Diffuse axonal injury
JOHN T. POVLISHOCK and CAROLE W. CHRISTMAN

This chapter discusses the factors involved in the genesis of diffuse axonal injury and the factors involved in its attendant morbidity. Topics covered include the pathobiology of brain injury, evidence for injury of axons in human traumatic brain injury, evidence for the occurrence of diffuse axonal injury in experimental animals, pathogenesis of diffuse axonal injury in experimental animal models, and consequences of diffuse axonal injury.

The longitudinal study of spatial cognitive development in children with pre- or perinatal focal brain injury
Joan Stiles, Pamela Moses, and Brianna M. Paul

This chapter discusses the perceptual effects of pre- or perinatal lesions. It shows that when subjects were asked to perform a task the outcome may appear normal, however, procedural affects may be present. Imaging techniques are used to study anatomical and functional changes related to recovered behavior.
Brain and Spinal Cord Injury
Lorene M. Nelson, Caroline M. Tanner, Stephen K. Van Den Eeden, and Valerie M. McGuire

in Neuroepidemiology: From principles to practice

Published in print: 2004 Published Online: September 2009 Publisher: Oxford University Press
Item type: chapter

Up to 50% of all trauma deaths in the United States involve significant injury to the brain or spinal cord. This chapter highlights the public health significance of traumatic brain and spinal cord injury and examines methodological issues in studies of the epidemiology of these injuries. It addresses methodological challenges in epidemiologic and clinical studies of brain and spinal cord injury, including difficulties in case ascertainment, differing approaches to brain injury classification, and measurement issues in brain injury severity and outcome scales. The chapter summarizes scientific literature addressing demographic and lifestyle risk factors for brain injury including age, sex, and alcohol consumption. External causes of traumatic brain and spinal cord injury are also discussed, including transportation-related injuries and increasingly recognized sports-related brain injuries.

Memory Development and Frontal Lobe Insult
Gerri Hanten and Harvey S. Levin

in Origins and Development of Recollection: Perspectives from Psychology and Neuroscience

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Item type: chapter

This chapter addresses the effect of traumatic brain injury (TBI) on memory skills in children. To provide a framework for the discussion of the neurobehavioral consequences of TBI in children, it first offers a brief overview of memory development and some findings regarding the relation between neural structure and memory performance in children. The multicomponent nature of memory interacts with injury variables, including the severity of impaired consciousness and associated multifocal and diffuse brain insult, together with focal lesions in the frontotemporal region, to contribute to persistent memory deficit after severe TBI in children. Prefrontal dysfunction during working memory performance is also demonstrated, suggesting that active maintenance
of representations is especially altered in children with TBI, implicating compromised strategy use. Early age at the time of severe TBI is related to persistent impairment of declarative memory possibly due to diffuse axonal injury and a disruption of the neural network mediating development of this ability.

**Executive Functions after Frontal Lobe Injury: A Developmental Perspective**

Vicki Anderson, Harvey S. Levin, and Rani Jacobs

*in Principles of Frontal Lobe Function*

Publishing in print: 2002 Published Online: May 2009


DOI: 10.1093/acprof:oso/9780195134971.003.0030

Item type: chapter

This chapter contrasts normal cerebral and cognitive development with that of children who have sustained frontal pathology. It focuses specifically on the domain of executive function, with the assumption that frontal regions are essential to the development and implementation of efficient executive skills. It discusses two studies from that illustrate the impact of frontal lobe pathology during childhood and the problems of assessing these skills accurately with current methodologies. The first study describes an ongoing program of research that examines the range of executive deficits exhibited by children who have sustained traumatic brain injury involving the frontal regions. The second study investigates the impact of focal frontal lesions during childhood, with an emphasis on approaches to the measurement of executive function.

**Is more aggressive treatment of pediatric traumatic brain injury worth it?**

J. Mick Tilford and Ali I. Raja

*in Economic Evaluation in Child Health*

Published in print: 2009 Published Online: February 2010

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Item type: chapter

Traumatic brain injury (TBI) is a major health problem worldwide and is often referred to as the ‘silent epidemic’. The uncertainty faced by clinicians in treating children with severe brain injuries is controversial with important clinical and social implications. This chapter weighs the costs and consequences of aggressive treatment of pediatric TBI. It is organized into three sections. First, the physiology and treatment of TBI
in children is described. Second, a cost-effectiveness analysis evaluating technology improvement in the treatment of pediatric TBI is presented. This analysis incorporates quality-adjusted life years (QALYs) using published data on preference-weighted health outcomes for children with TBI. Finally, the implications and clinical policy relevance of the analysis are discussed and additional research that could inform clinical policy is outlined.

**Frontal Lobe Plasticity and Behavior**
Bryan Kolb and Robbin Gibb

*in Principles of Frontal Lobe Function*

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DOI: 10.1093/acprof:oso/9780195134971.003.0032
Item type: chapter

This chapter focuses on how the structure of the frontal lobe changes over time, how this relates to behavior, and how the rest of the brain changes when the frontal lobe is injured. It shows that the prefrontal cortex is plastic, but its plasticity is different from that of other forebrain areas. The organization of the prefrontal cortex is affected by injury, and especially perinatal injury, in other parts of the brain. Other parts of the brain change when the prefrontal cortex is damaged. Various factors modulate the injury-related changes observed after frontal lobe injury. These include experience, psychomotor stimulants, gonadal hormones, neurotrophic factors, and neuromodulators.

**Critical periods for functional recovery after cortical injury during development**
Bryan Kolb and Robbin Gibb

*in Reprogramming the Cerebral Cortex: Plasticity following central and peripheral lesions*

Published in print: 2006 Published Online: September 2009
DOI: 10.1093/acprof:oso/9780198528999.003.0016
Item type: chapter

This chapter reviews studies in laboratory animals, and especially rats, in which precise developmental age has been manipulated and both functional and anatomical outcome has been examined. It also considers treatments that can modify the age-dependent effects of early cortical injuries.
This chapter reviews the effects of lesions in the orbitofrontal cortex (OFC) on mood states and aggressive behavior. Particular attention is paid to studies of patients with traumatic brain injury, although data from patients with stroke or degenerative disorders are also presented. Lesions of the OFC have been observed to cause disinhibited, impulsive states that result in an increase in impulsive aggression. Problems with reduced empathy and social processing may further contribute to the clinical picture. OFC lesions are not as closely associated with depression as are dorsolateral lesions. The current literature on the effects of OFC lesions in the development of anxiety appear contradictory, with some studies showing increased and others showed decreased anxiety symptoms. Methodological issues that hinder interpretation of the effects OFC lesions on personality and mood are discussed.

This chapter focuses on how injury during childhood to brain regions known to underlie cognitive memory in adults affects the functional development of cognitive memory. The aim is to review such cases, with an eye toward how they contribute to the debate regarding the neural correlates of a further subdivision within the cognitive memory system—that between semantic and episodic memory. The chapter concludes with a discussion of how understanding the impact of brain injury on memory development contributes to our understanding of the brain bases of normal memory development.
Inflammatory responses to traumatic brain injury: an overview for the new millennium
Maria-Cristina Morganti-Kossmann, Mario Rancan, Philip F. Stahel, and Thomas Kossmann

in Immune and Inflammatory Responses in the Nervous System
Published in print: 2002 Published Online: March 2012
Item type: chapter

This chapter presents an overview of the major developments in the study of inflammatory responses to traumatic brain injury (TBI), reviewing the controversial role of inflammatory responses after TBI resulting from clinical and experimental studies. It analyses the interaction of immune-competent cells of the central nervous system with the systemic immune system and discusses the controversy of the protective versus the deleterious consequences of immunoactivation.

Brain Injury and Survival
Walter Glannon

in Brain, Body, and Mind: Neuroethics with a Human Face
Published in print: 2011 Published Online: May 2011
Item type: chapter

This chapter discusses the metaphysical and ethical implications of severe brain injury, considering the respects in which individuals with these injuries survive or fail to survive them. It underscores the difficulty in diagnosing disorders of consciousness. Even when individuals survive brain injuries, they may or may not benefit from medical interventions that keep them alive and restore a greater degree of consciousness. Survival and consciousness by themselves have no value. What matters is which physical and cognitive functions are restored, the degree to which they are restored, and how they compare with the functions the individual had before the injury. In some cases, recovering a greater degree of consciousness can be worse for a person and result in significant harm.
Principles of cognitive rehabilitation
Nicole D. Anderson, Gordon Winocur, and Heather Palmer

in The Handbook of Clinical Neuropsychology
Published in print: 2010 Published Online: September 2010
DOI: 10.1093/acprof:oso/9780199234110.003.04
Item type: chapter

Cognitive rehabilitation can be defined as an intervention in which patients and their families work with health professionals to restore or compensate for cognitive deficits, thereby improving the patients' everyday functioning. This chapter discusses issues in cognitive rehabilitation, approaches to cognitive rehabilitation, and new directions in rehabilitation.

Response of Microglia to Brain Injury
Kazuyuki Nakajima and Shinichi Kohsaka

in Neuroglia
Published in print: 2004 Published Online: May 2009
DOI: 10.1093/acprof:oso/9780195152227.003.0035
Item type: chapter

This chapter discusses the response of microglia to brain injuries. Microglia are activated to induce various cellular changes, including morphology, immunohistochemical properties, proliferative activity, chemotactic mobility, biochemical change, secretion, and phagocytosis, in response to the signal(s) produced in the extracellular milieu of the pathological brain. Some putative or plausible signals from injured neurons or activated astrocytes have been predicted based on an acute injury model. In response to these candidate molecules, the microglia produce a specific combination of secretory molecules through a specific signal transduction cascade. Thus, the activated microglia might play different roles according to the type of pathology.

Immune Responses in the Nervous System
Nancy J. Rothwell (ed.)

Published in print: 1997 Published Online: March 2012
DOI: 10.1093/acprof:oso/9781872748795.001.0001
Item type: book
This new edition covers recent advances in understanding immunological and inflammatory responses in the nervous system, research driven by the potential to use knowledge of the molecules and mechanisms involved to intervene in, and arrest, neurodegenerative disease processes. This book covers developmental aspects of immune/inflammatory responses in the CNS and basic aspects of glial function, as well as inflammatory mediators and their mechanisms of action, clinical importance, and sites of infection. There is also coverage of the major diseases of the CNS, including stroke, brain injury, multiple sclerosis, and Alzheimer's disease. Throughout, the focus is on the underlying basic neuroscience, clinical relevance and the potential for therapeutic interventions. This book aims to contribute to the understanding and improving of the diagnosis of neuroimmune diseases and determining therapeutic measures.

Listening in the Silence, Seeing in the Dark
Ruthann Knechel Johansen

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Item type: book

Traumatic brain injury can interrupt without warning the life story that any one of us is in the midst of creating. When the author's fifteen-year-old son survives a terrible car crash in spite of massive trauma to his brain, she and her family know only that his story has not ended. Their efforts, Erik's own efforts, and those of everyone who helps bring him from deep coma to new life make up an inspiring story for us all, one that invites us to reconsider the very nature of "self" and selfhood. The author, who teaches literature and narrative theory, is a particularly eloquent witness to the silent space in which her son, confronted with life-shattering injury and surrounded by conflicting narratives about his viability, is somehow reborn. She describes the time of crisis and medical intervention as an hour-by-hour struggle to communicate with the medical world on the one hand and the everyday world of family and friends on the other. None of them knows how much, or even whether, they can communicate with the wounded child who is lost from himself and everything he knew. Through this experience of utter disintegration, the author comes to realize that self-identity is molded and sustained by stories.
Cognitive and behavioural disorders following traumatic brain injury

Anna Mazzucchi

in Cognitive Neurology: A clinical textbook

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Item type: chapter

Traumatic brain injury (TBI) could be defined as an insult to the brain caused by an external force producing altered states of consciousness that result in impaired cognitive or physical functions. TBI, especially if severe, can produce structural and functional modifications of the brain, which in turn can result in a highly variable and complex interaction of symptoms depending on the motor, sensory, cognitive, emotional, behavioural, and autonomic spheres. The brain during traumatic collision is prone to insults due to a complex combination of acceleration and deceleration and translation and rotation forces causing contusions, diffuse axonal injuries (DAI), and haemorrhages. Moreover, damages to neurons may occur as a consequence of biochemical modifications as a consequence of a drop in the levels of oxygen and glucose, and, finally, because of blood hypotension or increased intracranial pressure. This complex combination of and interaction among insults tends to produce a heterogeneous association of diffused and focalized damages that affect every possible area of the brain: cortical, subcortical, and midbrain. In addition, mild TBI can produce cerebral damage whose severity is directly correlated with the length of loss of consciousness and of post-traumatic amnesia.

Emotions

Kenneth M. Heilman

in Matter of Mind: A Neurologist's View of Brain-Behavior Relationships

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Item type: chapter

This chapter considers two subjects in the study of emotion. The first subject is how people convey their own emotions and understand the emotions of others, and how these processes are disturbed with injury to the brain. The second subject is how we experience emotion and how this experience, and the behavior that flows from it, are altered by brain injury.
Adaptive functional changes in the cerebral cortex during multiple sclerosis

Hasini Reddy

in Reprogramming the Cerebral Cortex: Plasticity following central and peripheral lesions

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DOI: 10.1093/acprof:oso/9780198528999.003.0018

This chapter examines reorganization following damage due to the progression of multiple sclerosis in humans studied using functional magnetic resonance imaging (fMRI) and other imaging techniques. It also discusses difficulties in assessing such reorganization and the methods used to bypass these difficulties.

Circuit Mechanisms Underlying Behavioral Variability during Recovery of Consciousness following Severe Brain Injury

Nicholas D. Schiff

in The Dynamic Brain: An Exploration of Neuronal Variability and Its Functional Significance

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DOI: 10.1093/acprof:oso/9780195393798.003.0013

Recovery of consciousness following severe brain injuries typically evolves through several stages marked by considerable behavioral variability. This chapter considers the role of ‘circuit-level’ mechanisms in the forebrain in the generation of behavioral variability and specifically emphasizes the contributions of the central thalamus to altered arousal regulation in neurological disorders of consciousness. Neurons within the central thalamus play a key role in forebrain arousal regulation, acting as a nexus for the influence of ascending brainstem/basal forebrain neuronal populations (‘arousal systems’) and control signals descending from frontal cortical systems. Clinical distinctions among neurological disorders of consciousness and some observations of wide fluctuations in behavioral responsiveness in severely brain-injured patients can be organized by considering the possible role of circuit-level alterations of function involving the central thalamus, striatum and frontal cortical systems.