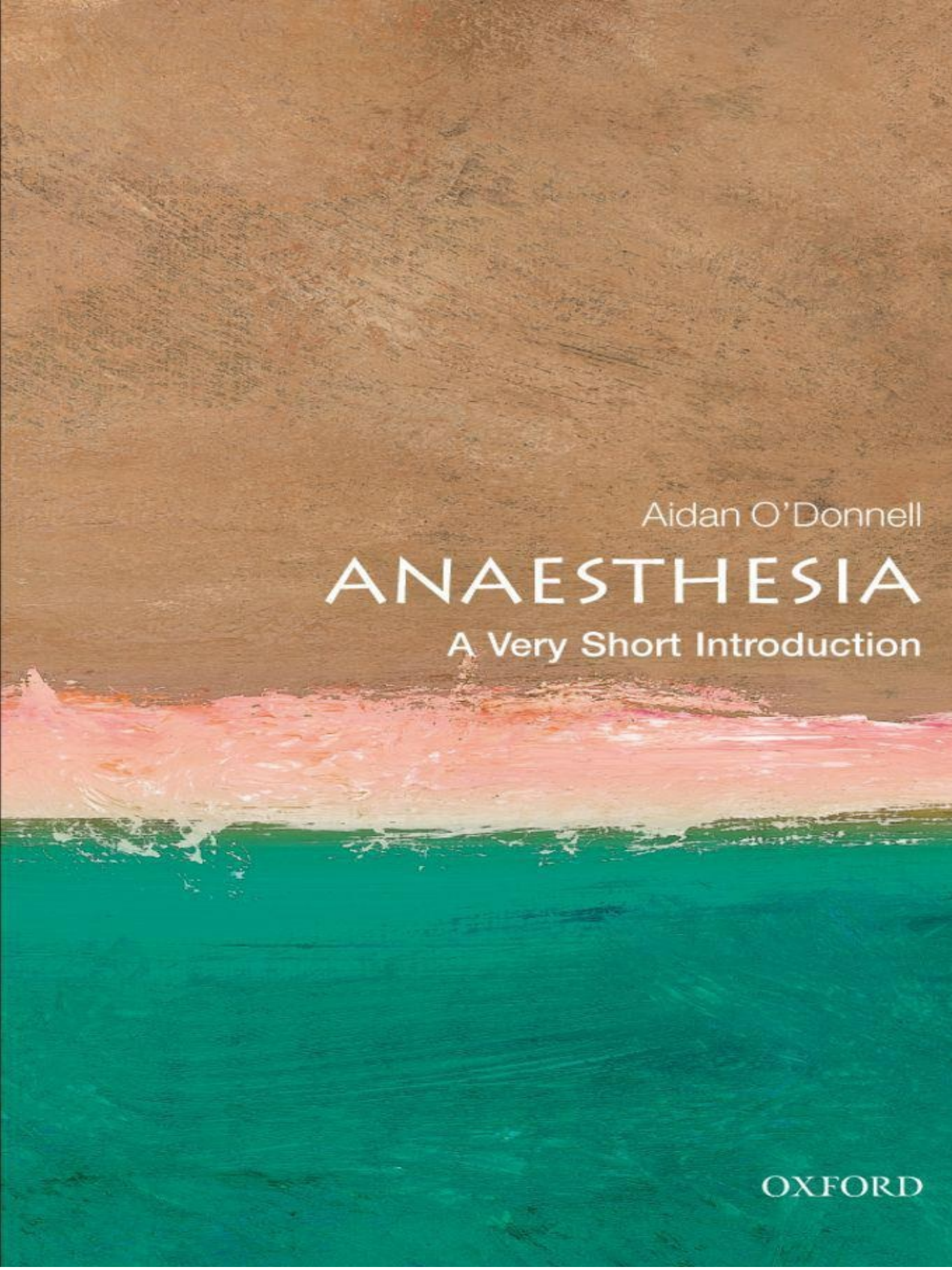
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ANAESTHESIA
A Very Short Introduction
OXFORD

# Anaesthesia: A Very Short Introduction

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# Aidan O’Donnell

# Anaesthesia

## A Very Short Introduction

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# Chapter 1

# Suspended animation: concepts of anaesthesia

## Introduction

A recent study estimated that 234 million surgical procedures requiring anaesthesia are performe worldwide annually. Anaesthesia is the largest hospital specialty in the UK, with over 12,00 practising anaesthetists, yet in many ways it is the most mysterious. Most non-medical people hav only the haziest idea of what anaesthesia involves. The media image is unhelpful. Medical dramas, f example, traditionally paint the surgeon as the hero, and the anaesthetist as a panic-stricke subordinate.

When undergoing an operation, the anaesthetic contributes only a tiny part of the overall risk. Yet, i general, people seem to fear the anaesthetic most of all. Many of my patients express real fears, an ask things like ‘What happens if I don’t go to sleep?’, ‘What happens if I don’t wake up?’, ‘Wh happens if I wake up in the middle?’, and ‘How do you know I am really asleep?’

Anaesthesia is both fascinating and rewarding. What I do every day is to suspend the conscious mind of my patients, so that they can undergo painful, invasive surgical procedures of which they rema entirely unaware. The means by which this is brought about still has a hint of magic for me.

In this book, I give a short account of the historical background of anaesthetic practice, a review anaesthetic equipment, techniques, and medications, and a discussion of how they work. The risks an side effects of anaesthetics will be covered, and some of the subspecialties of anaesthetic practice wi be explored.

## Concepts of anaesthesia

Many of us have undergone general anaesthesia ourselves, or we may know someone who has. Th concept of general anaesthesia is familiar to us, but it is worth having a closer look at the fundament aspects.

If you observe an adult male under general anaesthesia, he appears to be asleep. He is lying on h back with his eyes closed, not moving. His breathing is slow and regular. His skin is warm and dr However, if you were to shout his name, or shake him by the shoulder, he would not wake up. Even you were to cut into his skin with a scalpel, he would not wake up, move, or show any obviou outward response.

Although we often use the word ‘asleep’ to describe someone who is anaesthetized (and I usually us this form of words when talking to patients and colleagues), general anaesthesia is not sleep. physiological terms, the two states are very dissimilar. The term **general anaesthesia** refers to th state of unconsciousness which is deliberately produced by the action of drugs on the patient. **Loc anaesthesia** (and its related terms) refers to the numbness produced in a part of the body by delibera interruption of nerve function; this is typically achieved without affecting consciousness.

# What is general anaesthesia?

In the early days of anaesthesia, the mid-19th century, the term *etherization* was used to describe th state produced by the inhalation of ether vapour. However, it soon became clear that chloroform an other agents could produce effectively the same state as ether. Clearly, a patient could not be etherize with chloroform. To try to find one word which sufficed to describe this new state was not easy. Som of the early terms were ‘clumsy, and some of them cacophonous’, such as *narcotism, sopo hebetization, apathization, letheonization,* and *stupefaction.* The American neurologist Oliver Wende Holmes suggested the term *anaesthesia* in 1846 in a letter to William Morton, from the Gree meaning ‘without sensation’, and this word, together with its adjective *anaesthetic*, caught on rapidl By the time James Young Simpson was publishing his early results with chloroform in 1847, the ter was in common use, although ungainly alternative terms such as *northria* or *metaesthesia* are sti occasionally proposed.

The purpose of inhaling ether vapour was so that surgery would be painless, not so th unconsciousness would necessarily be produced. However, unconsciousness and immobility soo came to be considered desirable attributes of anaesthesia. John Snow, the first doctor to specialize i anaesthesia, wrote in 1872: ‘Ether contributes other benefits besides … preventing pain. It kee patients still who otherwise would not be.’ For almost a century, lying still was the only reliable sig of adequate anaesthesia. The state of unconsciousness was considered an advantageous relief from th traumatic experience of surgery.

For nearly a century after the introduction of general anaesthesia, it was provided by a single agent the majority of cases. Usually, this was ether or chloroform; occasionally, a mixture of the two, o switching from one to the other, was used. Since those agents did what everyone thought was require (they kept the patient unconscious and unmoving), no further consideration was needed. However, th introduction of intravenous agents, muscle relaxants, and other adjuncts led to a discussion of th more specific components of general anaesthesia.

In 1926, John Lundy from the Mayo Clinic introduced the term **balanced anaesthesia** to descril using an array of techniques (such as a sedative premedicant to cause sedation together with gener anaesthesia using different agents) to obtain best results. In 1950, Gordon Jackson Rees and Cec Gray from Liverpool proposed a ‘triad’ of anaesthesia: narcosis (by which they mea ‘unconsciousness’), analgesia, and muscle relaxation, which are often represented on a triangul diagram still taught to students. Crucially, one agent was no longer sufficient to produce all of thes effects, but by using (for example) halothane for unconsciousness, morphine for analgesia, an

tubocurarine for muscle relaxation, safe and reliable operating conditions could be produced. Th combination of an anaesthetic agent, an analgesic, and a muscle relaxant is still widely used, but th triad model is out of date. For a better model, a more careful consideration of the components general anaesthesia is required.

# Unconsciousness

A few years ago, an anaesthetist friend dislocated his shoulder playing squash. He went to his loc emergency department, where he was given a large dose of the analgesic morphine, and a large dose the sedative midazolam. His shoulder was then put back into joint. He knows he was awake at th time, and he knows that relocation of the shoulder is an extremely painful procedure, despite th morphine. However, due to the effects of the midazolam, which causes transient memory loss, h cannot remember the pain.

What my friend underwent was not general anaesthesia. However, the question he asked me wa whether it is ethical to inflict pain on a patient who does not remember it afterwards, assuming the is no emergency or other urgent reason to do so. After some thought, I replied that I do not think th it is ethical to deliberately inflict pain on a conscious human being at any time, when alternativ courses of action are to hand. Whether that person remembers it afterwards is beside the point.

General anaesthesia provides unconsciousness, but it is reasonable to look closer at what this actual means.

Among many other functions, the conscious mind is responsible for forming both experiences an memories of those experiences. If only one of those functions were interrupted, the mind might for experiences, such as pain, but not memories, and a situation like my friend's might ensue. Howeve general anaesthesia temporarily suspends the formation of both experiences (perceptions, awarenes and memories of those experiences.

In addition, general anaesthesia is considered to be a state induced by anaesthetic drugs (the patie cannot make it happen to him- or herself), and one that is reversible, in the sense of not bein permanent: if I were to suffer a head injury, I might cease to form experiences or memories, but this not general anaesthesia.

# Muscle relaxation

Another point on the triad model is muscle relaxation. Cutting into muscle, such as the muscle of th abdominal wall, causes a reflex spasm of the muscle itself which makes surgery technically mo difficult, and this reaction is only abolished at very deep planes of anaesthesia. Placing a tube in th trachea is also an extremely stimulating procedure, which can only be performed under very dee anaesthesia. Both these problems can be circumvented by the use of drugs to paralyse the muscle Anaesthesia need therefore only be deep enough to produce unconsciousness, but paralysis sufficie

for surgical access or intubation can be readily produced by drugs. The term **muscle relaxants** is use to describe such drugs, which came widely into practice in the 1940s.

However, for many surgical procedures, muscle relaxation is not required. Even without muscl relaxants, a patient under general anaesthesia will not make voluntary movement, even in response a painful stimulus such as surgery, and immobility to stimulation is one of the easiest objective sign of general anaesthesia.

But unconsciousness and immobility are not the end of the story. Anaesthesia was first introduced as means of eliminating pain.

# What is pain?

All of us have experienced pain, from our earliest experiences as infants teething or with colic.

The International Association for the Study of Pain (IASP) defines pain as ‘an unpleasant sensory an emotional experience resulting from a stimulus causing, or likely to cause, tissue damage, expressed in terms of that damage’. This is a helpful definition, as it incorporates those things whic cause pain (actual or potential damage to the body), and the result (an unpleasant sensory experience as well as the consequences of that result (an unpleasant emotional experience).

The neurophysiology of pain has been extensively studied, and it can be considered to compri several steps. First, there is the detection of a painful stimulus (**nociception**), which happens by th triggering of specific nerve endings called nociceptors in the skin and other organs. Nocicepto produce electrical signals in pain nerve fibres. These electrical signals are transmitted to the spin cord by peripheral nerves. The signals may be modified in the spinal cord, but are then transmitted u to the thalamus, a part of the brain which is responsible for integrating sensory signals of all type From the thalamus, the signals travel to the cortex, the convoluted surface of the brain. At this poin the pain signals are integrated into conscious perception, and it can be stated that pain is bein perceived. (Until this point, there were only pain signals.)

However, the process does not end there. The experience of pain triggers powerful emotion consequences, including fear, anger, and anxiety. A reasonable word for the emotional response t pain is ‘suffering’. Pain also triggers the formation of memories which remind us to avoid potential painful experiences in the future. The intensity of pain perception and suffering also depends on th mental state of the subject at the time, and the relationship between pain, memory, and emotion subtle and complex.

On their journey through the subconscious parts of the brain, pain signals also trigger physiologic responses to stress, by activating what is called the sympathetic nervous system to produce adrenalin (the so-called ‘fight or flight’ response). The effects of adrenaline are responsible for the appearanc