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978-0-521-51822-2 - Consciousness, Awareness, and Anesthesia

Edited by George A. Mashour

Frontmatter

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Consciousness, Awareness, and Anesthesia

Hypnosis, amnesia, and immobility are three major therapeutic endpoints of general anesthesia. In one to two cases out of a thousand, hypnosis and amnesia are not achieved – often leaving a patient paralyzed but capable of experiencing and remembering intraoperative events. Awareness during general anesthesia is one of the most dreaded complications of surgery and is feared by patients and clinicians alike. Despite numerous advances in the field, many unresolved questions persist. Some of the difficulties in the detection and prevention of awareness during anesthesia relate to the underlying complexities of the neuroscientific basis of consciousness. *Consciousness, Awareness, and Anesthesia* is a multidisciplinary approach to both the scientific problem of consciousness and the clinical problem of awareness during general anesthesia. An international cadre of authors with expertise in anesthesiology, neurobiology, and philosophy provides a cutting-edge perspective. No other book on the subject has drawn from such a breadth of scholarship.

DR. GEORGE A. MASHOUR received his MD and PhD in neuroscience from Georgetown University and was awarded Fulbright scholarships for neuroscience research in Berlin and Bonn. He completed his residency and chief residency in anesthesiology at the Massachusetts General Hospital and Harvard Medical School, as well as fellowship training in neuroanesthesiology at the University of Michigan. He is currently the director of neuroanesthesiology, as well as an assistant professor of anesthesiology and neurosurgery, at the University of Michigan Medical School. His main clinical interests are neuroanesthesiology and neurocritical care. Dr. Mashour's major scholarly focus is consciousness and anesthesia. He is credited with developing the cognitive unbinding paradigm of general anesthesia and advocating for the role of anesthesiology in the study of consciousness. In his clinical research, Dr. Mashour is the principal investigator of a 30,000-patient study focused on the prevention of awareness during general anesthesia. He has published and lectured extensively on the subjects of consciousness and intraoperative awareness. Dr. Mashour is the recipient of numerous awards for his work as a clinician, scholar, and educator.

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*This book is dedicated to my wonderful wife, Cynthia Jane Schoen, who
suffuses my own conscious experience with both love and light.*

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Preface

Consciousness, awareness, and anesthesia

George A. Mashour, MD, PhD

In 1947, the anesthesiologist Henry Beecher published an article in *Science* describing the “second power” of anesthesia: probing the mind.¹ It was, however, many decades until Beecher’s vision was realized. In 2008, yet another article appeared in *Science* discussing the mechanism of general anesthesia as one window into a fundamental mystery: consciousness.² Indeed, the problem of consciousness continues to perplex. How do we define it? What does it really mean to explain it? What is the appropriate method to study it? *Is there a scientific method to study it?* For some, the concepts and techniques of cognitive neuroscience hold the most promise for the future. For others, quantum physics seems to be the answer. For still others, the problem is thought to be inherently intractable.

For anesthesiologists, the real “problem of consciousness” is found not in the academy, but in the operating room. Awareness during general anesthesia, which denotes both intraoperative consciousness and postoperative recall, is a complication feared by patient and clinician alike. For patients whose fear is actually realized, the psychological consequences can sometimes be devastating. In many ways, the clinical problem of awareness is no less challenging than the intellectual problem of consciousness. While the neuroscientist or philosopher faces the question “How do we *explain* consciousness?” the anesthesiologist faces the question “How do we *detect* consciousness?” The two questions are fundamentally related, as they both involve the challenge of capturing *subjectivity* by *objective* means.

One of the major advances in the past two decades is the very acceptance that awareness during general anesthesia is a real and serious problem. Mechanistically, it is also becoming clear that the suppression of consciousness by general anesthetics may be less coarse than previously imagined. We do not simply extinguish neural activity altogether – rather, anesthetic-induced unconsciousness is likely associated with the interruption of higher levels of neural processing. One way of thinking about general anesthesia is as a disintegration or unbinding of neural information,^{2–5} with primary sensory cortices still capable of receiving and processing sensory stimuli.⁶ From this perspective, it is perhaps less surprising that intraoperative perceptions or memories could transiently form with fluctuations in anesthetic concentrations. We are still in the early phases of understanding the

cognitive implications of anesthetic mechanisms and how they may be related to molecular events.

Consciousness, Awareness, and Anesthesia represents a multidisciplinary approach to the problem of awareness during general anesthesia, from the perspectives of cognitive neuroscience, clinical anesthesiology, and even philosophy. There is a diversity of opinions discussed, from the very definition of awareness to the optimal modality for its prevention. I have not censored these opinions, including those with which I do not agree. It is my hope that this approach will be fruitful for the clinical practitioner, as well as for the investigating scholar. Although this book describes many advances in our understanding, we are only just beginning to harness anesthesia's "second power" of probing the mind.

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