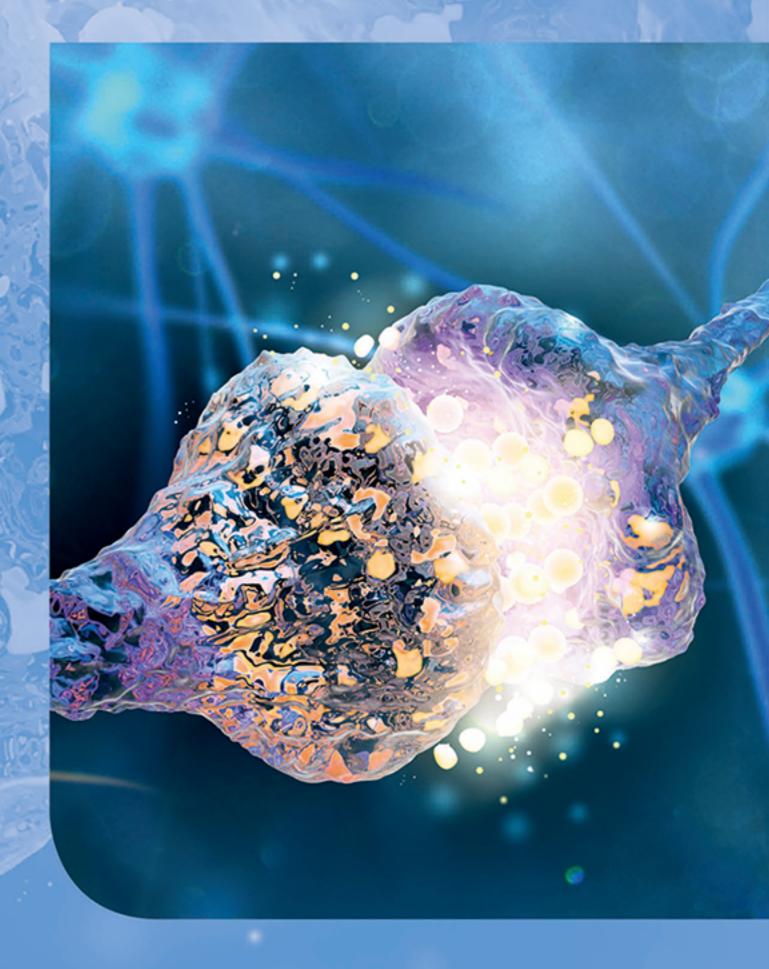
Oxford Textbook of

Neuroscience and Anaesthesiology

Edited by -

George A. Mashour Kristin Engelhard



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Edited by

George A. Mashour

Bert N. La Du Professor of Anesthesiology Research

Professor of Anesthesiology and Neurosurgery

Faculty, Neuroscience Graduate Program

Director, Center for Consciousness Science

Director, Michigan Institute for Clinical & Health Research

Associate Dean for Clinical and Translational Research

University of Michigan Medical School

Ann Arbor, Michigan, USA

Kristin Engelhard

Professor of Anesthesiology

Vice-Chair of the Department of Anesthesiology

University Medical Center of the Johannes Gutenberg-University

Mainz, Germany





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Dedication

George A. Mashour

Dedicated to my wonderful children, Alexander Fulgens Mashour Dedicated to my mentors and teachers Eberhard Kochs and Christian lives, and reach the fullest potential of their beautiful minds.

Kristin Engelhard

and Anna Luise Mashour—may they live long, healthy, and joyful Werner, who always encouraged and supported me throughout my academic career.

Preface-the three pillars of Neuroanaesthesiology

While serving as the President of the Society for Neuroscience in Anesthesiology and Critical Care, I espoused a vision for neuroanaesthesiology that was supported by three 'pillars'. The traditional pillar of neuroanaesthesiology relates to the care of neurosurgical and neurological patients. The clinical care of individuals with neurologic compromise is incredibly rewarding and represents a true opportunity to make a positive difference in the lives of others. However, the specialty of anaesthesiology is itself a form of clinical neuroscience. On a daily basis, even as anaesthetists for non-neurosurgical cases, we modulate peripheral nerves, the spinal cord, subcortical arousal systems, thalamocortical and corticocortical networks supporting consciousness, pain networks, memory systems in the medial temporal lobe, the neuromuscular junction, and the autonomic nervous system. From this perspective, 'neuroanaesthesiology' is more a compression of 'neuroscience in anaesthesiology' than 'neurosurgical anaesthesiology'. The mechanistic study of our therapeutic interventions, which represents another pillar, is exciting neuroscience in its own right, and has profound implications for nervous system function. Finally, the question of how the peri-operative period might negatively impact the brain is the new frontier of outcomes studies and has been a major priority for the field of anaesthesiology in the past decade. Questions related to anaesthetic neurotoxicity, cognitive dysfunction, stroke, and other neurologic outcomes of non-neurosurgical interventions represent a critically important third pillar for the subspecialty.

The Oxford Textbook of Neuroscience and Anaesthesiology is the first book of its kind to comprehensively address all three pillars related to neuroscience in anaesthesiology. The first section treats the neuroscientific foundations of anaesthesiology, including the neural mechanisms of general anaesthetics, cerebral physiology, the neurobiology of pain, and more. The second section represents the traditional pillar related to the care of patients with neurologic disease in the operating room or intensive care unit, with a focus on clinical neuroanaesthesia. These chapters systematically treat the peri-operative considerations of both brain and spine surgery, and provide introductions to neurocritical care and pediatric neuroanaesthesia. Finally, the last section examines some connections of neurology and anaesthesiology, examining how conditions such as dementia, stroke, or epilepsy interface with the peri-operative period.

This international textbook gathers the best available expertise of authors and leaders in the field from Canada, Germany, Italy, New Zealand, Spain, Switzerland, the UK, and the US. They have done an outstanding job of crafting concise yet highly informative chapters describing the cutting edge of neuroscience and neuroanaesthesia. It is my hope that this textbook is itself a 'chapter' in the evolution of the field, creating a lasting foundation and appreciation for the three pillars of neuroscience in anaesthesiology.

George A. Mashour, M.D., Ph.D.

Contents

Abbreviations xi

SECTION 2

Clinical Neuroanaesthesia

10 Neurologic Emergencies *125* Ross P. Martini and Ines P. Koerner

	Contributors xv		Antoun Koht, Laura B. Hemmer,
	Digital media accompanying the book xvii		J. Richard Toleikis, and Tod B. Sloan
	SECTION 1	12	Brain Trauma 149 Anne Sebastiani and Kristin Engelhard
	Neuroscience in Anaesthetic Practice	13	Supratentorial Craniotomy for
1	Neural Mechanisms of Anaesthetics <i>3</i> Andrew McKinstry-Wu and Max B. Kelz		Mass Lesion 161 Shaun E. Gruenbaum and Federico Bilotta
2	Intracranial Pressure 17 Harald Stefanits, Andrea Reinprecht,	14	The Posterior Fossa 173 Tasha L. Welch and Jeffrey J. Pasternak
	and Klaus Ulrich Klein	15	Cerebrovascular Surgery 189
3	Cerebral Physiology 27		Deepak Sharma and David R. Wright
	Stefan Bittner, Kerstin Göbel, and Sven G. Meuth	16	Interventional Neuroradiology 201
4	Introduction to Electroencephalography 35 Michael Avidan and Jamie Sleigh		Nathan Manning, Katherine M. Gelber, Michael Crimmins, Philip M. Meyers, and Eric J. Heyer
5	The Autonomic Nervous System 47 David B. Glick, Gerald Glick [†] , and Erica J. Stein	17	Pituitary and Neuroendocrine Surgery <i>213</i> Douglas A. Colquhoun and Edward C. Nemergut
6	Neuromuscular Junction: Anatomy and Physiology, Paralytics, and Reversal Agents 61	18	Hydrocephalus and Associated Surgery 225 Paola Hurtado and Neus Fàbregas
	Christiane G. Stäuble, Heidrun Lewald, and Manfred Blobner		Awake Craniotomy for Tumour, Epilepsy,
7	Principles of Neuroprotection 77 Sophia C. Yi, Brian P. Lemkuil, and Piyush Patel		and Functional Neurosurgery 235 Lashmi Venkatraghavan and Pirjo Manninen
8	Neurotoxicity of General Anaesthetics 93 Margaret K. Menzel Ellis and Ansgar Brambrink	20	Anaesthesia for Complex Spine Surgeries 245 Ehab Farag and Zeyd Ebrahim
9	Neurobiology of Acute and Chronic Pain 111 Adrian Pichurko and Richard E. Harris	21	Spine Trauma 255 Timur M. Urakov and Michael Y. Wang

11 Neurophysiologic Monitoring for Neurosurgery 137

22 Paediatric Neuroanaesthesia *263* Sulpicio G. Soriano and Craig D. McClain

23 Basics of Neurocritical Care *273* Magnus Teig and Martin Smith

SECTION 3

Neurologic Patients Undergoing Non-Neurologic Surgery

- **24 Cerebrovascular Disease** *289* Corey Amlong and Robert D. Sanders
- 25 Peri-Operative Considerations of Dementia, Delirium, and Cognitive Decline 297

Phillip E. Vlisides and Zhongcong Xie

26 Epilepsy 303

Adam D. Niesen, Adam K. Jacob, and Sandra L. Kopp

27 Parkinson's Disease 309

M. Luke James and Ulrike Hoffmann

28 Treatment of Psychiatric Diseases with General Anaesthetics 315

Laszlo Vutskits

Index 323

Abbreviations

133Xe	Xenon	BAER	Brainstem auditory evoked response
3D	Three-dimensional	BBB	Blood-brain barrier
AANS	American Association of Neurological Surgeons	BDNF	Brain-derived neurotrophic factor
ABC	Airway, breathing, circulation	BF	Basal forebrain
ABCB-1	ATP-binding cassette subfamily B member 1	BIS	Bispectral index
ABI	Acute brain injury	BIS	Bispectral index
ABP	Arterial blood pressure	BK	Bradykinin
ABR	Auditory brain stem responses	BP	Blood pressure
ACA	Anterior cerebral artery	BTF	Brain Trauma Foundation
ACC	Anterior cingulate cortex	Ca	Aterial concentration
ACDF	Anterior cervical discectomy with fusion	cAMP	Cyclic adenosine monophosphate
ACh	Acetylcholine	CAS	Carotid artery stenosis
AChE	acetylcholinesterase	CAS CAT-1	Cationic amino-acid transporter type 1
ACSNSQIP	American College of Surgeons National Surgical	CAT-1 CBF	Cerebral blood flow
ACSINSQIP	Quality Improvement Program	CBV	Cerebral blood volume
ACTH	Adrenocorticotropic hormone	CBVS	
ADH	Antidiuretic hormone	CCS	Cerebrovascular surgery Central cord syndrome
ADHD	attention deficit hyperactivity disorder	CCS	Cranial computed tomography
AED	Anti-epileptic drug	CEA	Carotid endarterectomy
AION	1 1 0	CEA CE-MRC	Contrast material-enhanced MR cisternography
AION	Anterior ischemic optic neuropathy Abbreviated Injury Scale	CE-MRC CGRP	0 1 7
AIS	<i>,</i> .		Calcitonin gene-related peptide
	Acute ischemic stroke	CHD	Congenital heart disease
AMPA	α-amino-3-hydroxy-5-methyl-4-	CHF CI	Congestive heart failure
AND	isoxazolepropionate	CIC	Cardiac index
ANP	Artial natriuretic peptide		Intracerebral compliance
ANS	Autonomic nervous system	CMAR	Cerebral microdialysis
AQP1	Aquaporin-1	CMAP	Compound muscle action potential
AQP4	Aquaporin-4	CMR	Cerebral metabolic rate
AQPs	Aquaporins	CMRO ₂	Cerebral metabolic oxygen consumption
ARAS	Ascending reticular activating system	CMT	Central medial thalamus
ARCTIC	Acute Rapid Cooling of Traumatic Injuries of the	CNAP	Compound nerve action potential
ADDC	Cord study	CNS	Central nervous system
ARDS	Acute respiratory distress syndrome	CNT-2	Concentrative nucleoside transporter type 2
ASA	American Society of Anesthesiologists	COMT	Catechol-O-methyl transferase
ASA PS	American Society of Anesthesiologists	COX	Cycloxygenase
	Physical Status	COX-2	Cyclooxygenase-2
ASIA	American Spinal Injury Association	СРВ	Cardiopulmonary bypass
ASICs	Acid-sensing ion channels	CPP	Cerebral perfusion pressure
ATP	Adenosine triphosphate	CPR	Cardiopulmonary resuscitation
AV	Atrioventricular	CRP	C-reactive protein
AVM	Arteriovenous malformations	CRPS	Chronic regional pain syndrome
Αβ	Amyloid-beta	CSF	Cerebrospinal fluid
BAC	Balloon-assisted coiling	CSWS	Cerebral salt wasting syndrome

MERCI Mechanical Embolish Removal in Cerebral PIN Pressure inside the endoscope [schemia trial legister in trial legister in the Milliams thyperthermia PIV Pressure inside the endoscope [schemia trial legister in legister in trial legister in trial legister in trial legister in legister in trial leg				
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miRNA Micro-RNA´ ml Millitres PKC Protein kinase C MLS Manual in line stabilization MPO Median preoptic nucleus MPO Median preoptic maleus MPO PONV Postoperative cagnitive dysfunction mps Metres per second MRI Magnetic resonance imaging MRI Magn		Ischemia trial	PION	Posterior ischemic optic neuropathy
nI Millilitres PKC Protein kinase C MnPO Median preoptic nucleus PNO Pentre reticular nucleus, oral part MnPO Median preoptic nucleus PNO Pontine reticular nucleus, oral part MPFC Medial prefrontal cortex POD Postoperative cognitive dystinction mps Metres per second POND Postoperative cognitive dystinction mRNA Magnetic resonance imaging POVL Postoperative cognitive dystinction mRNA Messenger RNA residual neuromuscular block mRN Modified Rankin score POVL Postoperative cognitive dystinction MS Mean flow velocity reactivity PPT Postoperative visibal curarization/Postoperative residual curarization/Postoperative vision loss MS Mean flow velocity reactivity PPT Postoperative vision loss MS Mean flow velocity reactivity PPT Pedunculopominic regenetum NSO Nicotinic acetylcholine receptor PPE Prosterior reversible encephalopathy syndrome NSC Nucleus cunciformis PRIO PRE Posterior reversible encephalopathy syndrome	MH	Malignant hyperthermia	PIV	Pressure-induced vasodilation
MLS Manual in-line stabilization PNOT Pontine reticular mucleus, oral part MOCAIP Morphological clustering and analysis of ICP pulse mPFC Median proprior incluse mPFC Median proprior makes and morphological clustering and analysis of ICP pulse mPFC Median preprior makes and morphological clustering and analysis of ICP pulse mPFC Morphological clustering and malysis of ICP pulse mPFC Morphological clustering and analysis of ICP pulse mPFC mPFC pulse makes and volving market mpfc. Morphological clustering and morphological clustering mPFC mPFC pulse mPFC mPFC pulse mPFC mPFC pulse mPFC mPFC pulse mPF	miRNA	Micro-RNA	PKA	Protein kinase A
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SNS SPECT	Sympathetic nervous system Single-photon emission CT	TNF-α tPA	Tumour necrosis factor α Tissue plasminogen activator
SRT	Spinoreticular tract	TRP	Transient receptor potential
SSEP	Somatosensory evoked potentials	TRPM	TRP melastatin receptor
SSRIs	Selective serotonin and norepinephrine reuptake	TRPV	TRP vanilloid receptor
	inhibitors	TSH	Thyroid stimulating hormone
STAIR	Stroke Therapy Academic Industry Roundtable	VAE	Venous air embolism
STN	Subthalamic nucleus	VEP	Visual Evoked Potentials
STT	Spinothalamic tract	VIP	Vasoactive intestinal protein
SVS	Slit ventricle syndrome	VLPO	Ventrolateral preoptic nucleus
SWS	Slow-wave sleep	vPAG	Ventral periaqueductal gray
TBI	Traumatic brain injury	VPL	Ventroposterolateral
TCA	Tricyclic antidepressant	VPS	Ventriculoperitoneal shunt
TCD	Transcranial Doppler sonography	VR-1	Vanilloid receptor
TCS	Transcranial stimulation	VRL-1	Vanilloid-like receptor 1
TDF	Thermal diffusion flowmetry	VTA	Ventral tegmental area
TEE	Transoesophageal echocardiogram	WDR	Wide dynamic range
THx	High temporal resolution	WFNS	World Federation of Neurological Surgeons
THx	Therapeutic hypothermia	ZO	Zona occludens
TIVA	Total intravenous anaesthetic	β-ARK	β-adrenergic receptor
TMN	Tuberomamillary nucleus		