

Preface

Thinking must never submit itself, neither to a dogma, nor to a party, nor to a passion, nor to an interest, nor to a preconceived idea, nor to anything whatsoever, except to the facts themselves, because for it to submit to anything else would be the end of its existence.

Henri Poincaré (1854–1912;

French mathematician and theoretical physicist)

‘Truth is sought for its own sake. And those who are engaged upon the quest for anything for its own sake are not interested in other things. Finding the truth is difficult, and the road to it is rough.’ wrote Ibn al-Haytham (965–1039; Persian polymath), a pioneer of the scientific method. This book tackles one of the biggest challenges of science; understanding the biological basis of human consciousness. It does so through observation and experimentation in neurological patients, formulating hypotheses about the neural correlates of consciousness and employing an objective and reproducible methodology. This scientific method, as first proposed by Isaac Newton (1643–1727; English polymath), has proven utterly successful in replacing dark-age, ‘magical thinking’ with an intelligent, rational understanding of nature. Scientific methodology, however, also requires imagination and creativity. For example, methodologically well-described experiments permitted Louis Pasteur (1822–1895; French chemist and microbiologist) to reject the millennia-old Aristotelian (384–322 BC; Greek philosopher) view that living organisms could spontaneously arise from non-living matter. Pasteur’s observations and genius gave rise to germ theory of medical disease which would lead to the use of antiseptics and antibiotics, saving innumerable lives.

The progress of science also largely depends upon the invention and improvement of technology and instruments. For example, the big breakthroughs of Galileo Galilei (1564–1642; Tuscan astronomer) were made possible thanks to eyeglass makers’ improvements in lens-grinding techniques, which permitted the construction of his telescopes. Similarly, advances

in engineering led to space observatories such as the Hubble Telescope to shed light on where we come from. Rigorous scientific measurements permitted to trace back the birth of the universe to nearly 14.000 million years; the age of the earth to more than 4.500 million years; the origin of life on earth to (very) approximately 3.500 million years and the apparition of the earth’s first simple animals to about 600 million years. Natural evolution, as brilliantly revealed by Charles Darwin (1809–1882), over these many million years gave rise to nervous systems as complex as the human brain, arguably the most complex object in the universe. And somehow, through the interactions among its 100 billion neurons, connected by trillions of synapses, emerges our conscious experience of the world and of ourselves.

Neurology is the study of mankind itself, said Wilder Penfield (1891–1976; Canadian neurosurgeon). You are your brain. This book offers neurological facts on consciousness and impaired consciousness. While philosophers have pondered upon the mind–brain conundrum for millennia, without making much if any progress, scientists have only recently been able to explore the connection analytically through measurements and perturbations of the brain’s activity. This ability again stems from recent advances in technology and especially from emerging functional neuroimaging modalities. As demonstrated in the chapters of this book, the mapping of conscious perception and cognition in health (e.g., conscious waking, sleep, dreaming, sleepwalking and anaesthesia) and in disease (e.g., coma, near-death, vegetative state, seizures, split-brains, neglect, amnesia, dementia, etc.) is providing exiting new insights into the functional neuroanatomy of human consciousness. Philosophers might argue that the subjective aspect of the mind will never be sufficiently accounted for by the objective methods of reductionistic science. We here prefer a more pragmatic approach and see no reason that scientific and technological advances will not ultimately lead to an understanding of the neural substrate of consciousness.

This book originated partly to satisfy our own curiosity about consciousness. We thank our funding agencies including the National Institutes of Health, the European Commission, the McDonnell Foundation, the Mind Science Foundation Texas, the Belgian National Funds for Scientific Research (FNRS), the French Speaking Community Concerted Research Action, the Queen Elisabeth Medical Foundation, the

Liège Sart Tilman University Hospital, the University of Liège and the University of Wisconsin School of Medicine and Public Health. We learned a lot while working on *The Neurology of Consciousness* and hope you do too while reading it.

March 2008
Steven Laureys (Liège) and Giulio Tononi
(Madison)