervical spinal cord and lumbar spinal cord, which was previously difficult to measure. Electrophysiological recording in peripheral nerves such as in the palm and brachial plexus have also been successfully completed. This achievement has extended the clinical applicability of magnetospinography and is a giant step towards clinical use.

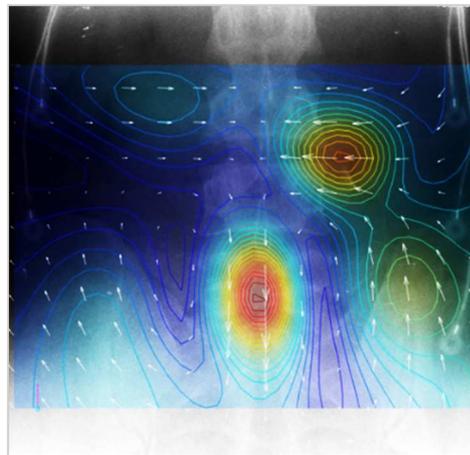
As the induced biomagnetic signal is nine orders of magnitude smaller than the geomagnetic field, and its conduction velocity is normally as high as 80m/s (maximum), the measurement of magnetic field from neural activity requires a magnetically shielded room, high-band and high-sensitivity magnetic sensors, and advanced signal processing methods.

Kanazawa Institute of Technology has developed highly sensitive and high temporal resolution Superconducting QUantum Interference Device (SQUID) sensors that allows the detection of faint magnetic signals to the several tens microsecond. The detected signals of the spinal cord's activities are superimposed on the anatomical image using a signal processing method developed by Ricoh. Tokyo Medical and Dental University established this functional evaluation method.

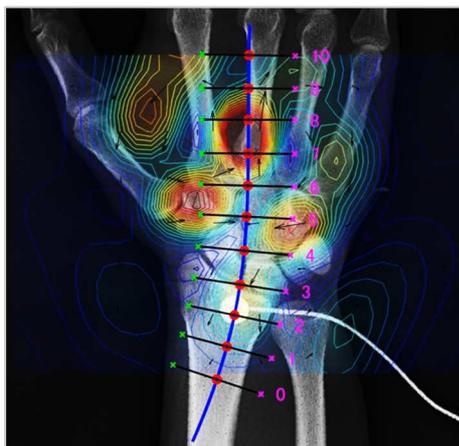
<Representative chart>



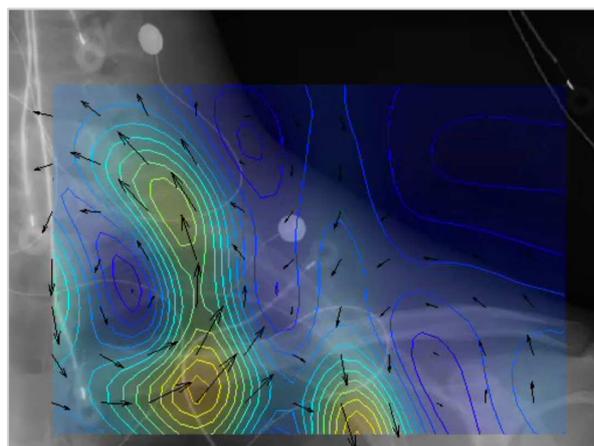
Cervical nerve activity



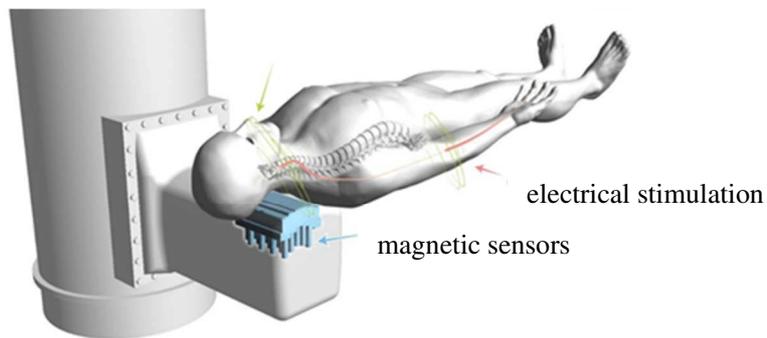
Lumbar nerve activity



Peripheral (palm) nerve activity



Peripheral (arm plexus) nerve activity



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#### <Significance of the study>

In addition to MRI, which images the anatomical structure, by visualizing the function of the spinal cord, we can accurately locate lesion sites and provide quantitative assessments of spinal cord diseases.

#### <Article information>

Journal: Clinical Neurophysiology

Title: Visualization of the electrical activity of the cauda equina using a magnetospinography system in healthy subjects

<https://www.sciencedirect.com/journal/clinical-neurophysiology/vol/130/issue/1>

※This device has not been approved for clinical use. It should not be sold or used for a clinical purpose.

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