

“A multidisciplinary approach to the improvement of societal care of nervous system dysfunction across the lifespan”

Background: The global capacity of modern medicine has led to a significant decrease in mortality and corresponding increase in life expectancy. The growing population of survivors of extremely preterm birth, spinal cord injuries, and stroke suffer from an increased risk of permanent neurological problems, including cognitive impairment, throughout their lifespans. The rising number of elderly people in the population has furthermore turned dementia into one of the leading causes of suffering and death. As a consequence, there is an increased number of people who suffer from severe and persistent disability due to central nervous system (CNS) impairments. The need for restoration or creation of a life of acceptable quality for these patients as well as good social living conditions poses a severe and rapidly growing burden on the public health system and on social services worldwide. Furthermore, separate trends in healthcare are shifting the *modus operandi* of healthcare towards (1) highly centralized research and technically advanced hospitals and (2) decentralization of healthcare that requires empowerment of citizens to assess and sometimes even treat their health issues at home. There are thus parallel imperatives to improve the development and exploitation of high-tech and multimodal medical solutions and increase patients’ empowerment for improved quality of care both within and beyond the walls of the hospital.

Approach: Herein, we suggest a multidisciplinary approach that brings together medical, social and technical researchers, healthcare practitioners, as well as communication/interaction scientists targeting both centralized and home-based healthcare settings. We will work on cross-disciplinary fertilization of new methods (spanning the healthcare chain from prevention to post-treatment follow-up) aimed at reducing re-hospitalization, social consequences, and societal cost whilst quality of care and the patient’s motivation and empowerment are improved. For example, we develop advanced imaging methods that provide new windows into CNS function and recovery. By applying such high-tech tools, we will expand our understanding of the underlying pathological, pathophysiological, functional, and neuroplastic responses to CNS impairments. Furthermore, new “apps” and techniques such as interactive and adaptive artificial intelligence systems integrated into consumer electronics enable us to monitor and treat patients at home. While the high-tech imaging systems must be developed hand-in-hand with clinical practitioners because they are the end users, the home-based approach requires more focus on interaction because the users will typically be people with cognitive disabilities. A critical outcome of combining such efforts is the ability to develop effective strategies for treatment and rehabilitation of patients with CNS disorders that include, e.g., neuromodulation and multimodal e-health technologies. In order to ensure proper implementation and assess the impact of these efforts, we will develop approaches to facilitate participation of individuals with CNS disorders in vital societal and civic areas such as higher education, employment, and family life. Of utmost importance to support this process is the participation of researchers within humanities and social sciences who will aid in advancing knowledge, quantifying effects, and building understanding about exposed individuals, groups, and societies. This will be done by investigating everyday lives and experiences as well as what individuals and families (social network) think, how they live, and interact. Such research expands the knowledge of healthcare in the past and present as well as informs our thinking about critical social, cultural, economic, technological, and environmental aspects, within both the research community and across the societal level.

Research consortium: Main applicants: Carina Mallard, *Dep. of physiology* and Malin Broberg, *Dep. of psychology*. Co-applicants and collaborators: Erland Hjelmquist, *Dep. of psychology*; Jörgen Lundälv, *Dep. of Social Work*; Jesper Petersson, *Dep. of sociology and work science*; Staffan Larsson, *Dep. of Philosophy, Linguistics and Theory of Science*; Henrik Hagberg, *Inst. for clinical sciences*; Georg Kuhn, Jakob Åsberg, Lina Bunketorp Käll and Johan Wessberg, *Inst. of neuroscience and physiology*; Magnus Thordstein and Justin Schneiderman, *Sahlgrenska University Hospital/Med Tech West*; Peter Ljunglöf; *Dep. of computer science and engineering*; Daniel Sjölie, *Dep. of Applied IT*.

Potential impact on society: Our vision is to initiate a paradigm shift in professional care for sufferers of severe CNS disorders by means of improving standards of prevention, diagnostics, intervention and follow-up. The success of this project will have large implications for science and medicine as well as for community care, family care and the quality of life of the patients.

Suggestions of international evaluators:

Prof. David Edwards, Director of the Center for the Developing Brain, *King's College*, London, UK
Prof. Grigore C. Burdea, *Dep. Of Biomedical Engineering*, Rutgers University, New Jersey