

## WORLD FEDERATION OF NEUROLOGY

### Applied Research Group on Space and Underwater Neurology

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### Report of the Applied Research Group For Space Neurology and Underwater Neurology Subdivision Hyperbaric Oxygenation Therapy 2013

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In our report, 28.3.2012, three different activities are quoted, Space Neurology, Underwater Neurology and a Subdivision Hyperbaric Oxygenation Treatment (HBOT). The pathophysiological basis of research in Space Neurology and Underwater Neurology is the dysfunction of the proprioceptive system as the reafference system of motor control. HBOT, employing sophisticated technical equipment, was included in the group adding additional scientific value in the management of diving accidents. All three special research activities are non-main stream in neuroscience. For Space Medicine as well as for Underwater Research there are only a few centers existing around the world. For Space medicine only the Russian Space Medicine has actual scientific projects focused on brain dysfunction in the real and the simulated micro gravity. The ARG for Space and Underwater Neurology has an intensive cooperation with the Russian Scientific Space Medical Institute in Moscow, directed by Prof.I.B.Kozlovskaya, the co-chair of the Research Group of Space Neurology. HBOT is till now a stepchild in therapeutic methods in neurology.

The activities of the ARG Space and Underwater Neurology are based on the cooperation with special centres at the Neurological University Clinic in Salzburg, the Adeli Medical Centre in Piestany, Slovakia and a close cooperation with the Centre for Space Medicine in Moscow. The organization of the scientific work of the ARG is based on the Karl Landsteiner Institute for Neurorehabilitation and Space-Neurology (KLI).

The Division of Space Neurology has its basic research possibilities together with the Russian Space Medicine, the IBMP Centre Moscow (Institute for Biomedical Problems). As it is noted in the last report, research projects are based on the scientific experience in the real micro gravity (space flights) and the results of experiments in the simulated micro gravity. The Russian Space Organisation is headed and guided by Prof. Inessa B. Kozlovskaya as a neuro-physiologist. A series of papers are published by the Russian group, the ARG is involved in the publication. Research focus are dysfunctions of the proprioceptive system.

Using the fMRI method the KLI group could demonstrate an activation of the sensory- motor brain region by vibro-stimulating proprioceptors. This experimental results were transferred into clinical research to examine long bed bound patients with consecutive bed rest syndrome, which is analog to the weightlessness ataxia syndrome in real micro gravity. In the scientific project patients in coma states, Apallic Syndrome/Vegetative State and Locked In Syndrome are involved. Results were presented at major congresses and specific papers published. As a side project the counter measures for the Bed Rest Syndrome are studied, details are taken from the counter measures in the real micro gravity.

In the report from 28. March 2012 a cooperation of the ARG with a special institute for neurorehabilitation, the Adeli Medical Center in Piestany, Slovakia, using Cosmonaut Trousers for the stimulation of the proprioceptive system was announced. The treatment program in the Adeli Centre is concentrated on children from 4 to 12 years with the diagnosis of Cerebral Palsy. The results are controlled with the Gross Motor Function Measure, scientific reports was presented, lectures are delivered, a special symposium in paediatric neurology is in preparation.

### Division Underwater Neurology

A new centre for Scuba Diving has to be reported, organized at the University Clinic for Neurology Salzburg, Department for Diving and Hyperbaric Medicine, headed by Dr. Helmut Novak. The program is based on the experience of a former Group for Scuba Diving and Neurorehabilitation of the ARG. Till now no Navy Organization and no institution of the Oil Industry drilling on sea ground has interest for research projects in underwater experiments.

The Subdivision Hyperbaric Oxygenation Treatment (HBOT) starts an active program in cooperation with the Adeli Centre, Piestany, Slovakia. The HBOT method is included in the neurorehabilitation program for patients with Cerebral Palsy (CP). The therapeutic program is based on previous and similar cooperations with the HBOT Centre in Fort Lauderdale, Florida. Beside CP patients, traumatic brain injury patients are included into the program. The presentation of the results are planned at the WFNR Congress June 2013. A special program started to treat patient with an Apallic Syndrome/Vegetative State with the HBOT method.

### Summarizing:

The Applied Research Group on Space and Underwater Neurology subdivision for HBOT is working in a pioneer field of neuroscience. The cooperation between the ARG and the Russian Space Medicine was the initiation of all current research activities. By these means cooperation of NASA and ESA provided the framework for this unique scientific field and the continuation for this important and new research activities in acute neurology and neurorehabilitation. Based on scientific results in real and simulated micro gravity, projects are initiated in the "passive weightlessness", the Bed Rest condition. New experiments using proprioceptive stimulation, controlled with fMRI showed interesting findings in brain functions and their activation through the proprioceptive system. Scientific results are translated into acute neurology and neurorehabilitation.

Underwater Neurology remains a problematic topic. New techniques of neurorehabilitation employing diving medicine with scuba diving are in preparation. Till now the cooperations with the Navy and the Oilfield Organizations are

unsatisfactory. Hyperbaric Oxygenation Treatment is in progress. A work shop, organized at the Adeli Centre Piestany, is in preparation.

The ARG Space and Underwater Neurology, Subdivision HBOT has no conflicts of interest with other ARG's of the WFN and receives no financial support.

Until now many projects are based on the work of the Karl Landsteiner Institute for Neurorehabilitation and Space Neurology, Vienna, Austria. The close cooperation with the Centre for Space Medicine in Moscow brings great benefit for the scientific projects.

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