This chapter traces the origins of our current ideas about visual cortex. I begin in the thirtieth century BCE with the earliest description of the cerebral cortex. In the second part I consider the views of Greek philosopher-scientists on the functions of the brain. The third part concerns the long period in which there were virtually no advances in Europe in understanding the brain or any other aspect of the natural world. In the fourth part I describe how even after brain research was again well under way, the cerebral cortex tended to be ignored. The fifth section considers the beginning of the modern study of the cerebral cortex and the localization therein of psychological functions. Our focus narrows in the sixth section, and I address how a specifically visual area of the cortex was delineated. The chapter ends with the award of the Nobel prize to David Hubel and Thorsten Wiesel in 1981 for their discoveries about visual cortex.

Ancient Egyptian Surgery and Medicine

The First Written Mention of the Brain

The first written reference to the cortex, indeed to any part of the brain, occurs in the Edwin Smith surgical papyrus (figure 1.1). Although written about
1700 BCE, this papyrus is a copy of a much older surgical treatise dating back to the pyramid age of the Old Kingdom (about thirteenth century BCE). The papyrus was bought in 1862 by an American Egyptologist, Edwin Smith, from a local in Luxor, probably one of the “hereditary” tomb robbers who inhabit a nearby village. It eventually found its way to the great American Egyptologist James H. Breasted.¹

The publication of Breasted’s translation in 1930 made an enormous impact on medical historians and Egyptologists.² Previously, Egyptian medicine had been thought to be a jumble of incantations, amulets, and superstitions. Rational medicine was supposed to begin only with the Greeks. Yet, the Edwin Smith papyrus is clear evidence of a scientific observer attempting to understand the human body and to treat, rationally, its injury.

The papyrus consists of a coolly empirical description of forty-eight cases, starting from the head and working down to the shoulders, where the copyist stops in mid-sentence. For each case, the author systematically describes the examination, diagnosis, and feasibility of treatment. Each diagnosis comes to one of three conclusions: that the patient should be told that it is “an ailment that I will treat,” “an ailment that I will try to treat,” or “an ailment that I will not treat.”

The word for brain first comes up in case six, a person with a skull fracture:

(Title) Instructions concerning a gaping wound in his head, penetrating to the bone, smashing his skull, (and) rending open the brain of his skull.

(Examination) If thou examinest a man having a gaping wound in his head, penetrating to the bone, smashing his skull, and rending open the brain of his skull, thou shouldst palpate his wound. Shouldst thou find that smash which is in his skull [like] those corrugations which form in molten copper, (and) something therein throbbing (and) fluttering under thy fingers, like the weak place of an infant’s crown before it becomes whole . . . (and) he
[the patient] discharges blood from both his nostrils, (and) he suffers with stiffness in his neck.

*(Diagnosis)* [you say] an ailment not to be treated.  3

And indeed, the "corrugations" that form in molten copper during the smelting process such as that of early Egypt really do look like cerebral cortex.

In several cases, the author notes the relation of the laterality of the injury to the laterality of the symptom. For example, in case five, the patient "walks shuffling with his sole on the side of him having that injury which is in his skull." (Presumably, a contracoup injury; that is, a blow to one side of the head that causes the brain to shift within the cranium and make impact on the inside of the contralateral skull, thereby causing damage contralateral to the site of the blow.)

The author was clearly aware that the site of injury determines the locus and nature of the symptoms. Thus, in case thirty-one, "It is a dislocation of a vertebra of the neck extending to this backbone which causes him to be unconscious of his two arms and legs." Elsewhere, the author mentions the meninges and the cerebrospinal fluid, and describes aphasia ("he speaks not to thee") and seizures ("he shudders exceedingly").

Although the document is startling in its rationality and empiricism and in the virtual absence of superstition and magic, Breasted did tend to overinterpret the papyrus; he wrote, for example, "this recognition of the localization of function in the brain . . . shows an astonishing early discernment which has been more fully developed by modern surgeons only within the present generations." 44 Perhaps Breasted's greatest flight of fancy was the suggestion that the papyrus was written by Imhotep, a famous physician who flourished about the time the original of the papyrus was written. There is absolutely no evidence that he wrote it, however; in fact, he is very unlikely to have done so, since the papyrus deals largely with battle wounds, and in the rigidly hierarchical world of Egyptian medicine, Imhotep was certainly not a battlefield surgeon.

He certainly was, however, an interesting figure in his own right. 5 He was the grand vizier of the third dynasty Pharaoh Zoser (2700–2650 BCE). A
Figure 1.2 A statuette of Imhotep as a demigod, a person of human origin who after his death was viewed as superhuman and worshipped. He achieved this status within 100 years of his death. As a demigod, Imhotep was typically represented with an open scroll on his lap. Statuettes like this one, from the Civica Raccolta Egitzia in Milan, must have been common, as there are, for example, forty-eight in the Wellcome Historical Medical Museum, twenty-one in the Cairo Museum, about fifty in the Louvre, and ten in the Hermitage (Hurray, 1926).
contemporary inscription describes him as “chancellor of the king of Lower Egypt, the first after the King of Upper Egypt, administrator of the great palace, hereditary noble, high priest of Heliopolis, the builder, the sculptor.” He is credited with designing the step pyramid of Sakkara, which was the tomb of Zoser, the first pyramid, and the first example of large-scale dressed stone architecture. He was also a priest, astrologer, and magician. Yet his fame as a physician seems to have impressed his contemporaries and later generations most of all. Miniature statues of him were used as amulets to ward off disease (figure 1.2), and eventually, he was deified as the Egyptian god of medicine (figure 1.3), an unusual honor even for a successful physician.⁶,⁷

The Legacy of Egyptian Medicine

The period of the Middle Kingdom (starting about 2000 BCE) saw a gradual decline in the artistic, architectural, and intellectual creativity and vibrancy that characterized the earlier dynasties. The society became more rigid and hierarchical, intellectual life more dominated by priests, sculptures were largely copies of earlier works, and buildings more gigantic and grandiose. The rational and empirical spirit of medical practice that suffuses the Edwin Smith papyrus largely gave way to mysticism, religion, and elaborate speculations on the next world.⁸ Yet, the fame of ancient Egyptian medicine lived on, in the Odyssey, in the Old Testament, among the presocratic physicians, in Galen, in the Cabala, and today, in any New Age boutique or “health food” store.

It is important to view the correlations between brain injury and symptom in the Smith papyrus in the context of ancient Egyptian medical theory and practice. We know that the Egyptians thought that the heart was the most important organ in the body, the seat of the mind, and the center of intellectual activities. This is clear from their philosophical and religious writings, and emphasized by their practice of mummmification. Both Herodotus’s descriptions⁹ of the process of embalming and later examination of mummies show the contrast between the importance of the heart and brain in Egyptian thought. The first step in mummmification was to scoop out the brain through the nostrils.
with an iron bar. In contrast, the heart (and most other internal organs) was either elaborately wrapped and replaced in the body or carefully stored in canopic jars near the body. As indicated in the Book of the Dead, ancient Egyptians considered it essential that the body be preserved and all the important organs be retained so that in the afterlife the body would be in a suitable condition for resurrection when the soul returned to it. Dead Pharaohs were prepared for their next life with everything but a brain.

The idea of the heart as the sensory and intellectual center of the body seems to have been universal, as it occurs also in other ancient civilizations such as Mesopotamia, Babylonia, and India.\textsuperscript{10,11} It is reported to be common among preliterature cultures,\textsuperscript{12} as well, as illustrated by the oft-quoted remark of a Pueblo chief to C.G. Jung,\textsuperscript{13} “I know you white men think with the brain. That accounts for your shortcomings. We red men think with the heart.” Ancient Chinese medicine held rather more complicated views than the relatively simple heart-centered ones, but it also seems to have largely ignored the brain.\textsuperscript{14} In fact, the role of the brain in perception and cognition does not appear to enter Chinese thought until the Jesuit Matteo Ricci’s treatise (1595, in Chinese) on the art of memory, which he wrote as part of his campaign to convert the scholar class.\textsuperscript{15}

As we will see, the view that the heart was the seat of sensation and thought was even held by the greatest of all savants, Aristotle. It persisted for over a millennium, together with the more prevalent theory that the brain, not the heart, was crucial for these functions.

Figure 1.3 Imhotep as the Egyptian god of medicine. The earliest known divine representation of Imhotep dates from about 525 BCE, about twenty-five centuries his death. This painting is from the temple of Ptah at Karnak. Typical for a god, he wears a ceremonial beard and carries a scepter in his right hand and an ankh in his left, and a lion’s tail is attached to his belt. The hieroglyphs representing an abbreviated version of his name are circled. The most famous temple devoted to Imhotep was at Memphis, and became a hospital and school of medicine and magic. By Ptolemaic times Imhotep was assimilated into the Greek god of medicine, Asclepius (Hurray, 1928).