EDITORIAL

Therapeutical Interventions in Motor Disorders at Young and Adult Age: Where Are We and Where Are We Going?

In June 2000, a meeting was held in Groningen, the Netherlands on 'Therapeutical interventions in motor disorders: Neural mechanisms and clinical efficacy'. The congress was a true meeting of neuroscientists who presented recent findings on mechanisms playing a role in various forms of motor disorders and clinicians involved in neuro-rehabilitation. The present special issue of *Neural Plasticity* contains the main contributions to this meeting. The issue concludes with an edited version of the lively discussion held at the end of the meeting.

The issue starts with the paper of Kolb and colleagues that presents a beautiful and intriguing overview of recent research on plastic changes after lesions of the cerebral cortex in the young and the adult rat. The paper illustrates very well that anatomical and behavioral outcome depends not only on the site and the extent of the lesion but also on the timing of the insult, the amount of tactile and motor experience provided after the lesion, and the presence of chemical factors like psychomotor stimulants or neurotrophic factors in the post-lesion period.

Next, four papers on motor disorders acquired at early age follow. Gramsbergen, who reviews the neural and behavioral consequences of lesions of the central and peripheral nervous system, stresses the impact of the age at which the lesion is acquired. Lesions in the central nervous system acquired at early age interfere with fundamental developmental processes, such as patterned neuronal cell death and the establishment of fiber connections. He eloquently describes that the net result of such drastic and plastic changes is not necessarily

beneficial but can be detrimental too. In addition, he reports that the young nervous system is able to reprogram motor output when faced with the problems induced by a lesion in the peripheral nervous system—a capacity that adult subjects possess only in a rudimentary form.

The second paper in the developmental section is from Hadders-Algra. She indicates that the neuronal Group Selection Theory (NGST) could offer new insights into the mechanisms directing developmental motor disorders, thereby facilitating the development of effective intervention strategies. In short, the NGST point of view suggests that the motor problems of children with pre- or perinatally acquired brain damage, such as children with cerebral palsy and part of the children presenting with clumsiness, consist of difficulties in selecting the best strategy out of a limited number of non-optimal strategies. Thus, Hadders-Algra suggests that intervention at an early age should aim at enlarging the number of strategies, perhaps by exposing the infant to a variety active motor experiences. At older ages, the emphasis of intervention could shift to the facilitation of selection of the best strategies for motor activities of daily life.

The third paper, by Mayston, provides a detailed overview on the heterogeneity of motor disorders in children with cerebral palsy and discusses possible therapeutical approaches for each of these disorders. Both this paper and the paper of Hadders-Algra indicate that we still have a rather limited understanding of the possible effects of intervention in children with motor disorders that are due to a lesion of the developing

brain. In these children, part of the motor problems, such as muscle contractures, are secondary to the primary brain lesion. The clinically highly relevant issue of how primary neurogenic problems, such as muscle dyscoordination and hypertonia can be disentangled from secondary myogenic ones is addressed the paper of Hof, the final paper of the developmental section.

The section of motor disorders in adulthood contains three specific and three general papers. The specific papers deal with spinal cord lesion, stroke, and Parkinson's disease. Dietz addresses the neuromotor consequences of spinal cord lesions. He provides evidence that lack of supraspinal control results in a reorganization of locomotor neural activity in such a way that it facilitates the preservation of the ability to walk at the expense of a loss of the capacity to adapt locomotor behavior to the details of specific walking conditions. Dietz and colleagues took the notion that basic locomotor capacity in patients with a lesion of the spinal cord is conserved as the starting point of specific training programs. Their promising results indicate that functional locomotor activity of patients with a lesion of the spinal cord improves after daily locomotor training on a treadmill with partial unloading of the body.

The paper of Hamdy et al. describes central reorganization after stroke of circuitries involved in the control of swallowing. Their studies indicate that recovery of dysphagia depends upon the plastic changes in the function of projections from the undamaged hemisphere. Moreover, the authors suggest that these changes might be enhanced by sensory stimulation of the pharynx. Leenders and Oertel report on recent advances in the understanding and treatment of Parkinson's disease. The authors indicate that one of the most promising approaches for treatment possibly consists of the

prevention of the untimely death of nigral dopaminergic neurons by means of neuroprotection. Central issues in the more generally oriented papers of Otten, Shepherd, and Mulder & Hochsténbach are the complex nature of motor control and the dependency of motor behavior in health and disease on environmental context. The authors argue that it is of utmost importance to take the interaction of motor behavior and the multi-faceted environment into account in research, diagnostic procedures, and treatment of patients with motor disorders.

The papers of this special issue reveal that our understanding of reorganizational processes in the nervous system occurring in various motor disorders is only in its infancy. This implies not only that our repertoire of current knowledge is relatively limited but also that it has a vigorous potential to grow. This is illustrated by some promising perspectives that have opened in the recent past. For example, neurons that continue to proliferate in the adult central nervous system might be recruited in compensational processes, and new pharmacological strategies and technologies derived from stem-cell research might help to either slow down or stop disorders like Parkinson's disease. In addition, we might find ways in pediatric habilitation to exploit the reorganizational capacities of the young nervous system. The possibilities are promising and exciting and form the feeding fuel on the long route to the full understanding and the development of effective intervention therapies. The route consists of multidisciplinary research in fields ranging from molecular neurobiology to neuro-rehabilitation, with a major role for studies using the techniques of systems physiology.

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