30, 2010, we establish the Japanese Society for Neural Repair and Neurorehabilitation (JSNRNR) and have first annual scientific meeting in Nagoya. JSNRNR is expected to facilitate wider and deeper communication among clinicians and scientists involved in neurorehabilitation.

S04.3
Neurorehabilitation in Mexico: Contrasts, Institutions and Vulnerabiiities

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The health system in Mexico is functionally organized in socioeconomic groups. It divides the population into two groups: the "insured", which consists of public and private workers; social security institutes provide care in this group.
The "non government insured" which includes the middle and high class groups which can use private hospitals and clinics. The lower classes also belong to this group and the secretary of health provides medical services through its own independent public health system.
Each one of these three systems, social security, private sector and health ministry institutes, dictate their own policies and procedures, control their own budgets, and provide services independently, creating most of the time a functional redundancy.
Each system has its own rehabilitation departments, and neurological rehabilitation is provided by physical therapists mainly through the use of neurodevelopment techniques, under the supervision of a physician, rehabilitation specialist. Neurologists are not well integrated into the neurorehabilitation process.
There is no consensus in Mexican neurorehabilitation regarding evaluation scales, a common problematic issue being the application of isolated measurements for spasticity or the presence of synergies, and the lack of use of a standardized functional scale.
Neurorehabilitation professionals in Mexico are not an active research group, limiting the development of evaluation and treatment protocols based on their social, economic and cultural context, tending to copy treatment models from abroad and importing expensive technology
Rehabilitation services are provided to rural areas through so-called "basic rehabilitation units". Only two out of 31 states in the country have "community-based rehabilitation" programs, which function independent of the three health systems.
It has been suggested that improving education in rehabilitation schools and institutes can make a difference in the training of new generations of physicians and therapists, and improve patient care regardless of the system to which they belong.

SWS Scientific Workshop: Proprioceptive system in modern rehabilitation

SWS.1
The proprioceptive system, neurophysiologicai review

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For any kind of body movement an efficient function of the proprioceptive system is indispensable. The "sense of locomotion" was described at the first time by J.C. Scaliger 1557. C. Bell 1826 created the term "muscle sense" as physiologic feedback mechanisms in a reverse direction after stimulation to the muscles reporting their conditions. H.C. Bastian introduced "kinaesthesia" instead of the term "muscle sense" which the idea that tendons, joints and skin producing a stimulation. 1906 C.S. Sherington introduced the term "proprioception" responsible for the awareness of movement derived from muscles, tendons and articular sources. The responsible receptors are positioned in muscles, joints and ligaments around joints. The receptors help to register tension and stretch. The information is transferred to the brain cortex using the medial lemniscus in the brainstem, the thalamus and the thalamo-cortical projection called a conscious proprioception, contrary to the unconscious proprioception as the second afferent system, but using the dorsal spinocerebellar tract (J. D. Fix, 2002). The sensorimotor area is registering the peripheral information, selecting the required afferent stimuli. Every motor activity needs correct information about the position of body and extremities.
The basis for the normal function of the proprioception is the undisturbed gravity of our planet. Disturbances as in the weightlessness, the real microgravity, bring disturbed stimulation to the brain causing misinformation for the motor system. This is producing the "cosmonaut syndrome" with typical neurological deficits. Counter measures in the real microgravity are necessary. The simulated microgravity as an experimental state, but also in patients with long-lasting coma states and with diminished motion, as well as in elderly people, is producing the so-called bed rest syndrome.

SWS.2
Brain Imaging in proprioception

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PURPOSE: The aim of the study was to develop a paradigm for the mapping of the sensorimotor foot region in fMRI with vibrotactile stimulation. Therefore, a proper vibrotactile stimulus was developed and the elicited brain activation pattern was analyzed to find best vibration parameters and an optimized experimental protocol for the applicability of the developed paradigm in clinical functional diagnosis of the brain.
METHODES: 10 healthy male subjects (25-45yrs) were stimulated with a vibrotactile stimulus within the arch of the right foot. The stimulus was delivered through a fully automated moving magnet actuator with frequency (0-100Hz) and amplitude (0-4mm) control.
To avoid adaptation phenomena a stimulus wave form was formed as the product of a fixed vibration carrier signal and a modulation term which varied sinusoidally. The carrier frequency was held constant at 100 Hz at a fixed modulation frequency of 25Hz and a fixed stimulus intensity of 0.05N throughout the fMRI run.
Experiments were performed on a 1.5Tesla MR-scanner. For fMRI, we employed T2*-weighted EPI sequences (TR/TE/α=0, 96ms/66ms/90°, matrix=64x64, acquisition time: 2sec, voxel dimension= 4x 4x4mm). Twenty-four slices parallel to the bicommissural plane were simultaneously acquired in an event related design with randomized stimulus presentation with stimulus duration of 1 sec as a 2x2 design with vibration amplitude of 0.5 and 1 mm and a vibration frequency of 25 and 50 Hz. A total amount of 120 volume images was acquired during a single fMRI run. The scan repetition time for the

stimulus on/off conditions was 3s. Post-processing was performed offline with SPM99. A statistical parametric activation map was calculated for each of the 10 subjects and for the group of subjects with an uncorrected $p< 0.001$ on a cluster level of $k>8$.
RESULTS: FMRI group data of the 10 subjects showed brain activity: 1. bilaterally within the secondary somatosensory cortex located in the inferior parietal lobule, 2. contralaterally to the stimulated side within the primary sensorimotor cortex overlapping the pre- and postcentral gyrus, 3. bilaterally within the supplementary motor cortex within the superior frontal gyrus and 4. on the right hemisphere within the anterior cingular gyrus. The present study supports an increasing stimulus-response relationship between vibrotactile stimuli and the amplitude of the BOLD response within the primary sensorimotor cortex SM to a single vibrotactile event. Stimulus frequency did not significantly influence BOLD amplitude.
CONCLUSION: In the presented study, an fMRI paradigm for vibrotactile stimulation of the foot could be implemented within the MR environment. The vibrotactile stimulus can be well defined and frequency and amplitude can be controlled. The stimulus with a modulation frequency of 25Hz is able to elicit brain activation within main centers of the sensorimotor cortex for the right foot within a group of 10 subjects. The described fMRI map by vibrotactile stimulation of the foot holds promise for the applicability in neurorehabilitation, especially in patients after head injury or patients in Apallic Syndrom as well as in the planning and functional monitoring in neurorehabilitation.

SWS.3
Clinical and imaging effects of the mechanical stimulation of support zones of soles

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The purpose of this study was to investigate the influence of mechanical support stimulation (MSS) of soles on the recovery of the motor disturbances in postsroke patents and on the sensorimotor cortex activation in healthy subjects.
The mechanical support stimulator
imitated the afferentation, obtained from feet while slow walking (75 steps/min, 37,5 cycles/min and pressure 0,5+0,15 kg/cm^2). 22 patients (mean age 59,6+15,0 years) with moderate to severe ischemic stroke (NIHSS at admission 14±3,1) admitted within 72 hours of symptom onset were included into the study. The control group (8 patients) received only standard rehabilitation. The basic group (14 patients) received additionally 10 sessions of MSS (20 min twice a day). Patients were assessed by NIHSS, Rankin Scale, Ashworth Scale, Barthel Index at before and after the course of the MSS, at 1 month after stroke onset. Besides we have used the fMRI (1.5T Symphony, Siemens) to assess the sensorimotor cortex activation during MSS at 11 healthy subjects. fMRI was made in a block-design, with alteration of task condition (30 sec) and the rest condition (30 sec) during 3 minute. The data were analyzed with SPM5. The results indicate that the patients of the basic group had a better recovery than the patients of the control group. It was revealed the activation of the brain areas participating in performance complex locomotion action during the MSS in the slow walking mode in healthy subjects.

SWS.4
Mechanical support stimulation as a countermeasure against hypokinetic motor disorders

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Results of long lasting research resulted in the development of well-grounded conceptual understanding of factors, triggering the complex of disturbances in motor system and its control under the microgravity conditions. This complex includes consistently atrophy, atonia, decline in force-velocity properties of muscle; disturbance in spinal mechanisms activities; deep changes in activity of motor control mechanism. The data obtained in experimental studies pointed out to the leading role of the support afferents in control of structural-functional properties of the tonic muscle system. It was shown that the support afferents play a role of the trigger in the postural system, that enhancing (when the support is present) or inhibiting (when the support is withdrawn) the activity of tonic motor units. This conclusion was supported by the fact that mechanical stimulation of the support zones of the soles under supportless conditions eliminated fully all abovementioned effects of microgravity.
Based on these results method and device for mechanical stimulation of the support zones of the soles was development, which is used as a countermeasure against motor effects of microgravity and now is under going clinical testing in neurorehabilitation.

SWS.5
Application of new space technologies to rehabilitation of patients with stroke and brain trauma

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To increase stability and symmetry of vertical posture the kinesitherapy and physical training are usually used. One of the new technologies in kinesitherapy, coming from space elaboration appeared to be an antigravital costume "Regent", witch can dosage and create specific proprioceptive afferentation. Theoretical conception: stimulation of afferent proprioceptive system of posture and motions promotes rehabilitation of motor stereotype.
Goal: To improve efficiency of neurorehabilitation after stroke and TBI by using antigravital costume "Regent".
Objects: 339 patients 22-73 age: 224 - ischemic stroke and 115 - TBI with damage of the left hemisphere. All of them were patients with right hemiparesis and higher mental disorders, including speech. Costume was applied in patients who could move without assistance or with support.
Methods: treatment course included 10-15 sessions of simple and complicated walking up and down stairs in costume "Regent", 30-90 min each per day. To evaluate efficiency Bartell-scale, stabilometry, EEG-mapping, Direct Current potentials and neuropsychological test were used before and after the course.
Results: We had improvement in all patients in neurological status and quality of life according to Bartell-scale : they have broadened practical skills of self-service and quality of walking. 86% increased oral and articulation praxis. Neuropsychological and neurophysiological data correlated with clinical examination.
Conclusion: Method of dynamic propriocorrection (using space costumes "Regent") can be an effective addition to rehabilitation programs.

SCIENTIFIC WORKSHOP
PROPRIOCEPTIVE SYSTEM IN MODERN REHABILITATION

MONDAY, MARCH 22
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Prof. Dr. Inessa Kozlovskaya

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Role of vegetative nervous system in pending and prognosis for recovery after ischemic stroke

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