

Neurorestoratology: one of the most promising new disciplines at the forefront of neuroscience and medicine

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Neurorestoratology is a new and emerging distinct discipline put forward on the basis of nervous restorable (neurorestorable) theory, which states that nerve damage to the central nervous system (CNS) can be restored. Neurorestorable theory in CNS was proposed by Huang et al based on clinical achievements obtained from cell-based neurorestorative therapy¹. Neurorestoratology, same as neurology, neurosurgery, neurorehabilitation, etc is a distinct discipline in neuroscience and medicine. The Beijing Declaration of International Association of Neurorestoratology (IANR) determined its definition in 2009.² The aim of neurorestoratology is to restore or promote recovery of damaged or lost neuronal functions. As depicted in Figure 1,³ it can clearly be seen that there was a blank space – indicated by the question mark in the figure – that needed to be filled with a new discipline, neurorestoratology, so it can be likened to an inexorable biological law and its development to a natural process quite similar to that of the periodic law of chemistry discovered and proposed by Dmitri Mendeleev. In recent years, neurorestoratology has become one of the most interesting core areas of neuroscience and medicine worldwide, representing a novel aspect of translational medicine.

Neurorestoration is thus a new center point of multiple disciplines comprising neurology, neurosurgery, neurorehabilitation, neuropharmacology, neuropathology, neurogenomics, neuroproteomics, orthopedics, pediatrics, ophthalmology, immunology, urology, otolaryngology, psychiatry, psychology, and related areas. However, until recently, it was only considered as subdiscipline or an interventional strategy in CNS injury or diseases among those disciplines. There was no independent platform for academic exchange of neurorestoration. Thus, it is now high time that neurorestoratology begins to play a prominent role in the multidisciplinary domain of interrelated neuroscience areas and establishes a conjunct platform for these disciplines (Figure 2).

Advantages of neurorestoratology

Recently, the US Brain Project⁴ and European Human Brain Project⁵ were initiated to improve understanding of CNS function. However, the direction and principal aims of these two enormous projects remain unclear. In the USA, for example, the most senior scientists still believe that it is too early to talk about the Brain Project and the specific purpose for which it has been created. Given that the human brain has more than 100 billion neurons and over 100 trillion neuronal interconnections, including several

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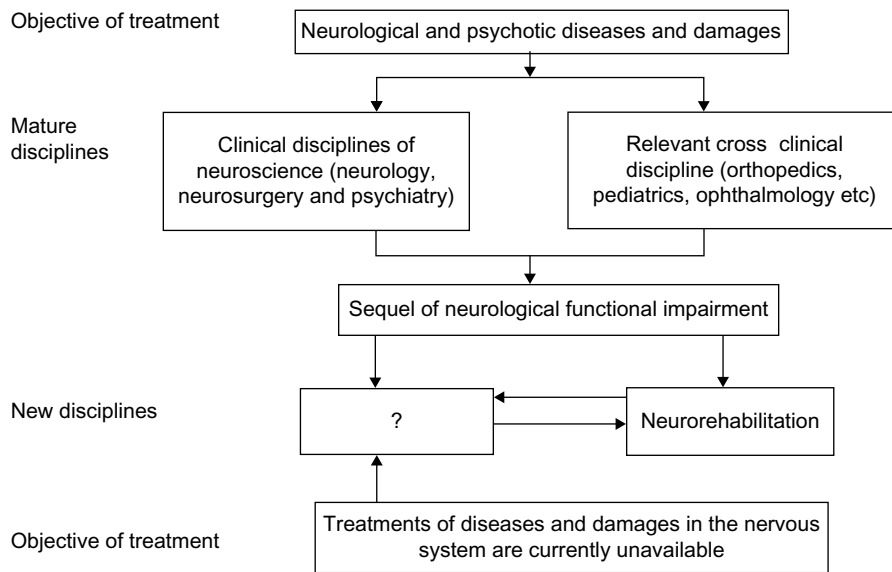


Figure 1 Distribution of disease treated by clinical disciplines of neuroscience and relevant clinical cross-disciplines.
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times more than that of interwoven glial cells that collectively continuously regulate the brain functions, the brain remains a great mystery for us to solve. Thus, these huge projects appear to have set themselves a very difficult task beyond imagination. For these obvious reasons, these two projects may focus on a technological understanding of brain function.

Essentially, then, these projects plan to do what neurorestoration is already doing. However, there are five key

subtle differences and advantages of neurorestoration over the US Brain Project and European Human Brain Project. First, neurorestoration has a theoretical foundation that uses the neurorestorable theory¹ in CNS as a guideline. The traditional viewpoint, still popular in the medical community, is that no effective therapeutic methods exist so far to restore, even partially, neurological functions lost due to intractable CNS damage or disease. Thus, current neurorestorative

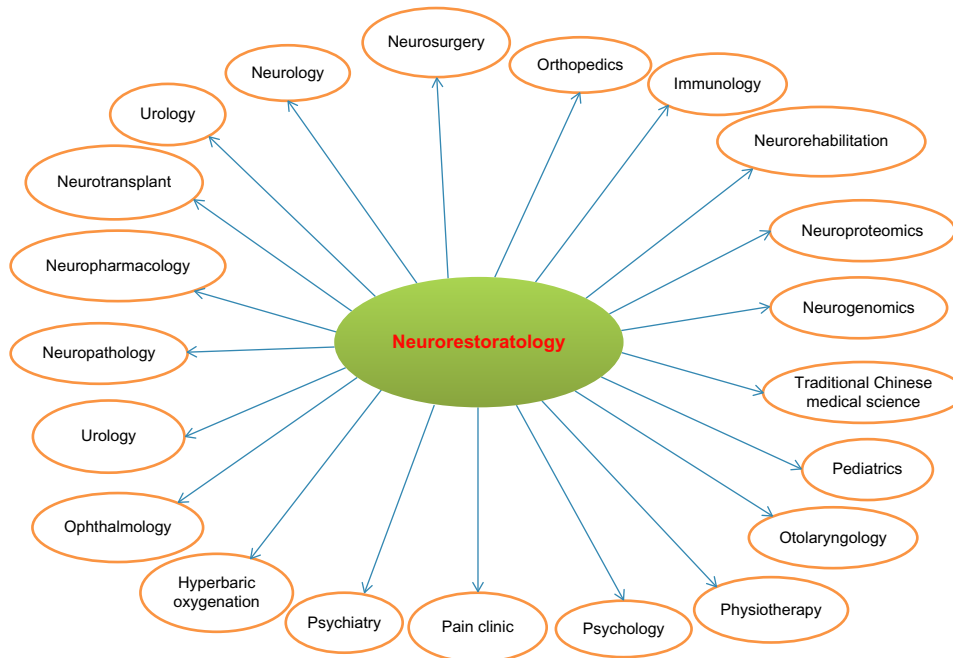


Figure 2 Neurorestoratology is a core platform and bridge for disciplines related to neurorestoration.
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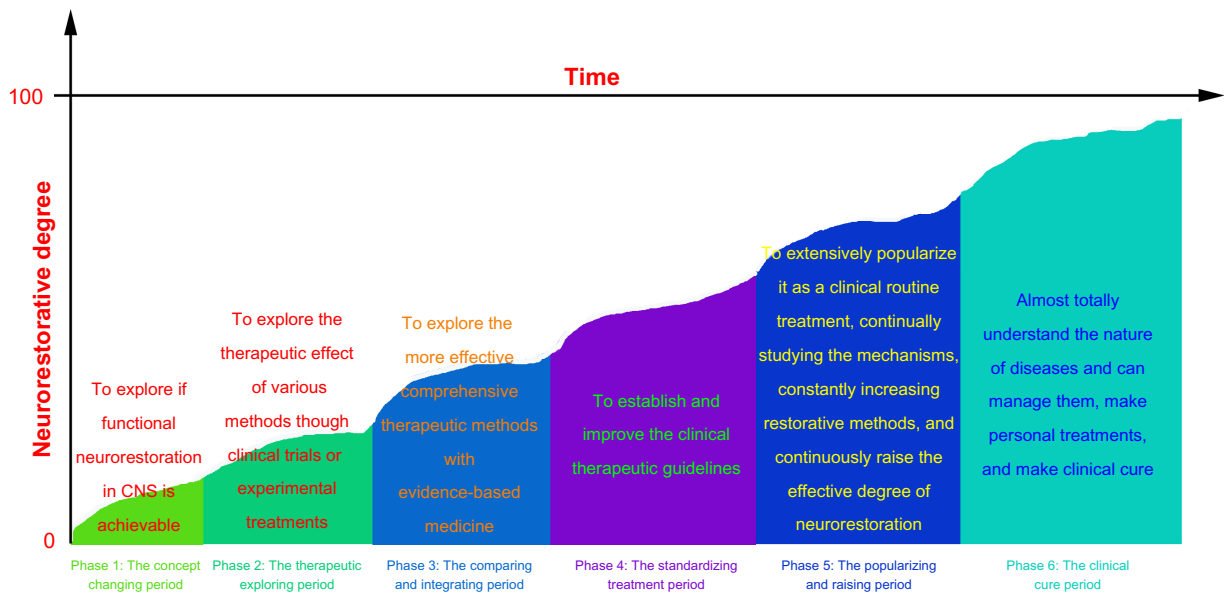


Figure 3 Neurorestorative road map in central nervous system (CNS).

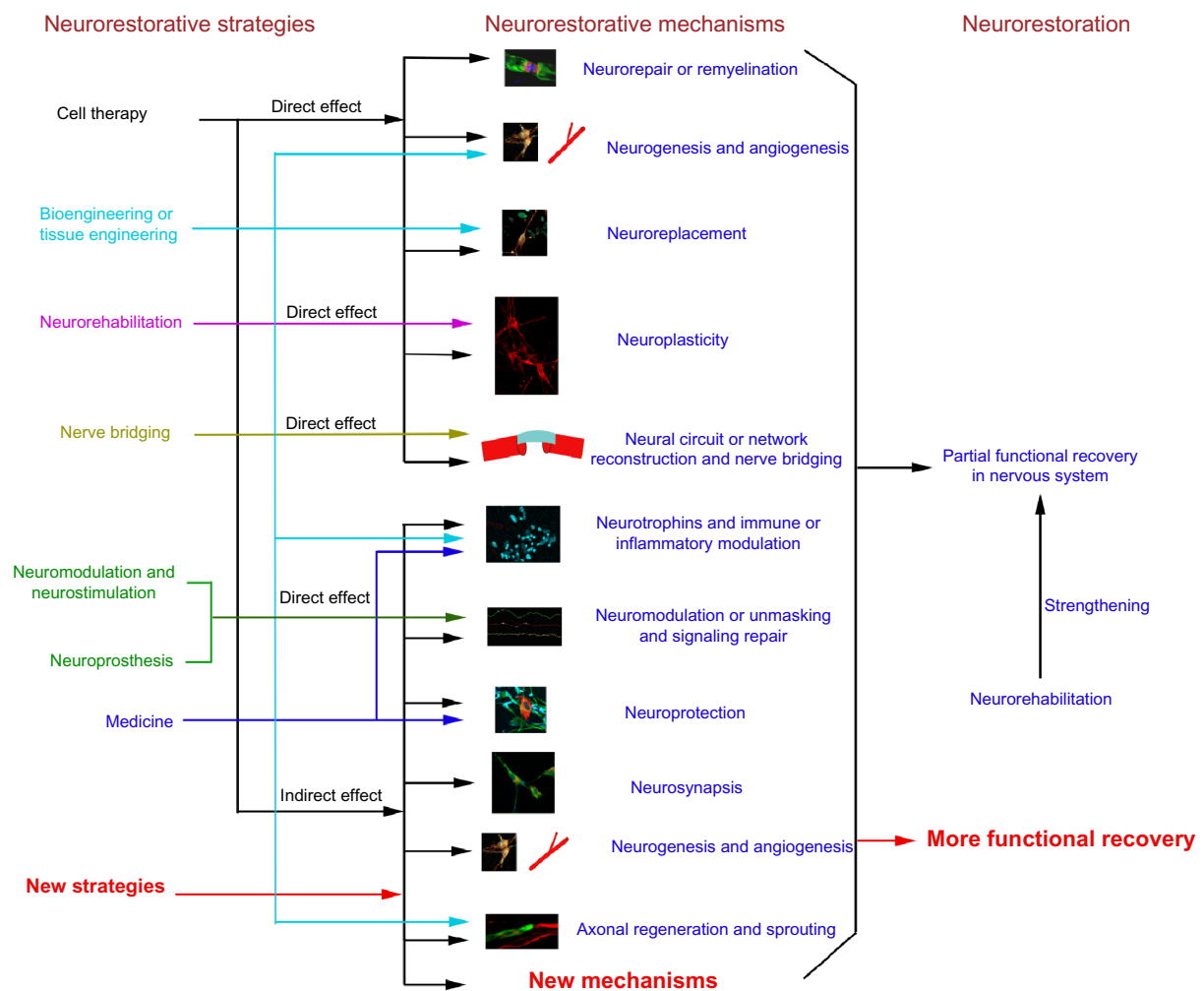


Figure 4 Neurorestorative schematic diagram for implementation.

strategies only achieve limited partial or moderate recovery. But these achievements are more than enough to answer the question of whether patients with intractable CNS damage or disease could benefit from various clinical neurorestoration strategies such as cell therapy, neurostimulation or neuro-modulation, neuroprosthesis or related advanced assistive devices, bioengineering or tissue engineering, neurotization or nerve bridging, neurorehabilitation, drug or growth factors, and other novel treatment procedures.³

Second, neurorestoratology has clear goals and directions. As we know, any kind of damage or loss of neuronal function has a pathological basis, either at the gross microscopic level or gene and molecular levels, as well as at electrophysiological levels. Theoretically, neurorestorative methods could be found for those pathological lesions; practically, some neurorestorative methods have already been able to restore those pathological lesions to some extent. Thus, the best way to restore or promote the recovery of damaged or lost neuronal function is through using neurorestorative approaches in an orderly manner in each phase showed by neurorestorative roadmap in Figure 3.³

Third, there is a clear schematic diagram for the implementation of neurorestoratology, as shown in Figure 4. Accordingly, more functional recovery will result from new strategies than from current neurorestorative approaches. New strategies can further be explained by new mechanisms of current neurorestorative principles. Moreover, as any new neurorestorative strategy or mechanism that promotes functional recovery or offers a new explanation for functional recovery is the need of the moment, the medical community should encourage any efforts to discover effective novel therapeutic strategies and thus favor not fear initial clinical pioneering results.

Fourth, more emphasis on translational medicine is needed. This is to encourage any new methods that show or promote neurorestorative effect for the benefit of the patients in the shortest time possible at the bedside, simultaneously any key problems in clinic should be explored further by new research projects at the experimental level. Thus, virtuous circle of bench and bedside would optimize the wisdom of the physician and the scientist alike to make full use of available scientific, social, economic, and government resources.

Finally, the development of any discipline can be endless. However, neurorestoratology is a discipline that aims to prolong or improve human health and quality of life – an eternal desire of clinicians and their patients that greatly needs to be fulfilled. We firmly believe that the

ongoing improvement of the neurorestorative degree should be a permanent process toward better human health care. So neurorestoratology will coexist with human beings forever.

The IANR and its role

The IANR is an authority for the community in the field, thus must take responsibility for encouraging and promoting the faster development of neurorestoratology among students, researchers, practitioners, policy makers, and health care providers for the betterment of human health care. The IANR and its members are trying their best to explore new effective neurorestorative methods and strategies to further benefit patients. The IANR has taken the lead in organizing multicenter clinical trials as well as research projects both independently and collaboratively with other international associations or societies. Accordingly, the IANR has held six annual conferences since 2008, in which physicians and scientists learned from each other through stimulating presentations and intensive discussions. In addition, the IANR is spreading new concepts and theories worldwide about the recent developments in the field by training young students, organizing workshops and lecture tours, and disseminating the new knowledge gained in these ways via publication in its official journals, *Cell Transplantation* and the *American Journal of Neuroprotection and Neuroregeneration*.

Introducing the *Journal of Neurorestoratology*

We feel very proud to be involved with the first new journal in the field of neurorestoratology, the *Journal of Neurorestoratology*, which is now the main official journal of the IANR. The existence of this will speed up the promotion of the scientific cause of the discipline and extend it out toward the horizon.

The journal encourages the submission of both experimental and clinical studies on neurorestoratology relevant to translational medicine. We are certain that these efforts will make this journal one of the best platforms for fair and frank academic exchanges on this field across the world.

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Disclosure

The authors declare no conflicts of interest in this work.

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