

## THE MEDIEVAL CELL DOCTRINE OF BRAIN FUNCTION

The central feature of the medieval view of the brain was the localization of mental faculties in the organ's ventricles. In its basic form, the faculties of the mind (derived from Aristotle) were distributed among the spaces within the brain (the ventricles described by Galen). The lateral ventricles were collapsed into one space, the first "cell" or small room. It received input from all the sense organs and was the site of the *sensus communis*, or common sense that integrated across the modalities. The sensations yielded images, and thus, fantasy and imagination were often located here too. The second or middle cell was the site of cognitive processes: reasoning, judgment, and thought. The third cell or ventricle was the site of memory (figure 1.7).

Although the basic doctrine remained intact for about 1200 years, there were some minor developments.<sup>59</sup> By the tenth century the original static localization shifted to a more dynamic process analogous to digestion. Sensory inputs were made into images in the first cell and were then transferred to the second cell, whose central location made it warmer, appropriate for further processing (cf. digestion) into cognition. Leftover thoughts were then trans-

Figure 1.5 Title page of the *Omnia Opera* of Galen published in 1541 in Venice. Among the famous anatomists who edited parts of this edition were John Caius, first Master of Gonville and Caius College, Cambridge; John Linacre, founder of the Royal College of Physicians; Jacob Syvius, Vesalius's teacher in Paris and later his archrival; and Vesalius himself, who edited the centrally important *On Anatomical Procedures*, among other Galenic works in the collection.

The eight scenes clockwise from the top are Galen removing his hat and bowing to a distinguished patient; Galen predicting the crisis in a patient's illness; Galen diagnosing lovesickness, which presumably refers to a case in which he revealed sophisticated understanding of the diagnosis of this malady (Mesulam and Perry, 1972); Galen bleeding a patient; Galen's brilliant demonstration in the pig that cutting the recurrent laryngeal nerve eliminates vocalization (among the dignitaries watching is Boethus, an ex-consul who once commissioned an account of this experiment) (Gross, 1998); Galen palpating the liver; Galen and his teachers; and Aesculapius, in a dream, urging Galen's father to send him to medical school. (Courtesy of Yale University, Harvey Cushing/John Hay Whitney Medical Library.)



## ANIMAB- SENSITIVAB

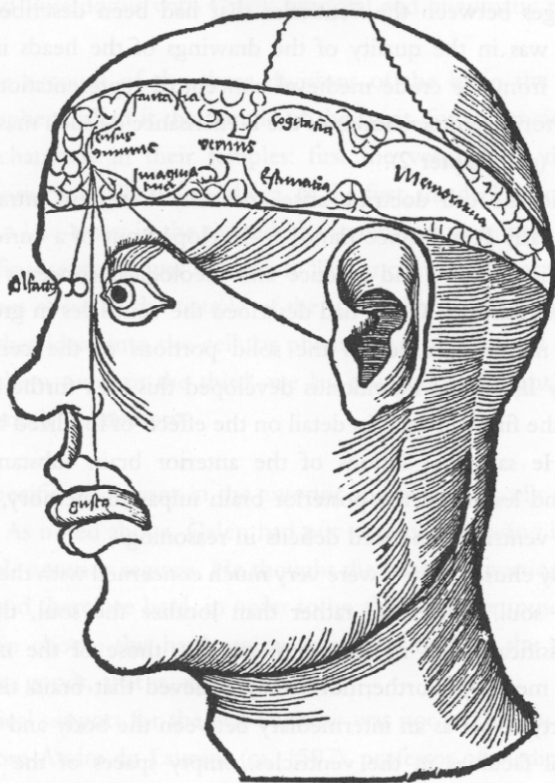


Figure 1.7 The organs of the “sensitive soul” (*anima sensitiva*) from G. Reisch (1503), *Margarita Philosophica* (*Pearls of Philosophy*), one of the first modern encyclopedias. This illustration of ventricular doctrine was copied by many subsequent illustrators as may be seen in the many versions in Clarke and Dewhurst (1996).

Messages from the organs of smelling, tasting, seeing, and hearing are united in the common sense (*sensus communis*) in the first ventricle, in which fantasy (*fantasia*) and imagination (*imaginativa*) also reside. The first ventricle communicates with the second by the vermis. Thought (*cogitativa*) and judgment (*estimativa*) are located in the second ventricle. Memory (*memoria*) is in the third ventricle. The curlicues around the ventricles may represent cerebral convolutions. As described in the text, Vesalius ridiculed this particular figure.

ferred to the third cell for storage. These transfers of information occurred through passages between the ventricles that had been described by Galen. Another shift was in the quality of the drawings of the heads in which the ventricles lay, from the crude medieval conceptual representations to the sophisticated pictorial representations of the Renaissance by such masters as Durer and Leonardo (see chapter 2).

How did the cell doctrine arise and why was it so attractive to the medieval and early Renaissance mind? It developed out of a curious amalgam of Greek medical theory and practice and ideological concerns of the early church fathers. Although Galen had described the ventricles in great detail, he localized the mental faculties in the solid portions of the cerebrum. The fourth-century Byzantine Poseidonus developed this idea further.<sup>60</sup> He seems to have been the first to report in detail on the effects of localized brain damage in humans. He said that lesions of the anterior brain substance impaired imagination and lesions of the posterior brain impaired memory, but damage to the middle ventricle produced deficits in reasoning.

The early church fathers were very much concerned with the nonmaterial nature of the soul. Therefore, rather than localize the soul, they localized Aristotle's classification of its functions, namely, those of the mind such as sensation and memory. Furthermore, they believed that brain tissue was too earthy, too dirty to act as an intermediary between the body and soul, so they located mental faculties in the ventricles, empty spaces of the brain. Thus, Nemesius, Bishop of Emesia (ca. 390), put all the faculties of the soul into the ventricles, following the same anteroposterior pattern as his contemporary Poseidonus, but making the site of mental faculties entirely ventricular.<sup>61</sup> Besides the desire for a suitable intermediary between the body and noncorporeal soul, another contribution to the doctrine of three brain cells may have been a parallel with the Trinity.

The three stages of processing postulated for the three cells were also influenced, or at least rationalized, by a comparison with the spatial division of function in classical law courts, as in the following quotation from the *Anatomia*

*Nicolai Physici*, a twelfth-century text derived from an Islamic synthesis of Nemesis and Poseidonus with Greek humoral and pneumatic physiology<sup>62</sup>:

On the account of the three divisions of the brain the ancient philosophers called it the temple of the spirit, for the ancients had three chambers in their temples: first the vestibulum, then the consistorium, finally the apotheca. In the first, the declarations were made in law-cases; in the second, the statements were sifted; in the third, final sentence was laid down. The ancients said that the same processes occur in the temple of the spirit, that is, the brain. First, we gather ideas into the cellular phantisca, in the second cell, we think them over, in the third, we lay down our thought, that is, we commit to memory.

The specific placement in the anterior and posterior cells clearly derives from Galen. As noted above, Galen had put sensory processing in the soft and impressionable anterior regions. He thought the posterior portions were motor in function and therefore hard, in order to be able to move muscles. The early church fathers choose this hard region as a good one for the safe storage of valuable brain goods, that is, memories.

Empirical support for the cell doctrine was not lacking, as shown in this quotation from Andre du Laurens (ca. 1597), professor of medicine and chancellor of Montpellier University and physician to Henry IV<sup>63</sup>:

If we will (saith Aristotle in his Problemes) enter into any serious and deepe conceit we knit the browes and draw them up: if we will call to mind and remember anything, wee hang downe the head, and rub the hinder part, which sheweth very well that the imagination lieth before and the memorie behinde . . . in the diverse pettie chambers in the braine, which the Anatomists call ventricles . . .



ANDREAE VESALII  
BRUXELLENSIS, SCHOLAE  
medicorum Patavinae professoris, de  
Humani corporis fabrica  
Libri septem.

CVM CAESAREAE  
Majest. Galliarum Regis, ac Senatus Veneri gra-  
tia & privilegio, ut in diplomatis eorumdem continetur.

B A S I L E A E.