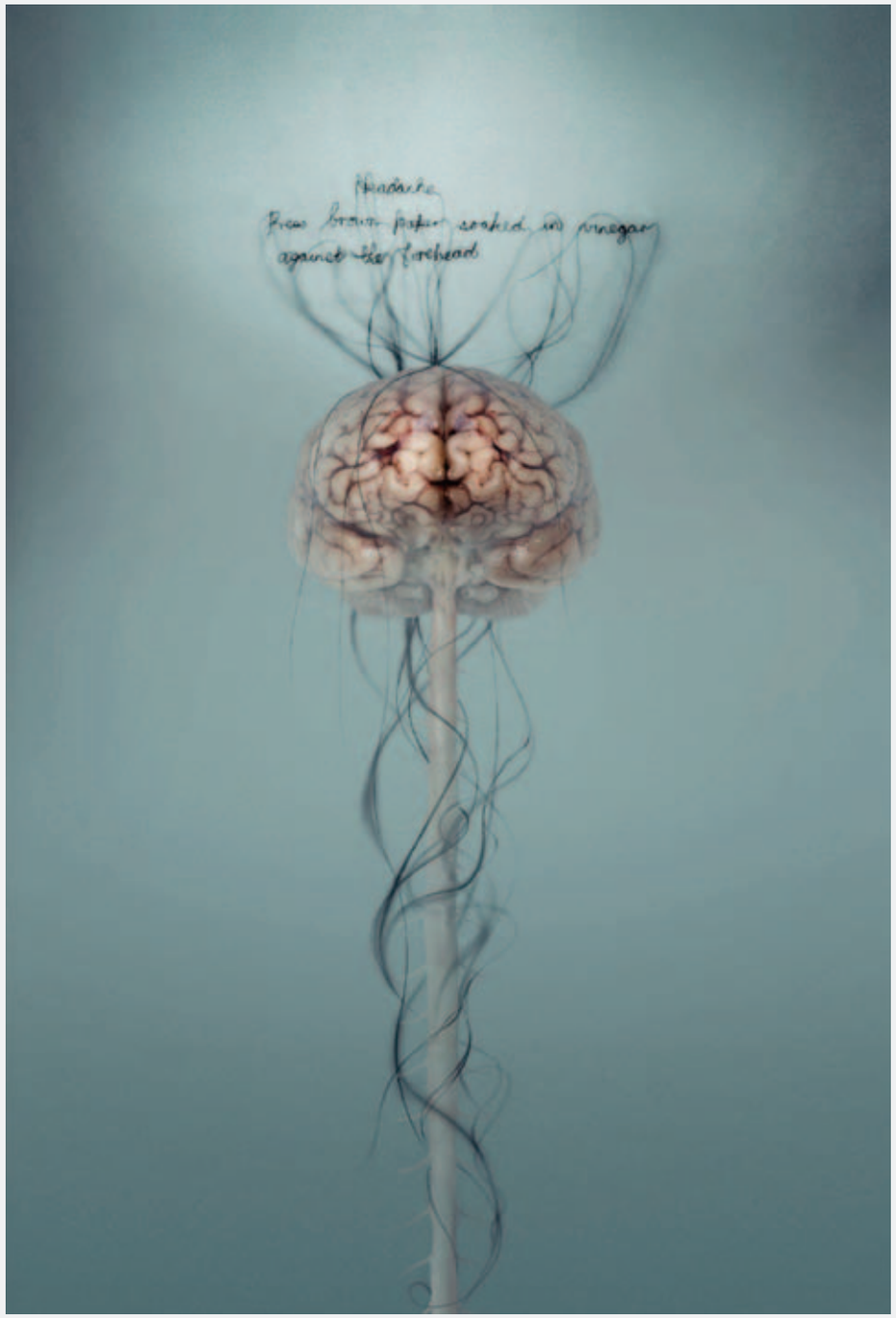
Exhibiting the brain
Marius Kwint

Neuroscientists estimate the brain to have an unimaginable 100 billion nerve cells with 100 trillion synapses or neural connections. There are numerous books, exhibitions, websites and television programmes about how these nerves and synapses combine to provide consciousness, thought, memory, movement, sensation, perception and emotion – what together is known, with connotations of authority and control, as the 'mind'. However, rather than attempting to explain what the brain does for us, this book explores what we do to brains. People do, and have done, a lot of different things to brains: we drill holes in their protective layers; we penetrate them with electrical wires and pass currents through them; we drug them; we subject them to intense magnetic fields; we cut out quite large parts of them; we shoot them out with bullets and scoop up the spillage with rubber-gloved hands and post the photos of this activity on the web; we slice, pickle, freeze and entomb brains in wax and plastic and then arrange them neatly in drawers and on shelves; and we make pictures – lots and lots of pictures – and models, as well as writing and talking about them. And that's only counting human brains.

It's customary for those writing about the brain to remark on the unpromising nature of its tissue in contrast to the richness, even infinity, of what it provides: 'the soul in a bowl of curds' and so on. Upon encountering a whole, real human brain, the sense of paradox at the cold flesh in hand versus the knowledge of consciousness and personhood can indeed be intense and overwhelming. "I cradled it like a baby," recalls the artist Susan Aldworth after observing a dissection at a London brain bank, "protective, respectful of holding 'someone' – someone very vulnerable in this disembodied state." Many studies pay lip service to the striking materiality of this object before proceeding to set out the brain as a subject, furnished with telling diagrams and seductive scanning images that force the substance of the brain into an imagining of its interior workings.

What if we refuse to go down that route, and instead allow the brain to retain the status of an object, with which humans engage in varied but purposeful activities, almost as if it were wood? To view the brain as amenable to different crafts and technologies reveals something of the actual operation of the brain upon the world. The aim of this book, and of the exhibition on which it is based, is to produce a physical encounter with the brain in its

Headache (detail)
Helen Pynor, 2008
C-type duratrans face-mounted on glass
COURTESY OF THE ARTIST AND GV ART, LONDON



many forms, and to exhibit some of the apparatuses and methods with which it has been worked. The perspective stays for the most part firmly on the outside of its wrinkly surface.

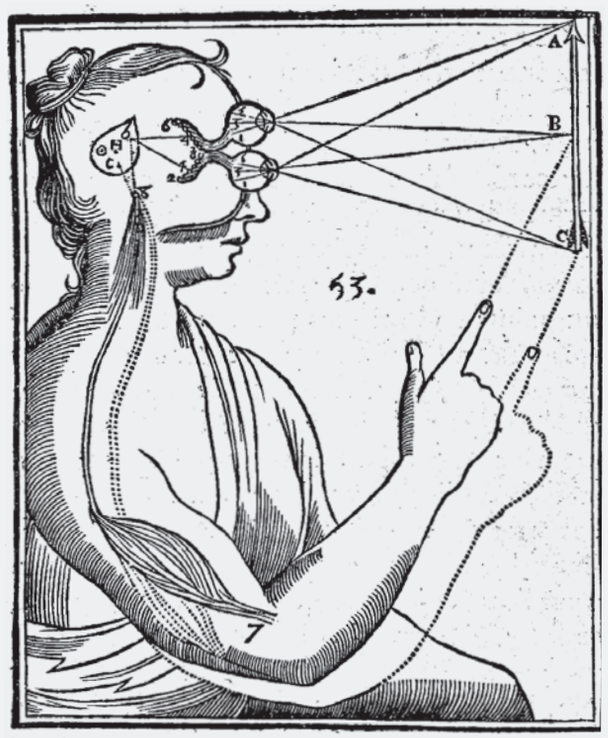
Exploring the brain

Having said that, curiosity about how the brain works has motivated most of the ways in which it has been exhibited and visualised over the centuries. It is worth considering a few historical landmarks in Western concepts of the brain (although European cultures by no means had the monopoly on theories about it). Aristotle famously underestimated the brain and identified the heart as the primary seat of consciousness and the emotions, partly because the brain's delicately gelatinous tissue was so hard to dissect and quick to decay behind its armour of cranium and meninges. By the time of the Roman Empire, there was an established consensus that the mind (aka the soul) was primarily located in the brain, but in the second century CE, Galen – doctor to the gladiators, with plenty of broken heads at his disposal – placed the mental faculties such as reason and memory in the brain's fluid-filled cavities, or ventricles, rather than its solid matter.

Throughout the Middle Ages, human dissection was heavily restricted in Europe and the Mediterranean world, and most surviving drawings of the brain from this period are diagrammatic.

Diagrams of the head showing the eyes and brain with internal ventricles (left)
Leonardo da Vinci, *c.*1508–10
Pen and ink over traces of black chalk

Coordination of muscle and visual mechanisms by means of pineal body (below)
René Descartes, *L'Homme*, Paris, 1664
Wood engraving in book
WELLCOME LIBRARY, LONDON



On the question of the ventricles, Galenic doctrine was still broadly accepted by Leonardo da Vinci during his furtive explorations of mouldering corpses some 14 centuries later. By the mid-17th century, the French polymath René Descartes argued instead that the small pineal gland, deep within the brain and named after a pine nut, was the regulator of zephyr-like animal spirits, analogous to hydraulics, which connect with the nerves and muscles throughout the body.

Scholars were able to debate the brain more confidently from the Renaissance onwards, when European university cities instituted anatomy theatres for the public dissection of cadavers. Working in 16th-century Padua, the great Flemish anatomist Andreas Vesalius published his unparalleled atlas of the human body. His engravings scaled new heights in the naturalistic depiction of the brain as an organ, with its graphically convoluted cortex and hemispherical structure. He dismissed the ventricle theory on the grounds that other animals also possessed that feature but only humans had the gift of a divine soul. However, conventional dissection techniques

Human brain with cerebellum and nerves (below)
Thomas Willis, *Cerebri Anatome*, London, 1664
Copperplate engraving in book
WELLCOME LIBRARY, LONDON

George Combe lecturing on phrenology to a large mixed audience in his Edinburgh home (right)
L Bump, after J Lump, London, 1826
Coloured lithograph
WELLCOME LIBRARY, LONDON

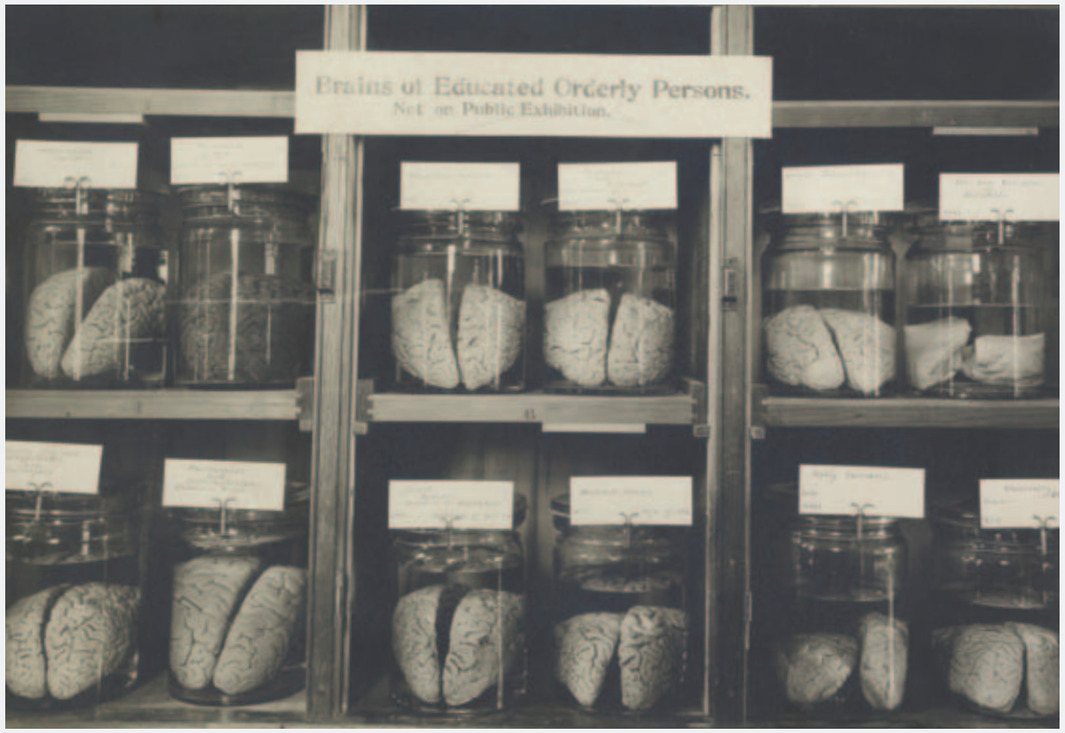
only enabled him to show the brain seated in the cup of the head, whereas in Civil-War Oxford a hundred years later, Thomas Willis, a critic of Descartes's pineal-centred account, managed to prise the brain intact from its vault and to discover the failsafe system of arteries on the underside that bears his name: the circle of Willis. His 1664 book, *Cerebri Anatome*, established neuroscience as a specialised discipline and boasted engravings by his friend Sir Christopher Wren that showed the brain in splendid isolation.

To the religious sceptics of the Enlightenment, the study of the brain promised a purely materialist explanation of human nature and variation, and so it became a guiding figure in the advance of scientific rationalism in the succeeding centuries. This single organ was scientifically venerated as the crowning glory of the evolutionary

process that had, according to elite opinion, culminated in the global triumph of Western civilisation. Sheer intelligence became a bourgeois cult, for which the image of the liberated brain became an icon, its cortical folds bursting forth from their cranial prison with untold intellectual potential. Here was the Lockean man in charge of his own destiny, with a soul which, according to the latest scientific findings, comprised nothing more than organically generated electricity. The experiments of Luigi Galvani and Erasmus Darwin had, after all, produced the appearance and movements of life in the electrified corpses of frogs and recently executed criminals – a concept that notably fascinated and horrified the young Mary Shelley, eventual author of *Frankenstein* in 1818.

Enlightenment brought about many other bizarre ideas, among the more notorious of which was phrenology, the commercialised science that purported to read the character of a subject from bumps around the head. Phrenology appropriated the resurgent (and to this day predominant) theory of localisation, which holds that particular mental functions and faculties operate in specific areas of the brain, sometimes alone, sometimes in concert. Much more respectfully viewed by many 19th-century anatomists was the work of the Italian criminologist Cesare Lombroso, who revived the classical discipline of physiognomy by arguing that moral propensities were evident not only in the shape and expressions of the face but also in the dimensions of the brain that lay behind it.

Cabinet of 'Brains of Educated Orderly Persons'
Burt Green Wilder Collection, 1890s
Black-and-white photograph
DIVISION OF RARE AND MANUSCRIPT COLLECTIONS,
CORNELL UNIVERSITY LIBRARY



Collecting brains
Equipped with chemical preservation methods that allowed the indefinite storage of entire brains, a few ambitious anatomists such as Burt Green Wilder at Cornell University in upstate New York set about systematically collecting them for the purposes of anthropometric comparison. Brain-collecting was only one facet of the great classifying endeavour to which Western knowledge-gatherers were then subjecting the entire globe. At the Wistar Institute in Philadelphia, Edward Spitzka began drawing up a list of the brain weights of eminent persons, in which both the top and bottom positions would be occupied by famous writers: Ivan Turgenev at 2012 grams and Anatole France at 1016 grams. Biographical accounts appeared in learned journals, correlating the qualities of well-known personages in life with the properties of their brains in death. By the twilight of the 19th century, staining techniques that revealed the beautifully dendritic, or tree-shaped, structure of brain cells began to indicate how brains functioned at the microscopic level as a network of interconnecting neurons. The subdiscipline of 'cytoarchitectonics',

or the division of different areas of the brain according to its different regional cellular types, was then developed by Korbinian Brodmann through a series of painstakingly constructed maps of the entire cerebral cortex in the 1900s.

With newly rigorous methods to hand, anthropometric collections continued to thrive in countries ranging from the USA to France, Japan, Russia and Sweden. The brains of many deceased greats, including Lenin and Einstein, entered the histological pantheon in the hope of identifying the substrate of genius, and indeed it became quite a fashion for men and a few women of science to bequeath their illustrious grey matter to their colleagues – a story engagingly told by Brian Burrell in his book *Postcards from the Brain Museum: The improbable search for meaning in the matter of famous minds* (2004). However, as Burrell's title suggests, few enduring conclusions were drawn, except to cement in the public mind the prejudicial fallacy that human intelligence was fixed, innate and directly correlated to brain size. This outcome was somewhat against the intentions of progressives such as Wilder.

"Sheer intelligence became a bourgeois cult, for which the image of the liberated brain became an icon, its cortical folds bursting forth from their cranial prison with untold intellectual potential."

While the powerful have usually been able to exercise their will over their post-mortem fates, there were many more instances in which certain types of brain were held to be of greater scientific or symbolic value than the wishes, or even the lives, of those whose heads contained them. Under traditional arrangements for the anatomisation of executed criminals and the unclaimed dead, many had had their cerebral matter, along with the rest of their bodies, denied the sanctity of the grave. And under the Third Reich, thousands of alleged mental defectives were even killed expressly for their brains under so-called euthanasia policy, culminating in the Aktion T4 extermination programme. Many of the physicians who had supervised these mass murders in the name of genetics went on to perfectly respectable postwar careers in both East and West, their papers still being published, and it was up to recent generations to bring light and some semblance of restitution to this episode.

Whereas the Nazis had the temerity to pursue their colonialism on the European continent, the Great Powers had been doing so for decades throughout the so-called darker parts of the world, and their scientists had been collecting, classifying and measuring apparent brain capacity all along. In most colonial settings, however, fresh brain material could not for the most part be readily obtained or preserved, so European researchers made

Frankenstein film poster
1931
Coloured lithograph
COURTESY OF NBCUNIVERSAL ARCHIVES AND COLLECTIONS

do with skulls. They would frequently dig up the burial sites of subject peoples to measure skull volumes and proportions. They also diligently photographed and applied headspanners and gnomiometers to the heads of their living, and often resentful, subjects.

Eugenics and anthropometric collecting fell into disrepute after World War II, but the latter bequeathed to popular culture the science-fiction image of the brain in a jar, as if suspended in an artificial amnion awaiting some ghastly rebirth. The most influential of these was the 1931 film of *Frankenstein* with Boris Karloff, where, in a shameless travesty of Shelley's novel, a blundering assistant supplies the creature with the brain of a criminal rather than the perfectly formed specimen that Dr Frankenstein intended. As a result, Brian Burrell says,

> *... there are now two monsters – Mary Shelley's and Boris Karloff's. One is an athletic superman who talks incessantly, while the other plods along and never speaks. One is driven to murder by his fragile ego, the other by a defective brain. One is wounded by careless nurture, the other by cruel nature. Shelley's monster imposes his will on a world that rejected him. His modern counterpart, on the other hand, has no will at all. He is simply a prisoner of his misshapen brain.*

Burrell explains how the film's scriptwriter, Robert Florey, was pressed by the producer, the 21-year-old Carl Laemmle Jr, to come up with a clearer reason for the creature going berserk than what was offered by Shelley's humane critique of scientific hubris and popular prejudice. Florey inserted the idea of the abnormal brain (or "*dysfunctio cerebri*") and "[t]he rest, as they say, is cinematic history". Television offered further fantasies of the disembodied but animated brain, for example the wired-up cortex of an intergalactic villain in the 1976 *Doctor Who* series *The Brain of Morbius,* and the character of Big Brain – just a big brain – in Matt Groening's cartoon *Futurama*. Similar ideas informed the 'brain-in-a-vat' hypothesis discussed by the Harvard philosopher Hilary Putnam in 1981. In this famous thought-experiment, an update of Plato's Allegory of the Cave, Putnam reasoned that he could not be a mere brain connected to a supercomputer providing the illusory sensation of volition and perception. All these scenarios played on the biologically absurd but ideologically plausible notion that humans are ultimately reducible to their brains.

Today, anatomical collections mostly gather dust amid the smell of formaldehyde in the basements and backrooms of medical schools, unless they are presented to the public as historical artefacts. But modern brain banks are now burgeoning around the world, furnished with super-cold freezers, opaque plastic buckets rather than jars, vast computer databases as well as walls of

slide-drawers, and new techniques for the genetic analysis of tissue. These are the means by which researchers endeavour to shed new light on the epidemics of Alzheimer's, Parkinson's, multiple sclerosis and other neurodegenerative conditions that especially threaten the future of affluent societies and their ageing populations. Ordinary citizens, whether healthy or afflicted, are being asked to donate their brains to science, under strict regulations to ensure that dignity and consent are respected. In the field of brain-mapping, delicate and sophisticated technologies and production techniques are now engaged in compiling huge online atlases of neural structures and connections, sometimes on a mass scale, for instance at the Allen Brain Institute in Seattle. However, for the moment, researchers are predominantly using the somewhat smaller, more fathomable and available cerebral matter of fruit flies and mice. As neurobiologist Richard Wingate and many of his colleagues freely admit, the human brain remains a largely mysterious world, and its explorers, surveyors and cartographers have only begun to identify its main roads, rivers and regions, albeit in spectacular and prolific ways.

"the human brain remains a largely mysterious world, and its explorers, surveyors and cartographers have only begun to identify its main roads, rivers and regions, albeit in spectacular and prolific ways."

A political economy of brains

Neuroscience may, in the words of critical insider Steven Rose, be "data-heavy, and theory-light", but in the USA especially it enjoys a prestige which derives partly from its stance as an objective material science. Some would regard it as the tech-savvy neoliberal nephew of Cold War psychology. Any trawl of an airport bookshop will reveal the promises of applied neuroscience to make you a better manager, marketer, citizen, parent, law-enforcer and consumer. With the prospect of manipulation through smart drugs and molecular interventions, a whole neurotechnological civilisation is beckoning. It is easier, as Hollywood realised, to blame or speculate about the brain than to change the social and economic conditions that many would still argue are crucial factors in mental illnesses such as schizophrenia, depression and post-traumatic stress disorder. Some of the claims made for neuroscience by the mainstream media are scarcely less fantastic than the dystopian visions conjured up by a recent sub-genre of neuro-fiction movies, such as *The Matrix* (1999), *Inception* (2010) and *Limitless* (2011). In all seriousness, US judges are now reported to be considering whether information held within a defendant's brain can legally be considered a physical thing and therefore, once extracted by fair means or foul, admissible as evidence in court cases. This would in effect remove the protection

Brain Tissue Freezer 1
(from the series 'After I'm Gone')
Ania Dabrowska, 2011
C-print
COURTESY OF ANIA DABROWSKA AND BRONWYN PARRY

of the Fifth Amendment, which prevents defendants from being forced to testify against themselves. The brain, under the new, penetrative regime of neuroscience, risks being exiled from its longstanding domain of the self.

Whether or not the brain remains the sovereign organ, it is, like any other substance or thing, part of a system of production, circulation and exchange, as the economic metaphors surrounding it suggest. Scientists 'harvest' and 'bank' brains in order to produce value in the form of scientific knowledge, professional advancement and public health; teachers 'cultivate' intelligent minds. We have seen how popular culture, through horror and science fiction, also perpetuates the idea that brain tissue is a thing of extraordinary power and potential, the core of the perennial trophy of the severed head. These complex processes have visible and tangible effects. Brains are displayed, pictured, scanned, analysed and treated, thus transforming them by scientific industry into academic papers, media spectacles of discovery, education and information, healthier citizens, more compliant workers and consumers – all to enhance national prowess, prosperity, security and so on. A multitude of spaces, aesthetic predilections, protocols, technologies and tools supports and enables this range of practices. There is, so to speak, a political economy of brains, by which the brain becomes invested with a level of hope and expectation that has usually exceeded the ability of science to make sense or use of it. The brain has, therefore, in the classical sense, considerable commodity value, as the Californian conceptual artist Jonathon Keats satirically pointed out when he sold futures contracts in his brain for $10 per million neurons.

"There is, so to speak, a political economy of brains, by which the brain becomes invested with a level of hope and expectation that has usually exceeded the ability of science to make sense or use of it."

While this book also capitalises on brains, it does so with their original owners firmly in mind. The images and objects arranged here are traces of human behaviours and experiences, rather than evidence towards some theory of mind or body (though they may have at one time served that purpose). Some of these episodes were cruel and disastrous, others noble and optimistic; some were unremarkable by the standards of the time but would be unacceptable today. All the exhibits are chosen because they consist of, directly involve or somehow represent the form and matter of the brain. They indicate how brain tissue has served as cultural material: a natural resource that humans have worked to produce meaning and perceived individual or social benefit, as well as profit, mainly in medical or scientific contexts. The emphasis is therefore on collecting and other

direct physical interactions with brains, not chemical interventions with drugs, which are nevertheless important and have biophysics at their root. There are also a number of reflections by contemporary artists on these processes, some of them specially commissioned for this project.

The selection of cases is neither exhaustive nor encyclopedic, but designed to highlight some of the most potent stories that emerge from past and present neurology. It is based partly on the great collection of historical and ethnographic artefacts and books amassed by Sir Henry Wellcome (1853–1936), the library and some objects from which are housed at Wellcome Collection in London. Though that collection covers an enormous cultural and historical range, the present selection is mainly from Europe and North America from the 16th century onwards. It is divided into four sections, reflecting impressionistic themes that emerge from the encounter with the brain as a thing. The first, Measuring/Classifying, explores the anthropometric motivations that lay behind much brain science. The second, Mapping/Modelling, shows some key attempts to represent the anatomy of the brain. The third, Cutting/Treating, considers surgical and anatomical interventions. And the fourth, Giving/Taking, explores some of the exigencies and salient narratives of brain-collecting to the present day. It is hoped that together, they show the immense weight of hopes, fears and beliefs with which this delicate organ has been saddled, and so open up some productive questions about our collective minds.