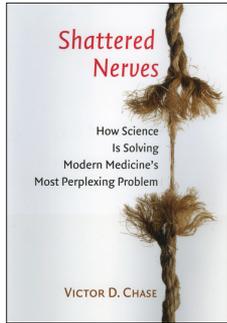


The past, present and future of neural prosthetics



Shattered Nerves

Victor D Chase

Johns Hopkins University Press, 2006

312 pp., hardcover, \$27.50

ISBN 0801885140

Reviewed by Dawn M Taylor

Shattered Nerves by Victor Chase is a comprehensive and easily readable survey of the field of neural prosthetics—devices that interact with the nervous system to restore or replace lost neural function. I was impressed by the book's level-headed and unbiased coverage of the successes and failures in the field, and of differing outlooks in an area that is sometimes controversial and all too often sensationalized.

This book does more than just convey the facts in a way accessible to intelligent novices and to experienced clinicians, researchers and engineers alike. *Shattered Nerves* weaves a history of how a field evolves—how advances and ideas in one area spawn progress in other areas, how collaboration and competition drive progress, and how our awakening as a society to ethical concerns in human research has changed the regulatory landscape in which new medical products can be developed.

The field of neural prosthetics spans a diverse range of technologies including those designed to restore hearing to the deaf, vision to the blind, movement and sensation to the paralyzed, memory to those suffering from Alzheimer disease and even happiness to the depressed. The book steps us through the relatively mature cochlear implant technology, starting with early systems that only provided crude sounds useful for improving lip reading. It shows how the field has grown by baby steps into a mature commercial technology that enables deaf individuals to talk on the phone and function well in a hearing society. We then see how technology and success in the cochlear implant area has jumpstarted the development of many other research areas, including devices for restoring vision, which have had a parallel history of technical success but have yet to realize the same level of functional benefits. We also see how devices that are effective for restoring movement to people with paralysis can hit road blocks in the commercialization phase, preventing deployment of these systems to the people who can benefit from them.

What strikes me most about this book is its honest look at the human side of this field, both in terms of the volunteers who are willing to undergo

untested procedures and the researchers who have enough confidence in their ideas to take a leap of faith and who ultimately bear responsibility for the outcomes. The author provides background stories on how these pioneering research volunteers became disabled, how their injury or disease changed their lives and what neural prosthetic technologies have meant to them when the devices have succeeded and when they have failed.

Many of the volunteers tell of how they fought hard to be included in the various research studies in spite of no guarantee of any benefit and significant potential risks. Personalities of the research volunteers come through loud and clear from the brief but well-chosen quotes and anecdotes the author uses. Some volunteers are not going to let anything hold them back, like the woman paralyzed in a snowboarding accident who was back on the slopes eight months later in an adapted 'sit ski'. Others are eager to do anything they can to ensure other people will not have to go through what they did, even if the current research is unlikely to benefit them personally in any way. The knowledge that they are doing something to fight back is enough to spur them on. This acceptance of risk and altruistic outlook is not right for everyone, and this book can serve as an inspiration and as a reality check for individuals considering participating in future research studies. The book does not overinflate the benefits or risks but simply looks at the research and development process and its impact on these people's lives.

Researchers in this field also have their stories, and their hopes, joys and disappointments come through in the text. Many who choose neural prosthetics as a career are motivated by friends, family members or personal experience with neurological disabilities. At the other extreme are some colorful characters driven by their insatiable curiosity for science—a curiosity that often leads them to happily conduct *ad hoc* experiments on their own healthy bodies, such as having someone twist their eyeball with forceps to determine if feedback mechanisms will tell the brain the eye's new rotated position. This field brings together a mix of personalities that sometimes complement, collaborate and even compete with each other. But they also inspire and motivate each other to move the field forward.

Appropriately, the book concludes with discussions on ethical issues associated with human research. The book covers how the current societal standards and government regulations evolved, and it brings in discussions by noted bioethicists on the various issues that are inherent to the field of neural prosthetics. These issues range from the potential 'off-label' or unapproved use of available devices, the social impact of neural prostheses on disabled communities and cultures and how our nation sets research funding priorities for technologies that save lives versus those that restore quality of life to disabled individuals. No book on neural prosthetics would be complete without discussing the potential use of these new technologies to augment the abilities of healthy individuals or to alter someone's personality or thoughts. Human enhancement applications of neural prosthetics are often sensationalized in the media, but here they are addressed from a realistic and sensible perspective.

In thinking through what information should be conveyed to the public about the evolving field of neural prosthetics, I would want readers to have an accurate understanding and appreciation of the state of the art. I would also want readers to come away with a nonsensationalized but very human view of the impact this technology can have on people's lives. On both of these fronts, *Shattered Nerves* gets it right.

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