

Mondino's book and the human body

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Abstract

The assertion that Mondino da Luzzi, the 14th Century Bolognese anatomist, was the first genuine human anatomist is questioned. Mondino's work is examined and his findings shown to be less than original. The investigations of surgeons, who conducted post mortem examinations during the 13th Century are highlighted, their contributions to anatomical science underscored, and their knowledge of human structure reexamined and evaluated.

Résumé

L'assertion selon laquelle Mondino da Luzzi, l'anatomiste bolognaise du quatorzième siècle était le premier anatomiste humain authentique est remise en question. L'oeuvre de Mondino est réexaminée et les résultats démontrent qu'elle est moins originale qu'estimée auparavant. Les recherches entreprises sur les chirurgiens qui ont pratiqué des autopsies au cours du treizième siècle sont rapportées ici, ceci montre que l'importance de leurs contributions à l'anatomie a vait été sous-évaluée jusqu'à ce jour. Leur approche du corps humain est ainsi réexaminé et réévalué.

One of the common assertions in many accounts of medical history, is that an early 14th century book written by a Bolognese academician, Mondino da Luzzi, was the first text of human anatomy (Major 300; Singer 1928 74). Castiglione, one of the most eminent medical historians of the twentieth century, suggests that it "may be regarded as the first anatomical text worthy of the name" (Castiglione 343). In keeping with this tradition, over thirty years ago, the eminent Vesalian scholar, CD. O'Malley, described Mondino's *Anothomia* which the Bolognese professor completed in 1316, as the first modern book on anatomy. O'Malley explained this judgement by noting that Mondino's master opus was the first work devoted exclusi-

vely to the subject, and that it contained a few observations derived from its author's own dissection of human cadavers (O'Malley 13).

If one accepts these qualifications, O'Malley's dictum can still be defended. Certainly, Mondino's methods were extremely influential in academic circles and his work was used as the definitive text for university dissections until Vesalius' time and slightly beyond (Ongaro, 68-82). The anatomical demonstrations and lectures that Vesalius delivered to students in Bologna in 1540, some three years before the publication of his *Fabricawere* organized as a commentary on Mondino's *Anothomia* (Heseler 45). But during the last quarter century, we have learned that Mondino's work drew little from its author's practical experience (Kudlien 1964 210-214). The corpus he relied on chiefly was a body of text, the mass of material available to him from the translations of Arabic and Greek texts effected during the 11th, 12th and 13th centuries.

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Mondino's work can be shown to have incorporated the observations of earlier classical and Islamic investigations, particularly those of Galen and Avicenna. More surprising perhaps is the influence of the so-called Salernitan anatomists which pervade the treatise. Statements from the works of these animal dissectors of more than a century earlier who, like Mondino, worked in an academic setting, are more frequent than are statements of his own findings. In fact, one eminent medical historian and medievalist asserted that "If we must have a sudden rebirth... (these animal dissectors)... make the best case" (MacKinney 233). His own examinations of human material and those of his contemporaries exerted relatively little effect on his text.

Mondino's discussion of the uterus is illustrative of this point. Although he tells us he dissected the bodies of two women in 1315, and discovered that the uterus of one was almost twice as large as the other, he continues to repeat the old fallacy that the human uterus is divided into seven cells (Singer 1925 76). This traditional view enjoyed a distinguished lineage having been proposed, if not originated by the author of the so-called first Salernitan anatomy, written in the twelfth century which described the dissection of a pig.

In all of the late versions of the *anatomia porci* the legend of the seven-celled uterus is propounded (Corner 53; Sudhoff K. 144; Kudlien, 1965 415-416; Reiser 54-55). Mondino seems to have subscribed to this traditional myth despite his contention that he had actually performed human dissection. Perhaps he was confused by the sow, pregnant with thirteen unborn piglets, that he dissected a year after dissecting the two women (Dryander 26v; Singer 1925 76).

Mondino also accepted the notion that the human uterus had horns. This idea was to continue for two centuries. It was illustrated in the *Isagogae* of Berengario da Carpi, a 16th century commentator on Mondino's *Anothomia*,

where a rather plump woman points to an object on a pedestal which is purported to be her own uterus, but is in fact the uterus of a cow (Berengario da Carpi 1522 24v 1522; Lind 79). The uteri of sows, cows and some other mammals do indeed have hornlike appendages.

The picture also serves to illustrate the perhaps unfortunate durability of Mondino's influence. Berengario, who some two centuries later succeeded Mondino in the Bolognese chair of anatomy, designed his massive major work as a commentary on Mondino's *Anothomia* (Berengario da Carpi 1521). Although Berengario's *Commentaria* proper has no illustrations, its digest, the *Isagogae* does, and it is from that work that the strange amalgam of human and animal anatomy derives.

Moving to another anatomical locus, the classical notion of functional localization in three cerebral chambers, the sites respectively of fantasy, cognition and memory, is illustrated in another of Berengario's works, his discussion of head injuries, *Tractatus de fractura calve (sic) sive cranei* (Berengario da Carpi, title page 1518). Mondino diverges from this the most prevalent form of the localization doctrine, not again as the result of empirical investigation, but because of his adherence, as he himself tells us, to Avicenna's insistence on distinguishing fantasy from imagination (Clarke and Dewhurst 20-21; Dryander 52r; Singer 1925 90-91). It should be noted, however, that he apparently had no use for Avicenna's separation of *cogitativa* and *estimativa*. To Mondino this doctrine, required *a priori*, a four chamber, or at least a "double chamber plus two" physiology and anatomy, affording another example of his reliance on textual authority.

The effect of Galenic authority is reflected in Mondino's contention that injuries to different parts of the brain resulted in different disturbances of cerebral function. This notion contrasts with that of Avicenna but can be traced to the

Galenic work *De locis affectis* (Galen 327 ff.), where Galen by way of clinical observation, comes nearest to formulating a localization theory of brain function. This Galenic work would have been available to Mondino, as it was translated from Greek to Latin in the late 12th century and Mondino apparently found it a useful prop to his version of cerebral ventricular theory. Mondino also follows Galen in maintaining that a *rete mirabile* or miraculous network, which we know is found only in the brains of ungulates, can be found in the human cerebrum (Singer 1925 94).

It is in his description of cardiac form and function, however, that Mondino displays the greatest devotion to his chief classical authority, Aristotle, even if obtained second hand through the writings of Avicenna. Mondino, like Aristotle, believed the heart's central position in the body demonstrated its role as the "source and ultimate root of all the organs" (Dryander 36v; Singer 1925 82). The most obvious Aristotelian influence in Mondino's cardiac account, however, is his contention like Aristotle's that the heart is three chambered.

Several aspects of this description are curious, but we will analyse only one. It involves instructions for dissecting the heart in order to make the supposed "three chambers" appear.

"Cut then the heart, first in the right side beginning from the point, yet guarding thyself against reaching the opposite wall, but dividing at the side of the middle ventricle... When you have seen this, cut open the left ventricle leaving whole the middle wall where is the third ventricle... No less wondrous is the middle ventricle. For this ventricle is not one cavity but many small cavities, extending rather toward the right than the left, to the end that the blood which crosseth from the right ventricle to the left may be continually subtilized as to be turned into spirit" (Dryander 37r-37v; Singer 1925 83-84 ff.).

Thus what Mondino does here is reconcile Aristotle's vision of a triventricular heart with the Galenic notion that the interventricular cardiac septum is permeable and acts as a filter allowing only the most rarefied portion of the blood to reach the left ventricle where it is concocted into vital spirit. Mondino thus conflates the opinions of Aristotle with those of Galen which allows him to preserve the Galenic idea that the vital spirit which moved in the arterial blood was formed in the middle ventricle whose existence Aristotle had maintained.

These selected examples then illustrate that Mondino's authorities were more important to his thinking and text than was the empirical evidence he obtained from the dissection table. But are we being too harsh? Were any of Mondino's contemporaries willing or able to defy authoritative dicta on the basis of their empirical observations concerning human anatomy? Obviously this article would not have been written had there not been.

There was, in fact, a 70-year old tradition of surgeons proceeding in precisely this fashion. They are known to twentieth-century scholars as the New Surgeons or the School of Bologna, and to themselves as the *moderni*. The most industrious, and with a certain sad irony, the last of this line was Mondino's contemporary, Henri de Mondeville, a French surgeon. Henri studied medicine and surgery at Paris in the 1270's and like other *moderni*, gained clinical experience on battlefields. While serving with the royal armies of Philippe le Bel, he may even have travelled to England in the retinue of the king's brother, Charles de Valois. On his return to France Henri laboured long and hard, to compose his *Great Surgery*, with a major chapter on anatomy, revising it right up until his death sometime after 1320 (O'Neill and Infusino 223-226).

As a military surgeon, Henri was particularly interested in head injuries. Having read Aristotle's contention that male craniums contained three

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sutures and females only one, he decided unlike many of his predecessors to examine them :

It is necessary to note that, despite the popular misconception on the difference between the bones and the sutures of the female and the male, and even though the Philosopher, in the first book of De historiis, at the beginning of chapter 4, speaking of the anatomy of the cranium, may say that there is a round bone having in women one single suture in the circumference of the head, and in males three, which rejoin into one ... it is necessary to note that in truth there is absolutely no difference between them, as one can demonstrate in the ossuary of the Cemetery of the Holy Innocents, where one can find one hundred thousand skulls. (Nicaise 34).

Henri's empirical emphasis comes through again in his use of pictures during his anatomy classes -- an innovation -- and by his advice to other teachers to teach cranial anatomy from a detailed wooden model of the human head (Nicaise 26; Mackinney 235). As an academician, however, Mondeville was also influenced by Aristotle in style and in some cases in substance.

A thirteenth century surgeon who was willing to diverge from classical authorities was the Piacenzian, William of Saliceto, a medieval surgeon who explicitly emphasizes the empirical and practical side of anatomy :

(Therefore,) it seems to me better and more useful to proceed, generally, in anatomy, as I promised, that is, in exposing the number, and the form, and the site, and the location of the members which can be made manifest to the senses, so that you, in the course of incisions, cauteries, and manual procedures can proceed in them without error. (William of Saliceto 163r)

William wrote a topographical anatomy that described structure and only structure. Little if any physiological discussion, Galenic or Aristotelian interrupts his straight descriptive anatomy.

When, in the anatomical chapter in his *Surgery*, he arrived at the ventricles of the brain, the seats of human perception, cognition and memory, he faced a challenge to his matter-of-fact approach. These essential organs were usually conceived of as hollows, often not those beneath the brain, as in our modern terminology, but lost somewhere amid the folds of the meninges (the tough connective tissues protecting the brain). Most earlier writers had covered their vagueness with lengthy discussion of cerebral function (Sudhoff W. 149-181; Clarke and Dewhurst 10-44).

Mondino, as we saw above, simply appropriated Avicenna's discussion. William, in his characteristic style, gets right down to the facts of size, number, form and location as he believed he had seen them. Indeed he had seen them, since he decides that the ventricles must be what we call the anterior, medial and posterior lobes of the brain, the "rounded protuberances above the cavities" as he puts it (William of Saliceto 163r).

William avoids another old "ghost" of cranial anatomy, the alleged existence of "*rete mirabile*", a netlike cushion of vessels, beneath the human brain. "That blessed and wonderful reticular plexus", as Vesalius was to complain centuries later, "there is nothing of which physicians speak more often -- even though they have never seen it ! " (O'Malley 179). In contrast to Mondino's dutiful repetition of this error, William simply proceeds to describe the hollows we call ventricles which do in fact exist there. Henri de Mondeville feels obligated to mention the "*rete*", but only briefly, as an after thought to his cranial discussion, and seems at pains to identify this structure with the blood vessels around the pituitary (Nicaise 37).

How, you may wonder, did Saliceto get access to cadavers if he was not primarily an academician ? One motive -- or pretext -- was forensic. In an earlier article, an autopsy ordered at the beginning of the 13th century by Pope Innocent III has been analyzed (O'Neill 429-433). Not only church officials, but city authorities as well, wanted to know cause of death in cases of injuries inflicted in brawls, in cases of suspected poisoning, and in cases of suspected pestilential death. Surgeons were called on to make these inquiries. In addition surgeons regularly performed, for families who could afford it, functions for which we would call a mortician. Such services often called for considerable dismemberment of the cadaver, for preservative purposes, or (just as often it seems), for pious ones. A lord or lady might want his or her heart buried at a favorite monastery or shrine, the head at the seat of power during life and the "remaining remains", if we may so express it, at the original family home. Pope Boniface may not have liked such practices (and it was at these procedures, not at academic dissections, that his famous bull against dismemberment was aimed) but kings and nobles usually went ahead and continued them anyway, as a recent study has shown (Brown 1990 803-832 and 1985 241 - 266).

The forensic motive may have been more prominent in Italy because of its legalistic climate, and the pious impulse more influential in Northern Europe - England, France and Germany. In any case, prominent, well-educated physician-surgeons like these predecessors and contemporaries of Mondino had many very specific questions about the human body, and a number of opportunities to answer them.

The credentials of a purely academic text like Mondino's for the title of "first anatomical text worthy of the name" are therefore shaky. This formal treatise seems to have less right to the title than do the surgical and medical texts written by the enterprising surgeons who conducted procedures on human cadavers with a practiced and critical eye. Their contributions may have been recorded in mere chapters rather than separate accounts, but one cannot help but suspect that if the advancement of anatomy had been left to investigators like them, rather than to the likes of Mondino, Guido de Vigevano, or Guy de Chauliac, and the classicists, Europe might not have needed to wait 250 more years for an Andreas Vesalius of Brussels to offer a credible response to the challenges posed by Galen and Aristotle. Until then, the books obscured the body more than they revealed it.

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