Neural Prostheses for the Blind

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Loss of vision poses extraordinary challenges on individuals in our society which relies heavily on sight. Although in recent years the techniques of molecular genetics have led to a rapid identification of a great number of genes involved in visual diseases, the nervous system once damaged is capable of little functional regeneration and currently there is no effective treatment for many patients who are visually handicapped as a result of degeneration or damage to: 1) the retina, 2) the optic nerve, or 3) the brain. Drug development has been very limited in this context, but new hope has been generated recently by showing that electrical stimulation of almost any location along the visual path can evoke the perception of visual perceptions called "phosphenes".

We will present a survey of the present state of developments concerning the feasibility of a visual neuroprostheses, as a means through which a limited but useful visual sense could be restored to profoundly blind people. We will review and summarize the most important physiological principles regarding this neuroprosthetic approach and emphasize the role of neural plasticity to achieve the desired behaviour of the system. While the full restoration of vision seems to be impossible, the discrimination of shape and location of objects could allow blind subjects to 'navigate' in a familiar environment and to read enlarged text, resulting in a substantial improvement in the standard of living of blind and visually impaired persons. Moreover, if we can understand more about the fundamental mechanisms of neuronal coding, and to safely stimulate nervous system, there will real potential to apply this knowledge clinically.