On the innovative genius of Andreas Vesalius

Brinkman, R.J.C.

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Chapter 10

Vesalius on animal cognition

Chapter based on article
Andreas Vesalius (1515-1564) on animal cognition
Brinkman R.J., Hage J.J., Oostra R.J., van der Horst C.M.A.M.
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Introduction
Until well in the 19th century, the Aristotelian concept of scala naturae (ladder of nature) was the most common biological theory among Western scientists. Aristotle (384–322 BC) had a hierarchical view of life in which all creatures could be grouped in order, with humans being the highest order. Western medieval commentators on Aristotle interpreted this as the scala naturae or the great chain of being, but these were not Aristotle’s terms [1, 2]. The scala may be represented by a virtual pyramid that included non-living things (such as minerals and sediment) and the simplest form of life on its lowest levels. Higher levels are occupied by animals with progressively increasing complexity and the top is occupied by human, with only the angels and God above them. Of the earthly creatures, only humans were felt to possess a rational soul that provided the ability to reason and reflect. Animals were believed to be able to react to sensation by use of a sensitive soul [3]. Because this view agreed with the Christian belief that humans occupied an exceptional and superior position in God’s creation, the Aristotelian theory became dominant.

Michel Eyquem de Montaigne (1533-1592) was the first philosopher that was influential enough to lastingly posit that animals are fully cognitive creatures [4]. This view stirred a fierce controversy, with René Descartes (1592-1566) leading among his many adversaries [4, 5]. Like the Aristotelians, Descartes denied that animals had reason or intelligence. Unlike the Aristotelians, however, he felt that animal reaction to sensations or perceptions could be explained purely mechanistically, rather than being initiated by an Aristotelian sensitive soul [1]. After de Montaigne and Descartes, naturalists disputed violently until well in the eighteenth century over the controversial interpretation of animal behavior [4], contending whether the activities of animal ‘brutes’ were to be regarded as congenitally fixed or as the consequences of reasoned choice [5].

Meanwhile, the increasing acceptance of other animals as intelligent beings had tantalizing implications for human cognitive psychology [4]. Evolutionary theories of mind and behavior appeared distinctly for the first time in the nineteenth century and accumulated in the famous works The Descent of Man (1871) and The Expression of Emotions in Man and Animals (1872) by Charles Darwin (1809-1882) [6]. Darwin concluded that “the difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind” (quote on p. 837) [6]. Only after it became accepted that animals and humans alike have cognitive abilities, did the research on the influence of conscious awareness and intention on the behavior of an animal (cognitive ethology) become possible in the 20th century [7].

We found the anatomist Andreas Vesalius (1515-1564) to have rejected the Aristotelian view on the lack of the rational soul in animals, some 40 years before de Montaigne posited his views and some 90 years before Descartes formulated his objections to both the Aristotelian view on the animal sensitive soul, and de Montaigne’s view on animal cognition. To understand the extent and moment of Vesalius’ rejection, we
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present the texts that Vesalius spent on it in his 1543 opus magnum De Humani Corporis Fabrica Libri Septem (De Fabrica) [8] and put his observations in historical perspective.

Materials and Methods
For this paper, we used the English translation of De Fabrica as presented by Australian classicist W.F. Richardson and anatomist J.B. Carman, in 2009 [9].

Results

Aristotelian view on animal cognition in Vesalius’ time
Aristotle’s attempt to classify all animals known to him in his Historia Animalium (History of Animals), made him the earliest natural historian whose written work survives. He grouped animals according to their morphological and behavioral similarities (e.g. bloodless animals vs. those with blood; water animals vs. land animals; animals with feathers, wings and beaks vs. those without) [2]. Aristotle’s felt that all living creatures had souls. In De Anima (On the Soul), he argued that the soul is the form, or essence of any living creature and that it is not a distinct substance from the body that it is in [3]. This soul is not to be confused with the currently popular view of the soul as a spiritual entity that inhabits the body. Hence, Aristotle’s soul is sometimes translated as life force. The main part of De Anima is dedicated to the determination of the nutritive, the sensitive, and rational souls. All species, plant or animal, must have a nutritive or vegetative soul to be able to nourish themselves and to reproduce. All animals additionally have a sensitive soul that grants movement and sense. Aristotle regarded the ability to feel pleasure and pain as the simplest kind of perception. Only some animals possess more developed versions of all five senses and, therefore, the ability to distinguish objects in a complex way. As such, he provided the first written reports of mutualistic relations between individual animals, of animal tool use, and of brood parasitism. Still, Aristotle did not explain these reports by any internal powers of sense even though he “pointed out that animals seem to emulate humans in the qualities of their mental life” (quote on p. 111) [3]. Only humans were considered to possess a rational soul or mind that provides the ability to reason, reflect, and realize rationally formulated projects. This capacity for deliberative imagination was singled out as the defining feature of humans in De Anima.

Based on Aristotle’s De Anima, the Persian scholar Avicenna (Abû Ali al-usayn ibn Abd Allâh ibn Al-Hasan ibn Ali ibn Sinâ, c.980–1037) developed a theory of instinct in his Kutab al shifa (or Sufficientiae). This elaboration of the Aristotelian view on the lack of animal rational abilities was adopted by Roger Bacon (c.1219–c.1292), by Albertus Magnus (c.1200-1280) and his student Thomas Aquinas (1225-1274), and by John Duns Scotus (c.1266-1308) [3]. Thus, Aristotle’s views were fully accepted in the
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Middle Ages. While the use of the Latin term *rational animal* for humans originated in medieval scholasticism, it reflected the Aristotelian view of man as distinguished by a rational principle. Thereafter, the Jesuits of Coimbra (in their *In Octo Libros Physicorum Aristotelis Stagiritae*, 1602) and Franciscus Suarez in particular (in his *De Anima*, 1621) were among the many Christian scholars who contributed to, and preserved, the Aristotelian legacy of interpretation of animal instinct, up to the Renaissance [5].

Because no work on zoology of similar detail as Aristotle’s work had been attempted until the sixteenth century, the Aristotelian concepts remained highly influential for some two thousand years [2, 3]. Only in 1580 did the French philosopher Michel Eyquem de Montaigne (1533-1592) start to publish his *Essays* in which he argued, among many other theses, that animals had rational abilities comparable to those of humans. Still, Andreas Vesalius argued the existence of animal rational abilities some 40 years earlier in his *De Fabrica* [8].

Vesalius and his view on animal cognition

Vesalius (Andries van Wesel) was born in Brussels to a family of skilled physicians that had had a lasting relationship with the rulers of the House of Habsburg for at least four generations. His father was the apothecary of king Charles V, who would later become the emperor of the Holy Roman Empire. Vesalius studied in Louvain, Paris, and Louvain again to become Bachelor in Medicine. He was taught and trained in the anatomical and physiological theories of Galen (c.130-c.200/c.216 AD) [10]. Galen’s teachings had become influential again at the end of the Medieval times that had mostly been influenced by Arabic medicine. In Vesalius’ time, such teaching was still done in Medieval tradition with a professor anatomiae declamating Galen’s teachings from a pulpit, while a barber-surgeon performed possible dissections of dogs, pigs and, sometimes, human corpses. One of the few exceptions to that rule was Jacobus Sylvius (Jacques Dubois; 1478-1555) who taught a three-year course of medicine in the de Tréguier in Paris, which Vesalius followed. Sylvius was an ardent Galenist but he did his own dissections. Like Galen, however, he predominately dissected animals as he had no human corpse at his disposal. Only occasionally, may he have brought the arm or a leg of an executed convict to his demonstrations [11].

In December of 1537, Vesalius took his Medical Doctorate *magna cum laude* in Padua, Italy, to be appointed Professor of Anatomy a few days after. Vesalius’ subsequent extensive dissecting of human corpses taught him that Galen’s theories flawed in many aspects, mostly because Galen had only dissected animals. During his public dissections, Vesalius saw no problem in intellectual clashes with older authoritarian Galenists and in his *De Fabrica*, he mentioned an corrected over 200 of Galen’s mistakes [12, 13]. In this way, Vesalius initiated the overthrow of 1350 years of Galenic anatomical dogma. Likewise, we found that Vesalius did not hesitate to doubt some 1900 years of Aristotelian theory that had accumulated to the Christian dogma of man being the only rational animal. Again on the basis of comparative anatomy he concluded in the seventh book of his *De Fabrica* entitled ‘Devoted to the brain as the..."
seat of the animal faculty and to the sense organs’, that at least the “higher” animals must have a mind similar to humans including some sort of rational soul [9].

In the chapter entitled ‘The brain was constructed for the soul-in-chief, for our senses, and for movement dependent on our own whim’, Vesalius stated “that the concupiscible soul dwells in the principal viscus of [the organs of food and drink] .[.]. and [.]. that the power of the irascible soul dwells in the principal viscus of .[.]. the organs devoted to generation. We did not agree with the teachings of the Stoics and Peripatetics to the extent of locating the animal principle in the heart or saying that the nerves take origin from the heart. We have still to deal with the source of sensation, of voluntary movement and of the soul-in-chief (by means of which we imagine, reason and remember), and that is therefore the subject of the present book, which will describe the brain and all its parts along with the organs of the senses” (quote on p. 161) [9].

In the same chapter, Vesalius recalled the Aristotelian principles of his training: “I have not yet forgotten something that I heard when I was a student of natural science in the Castle School, the most important and famous wing of the university at Louvain. Our teacher was a theologian by profession and therefore, of all the academic staff in that university, the most inclined to mix religious teachings with scientific. He was reading to us commentaries on Aristotle’s On the Soul, and in these it was written that the brain has three ventricles of which the first is in the front, the second in the middle and the third at the back. In addition to names derived from their positions they have other names derived from their function. The first, or anterior, ventricle, which was said to be in the forehead, was called the ventricle of the common sense, because from it the nerves of the senses travel to their organs, and because by means of these nerves odors, colors, flavors, sounds and tactile qualities are conveyed to this so the authors of these commentaries thought! They thought that the main function of the first ventricle was to receive things transmitted by the senses (popularly grouped together as the common sense) and pass them on to the second ventricle by a channel linking the two, so that the second ventricle could imagine, reason or think about the thing transmitted; thought or reasoning was therefore attributed to this second ventricle. The third ventricle was sacred to memory; in it the second ventricle, having abundantly mulled over the things transmitted to it, would deposit all such portions of them as it wanted to retain. If this third ventricle is moister like wax, things can quickly be engraved in it; if it is drier like hard stone the engraving process is slower. This means that in proportion to the ease or difficulty of the engraving this ventricle would preserve for a shorter or longer time what was entrusted to so these commentaries said! But this third ventricle did not retain or form likenesses of these things for its own purposes or its own benefit, but rather for the sake of the second ventricle, so that whenever the second ventricle began to reason on some subject that had been entrusted to the sinus of memory this sinus could swiftly dispatch it, whatever it was, to the second ventricle, as to a sort of factory of reason, for processing” (quote on p. 164) [9].

Vesalius continued that “to help us grasp each point in which we were being instructed we were shown a diagram taken from some pearl of philosophy. This diagram depicted the afore-said ventricles, and we students copied it down in our notebooks with accuracy in proportion to our interest in scholastic drawing. We were persuaded that it showed, not merely the three
Figure 10.1: Tabula VI of the 7th book of Vesalius’ De Fabrica showing an ‘amount of the brain left in the skull’. We have detached the front of the body that resembles a tortoise shell [body and crus of fornix] from the substance of the brain and bent it upwards and backwards to reveal its lower surface. The key to the symbols of this figure is as follows. A,A,A: Lower surface of the body that resembles a tortoise shell [body and crus of fornix]; this surface forms the top of the third ventricle. B: Portion of the body that resembles a tortoise shell within the right ventricle; it takes origin here from the substance of the brain. C: Portion of the body that resembles a tortoise shell in form and function; this portion grows out from the left ventricle of the brain. D,D: Right ventricle of the brain. E,E: Left ventricle of the brain. H: Vessel [great cerebral vein] that takes origin from the fourth sinus of the hard cerebral membrane and runs under the body that resembles a tortoise shell into the cavity shared by the right and left ventricles and known as the third ventricle. (quotes on pp. 135 – 136) [9].
ventricles, but all the parts, not merely of the brain but of the whole head” (quote on p. 164) [9]. Subsequently, he set out to correct this dogma by stating: “But the whole thing was a figment of the imagination of people who had never seen the brilliance of our Creator in the fabric of the human body; the following account show how wrong their account of the structure of the brain was” (quote on p. 165) [9].

Some further, Vesalius provided the detailed anatomy of the cerebrum and cerebellum and discussed the morphology and function of the ventricles (Figures 10.1-10.3). After having done so, he commented that there cannot “be anyone (excepting disciples of Albertus Magnus, Thomas of Aquino, John Duns Scotus, and that gang of theologians) who could be persuaded that one of the worms [the anterior and posterior parts of the vermis cerebelli] (for they cannot both be used to close a single orifice) controls the channel so as to allow phantasms to enter into the seat of memory [.]. and then transmit them, like thieves fettered in the jailhouse of memory, into the middle ventricle, which they regard as the seat of reason. In that case God the Creator of the world would in vain be providing the dog, the sheep, and other such animals with wormlike processes [lingula cerebelli and uvula vermis], since (according to them) these animals have no faculty of reason” (quote on p. 208-209) [9].

Vesalius thinks differently on the animals having faculty of reason and in a paragraph entitled ‘The structure of the animal brain does not differ from the human’, he noted that “it is a fact that the brain of a sheep, a goat, an ox, a cat, an ape, a dog and even of certain birds that I have dissected shows virtually no difference from the human brain in respect of the conformation of the parts, and especially in respect of the ventricles. We do, however, know that there is a difference in size according to the amount of reason that they seem to possess: man’s brain is the largest, followed by the ape’s, the dog’s, and so on, corresponding to the amount of rational force that we deduce each animal to have. The size of the human brain is not proportional to the size of the body, for man’s brain is larger than that of any other animal: it is larger than the brains of two horses or two oxen or two donkeys” (quote on p. 165) [9]. This observation echoed some 330 years later through Darwin’s conclusion that “the difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind” (quote on p. 837) [6].

Vesalius continued that “all this, along with the fabric of the ventricles, [was to] be made perfectly clear” by his anatomical dissections (quote on p. 165) [9]. “In examining the brain and its parts there is nothing to be gained by vivisection” according to Vesalius, “since here, whether we like it or not, we are required by the theologians of our own day to deny that dumb animals have memory, reason or thought, even though the construction of their brain is the same as that of the human one. Hence the anatomy student who is well versed in dissection of the dead and not infected by any heresy well understands what a mess I should get myself in if I were to say anything about vivisection of the brain, much as I should like to do so” (quote on p. 269-270) [9]. Still, he felt he could “demonstrate the functioning of the brain by the vivisection of animals with a high degree of truth and probability. But as to how the brain performs its task in respect of imagining, reasoning, thinking and remembering (or however else you like to subdivide and enumerate the powers of the soul-in-chief in conformity
with someone else’s teachings) I have reached no satisfactory conclusions. I have examined the parts of the brain unceasingly and in the utmost detail and have observed all other parts of the body whose function is apparent to even a passing examination in the course of dissection; but whatever analogy I should come up with as a result of this or whatever likelihood should arise in my mind could not be set down without damaging our most holy faith” (quote on p. 163) [9]. This way of reasoning for the existence of animal cognition may be seen as an argument from analogy. Such an argument can be formulated as [14]:

1. All species I already know to have cognition (i.e., humans) have property X (i.e., three ventricles);
2. Individuals of species Y (i.e., a “higher” animal) have property X;
3. Therefore, individuals of species Y probably have cognition.

Moreover, Vesalius indicated to be fully aware of “the degree of impiety that my description of the function of the cerebral ventricles (so far as the powers of the soul-in-chief are concerned) will bring to beginners whose minds are not yet strong in our most holy faith: this point can be pondered by those who have learnt that the brains of quadrupeds closely resemble human brains in every respect, despite the fact that, on the basis of the teachings of theologians, we deny to the animal brain all power of reasoning and indeed a rational soul” (quote on p. 165) [9].

Still, he concluded the part on the function of the ventricles with the remark that “at the beginning of this book I gave a summary account of the functions of the brain, and I included there everything that I felt confident enough to set down in writing. I have decided that the only thing I will say here about the ventricles is that they are the cavities or sinuses in which the air that is brought in by inhalation, and the vital spirit that is conveyed to them from the heart, are transformed by the power inherent in the characteristic cerebral substance into animal spirit. This spirit is subsequently distributed by means of the nerves to the organs of sense and movement and they, by virtue of this spirit and of their structure (which is adapted to their own functions), perform their task: the muscles move, the eye sees, the olfactory organs detect scents, the organs of hearing perceive sounds, the tongue distinguishes flavors, and every part to which a nerve travels recognizes different tactile qualities. I have no hesitation at all in saying that the ventricles produce animal spirit; but I cannot say anything about the areas in the brain occupied by the faculties of the soul-in-chief (though the people who nowadays like to be called theologians and consequently think that there are no limits to their powers allot these as well). All the theologians of our own time flatly deny that apes, dogs, horses, sheep, cattle and similar animals have the principal powers of the soul-in-chief [imagining, reasoning and remembering] and state that humans alone have (to say nothing of others) the faculty of reason and that (if I understand them correctly) all humans have this to an equal degree. Yet our dissections reveal that animals have the same number of ventricles as humans; and not only is the number the same but they are alike in every other respect as well except size and the integrity and accuracy of their temperament. Even for the sake of these humans, therefore, let me hold aloof from inquiring any further into the function of the ventricles” (quote on p. 198-199) [9].
Figure 10.2: Tabula VIII of the 7th book of Vesalius’ De Fabrica showing that ‘we have removed still more of the brain and have divided the testes [superior colliculi] by a cut lengthwise so as to show the channel that stretches from the third ventricle to the fourth. In addition, the part of the hard membrane that covers the cerebellum has been cut through and is seen turned back. […] L: If this symbol had been placed directly on the thing it marks it would have been lost in the shading, or else the shading would have had to be scooped out to accommodate it, thus spoiling the picture. I have therefore placed it on the front end of the cerebellum, to mark the foramen and channel that travels from the third ventricle of the brain into the fourth. It would have been impossible to show this foramen if the L had been placed directly on it. M: We have left in position the gland that resembles a pine nut [pineal body]. […] N,O,P,Q: These four symbols mark what was a single body before cutting […] It has now been divided in two in the course of dissection. N and O mark the parts of this body known as testes [superior colliculi], P and Q the so-called buttocks [inferior colliculi]. […]’ (quotes on pp. 141-142) [9].
This conclusion resonated in Frans de Waal’s summary of The Cambridge Declaration on Animal Consciousness [15]: “that given the similarities in behavior and nervous systems between humans and other large-brained species, there is no reason to cling to the notion that only humans are conscious.” As the document puts it, “The weight of evidence indicates that humans are not unique in possessing the neurological substrates that generate consciousness” (quote on p. 234) [16].

Discussion

Early modern thinkers’ view on animal cognition

Even though Greek philosophers such as Pythagoras (c.580-c.500 BC), Aristotle’s pupil Theophrastus (c.371–c.287 BC), Pliny the Elder (23–79 AD) and Plutarch (c.45–c.120 AD) had defended that animals had cognitive abilities [4], the Aristotelian denial of such abilities was to dominate Western intellectual thought for some 2000 years [17]. Michel Eyquem de Montaigne (1533-1592) was the first philosopher to be heard when he posited that animals are fully cognitive creatures and that their societies are not so different from ours. Allegedly, his view on animal cognition reflected “an increasing tendency in the early modern period to credit animals with reason, intelligence, language and almost every other human quality” (quote on p. 29) [4]. Other early modern thinkers immediately recognized that de Montaigne’s thesis on animal cognition was inextricably linked to human nature and the theological discourses pertaining to the problem of the human soul’s (im)mortality. Obviously, this led to fierce debate. De Montaigne’s ideas needed to be defended against critics who accused him of promoting the unchristian idea that the human soul is mortal due to its intimate connection to the material body [4]. On the one hand, Etienne Pasquier (1529-1615), Hieronymus Fabricius ab Aquapendente (c.1533-1619), Pierre Charron (1541-1603), Francis Bacon (1561-1626), Marie de Gournay (1565-1645), John Hagthorpe (1585-c.1630), Pierre Gassendi (1592-1655), and Marin Cureau de la Chambre (1594-1669) strongly supported de Montaigne’s natural philosophy [4, 18]. On the other, Joseph Justus Scaliger (1540-1609), René Descartes (1592-1655), Jean de Silhón (1596-1667), Charles Cotton (1630-1687), John Locke (1632-1704) and Nicolas Malebranche (1638-1715) vigorously refuted his views [4, 5].

Some 90 years after De Fabrica, Descartes formulated his views on the rational soul. In a letter to the Marquess of Newcastle, Descartes explicitly states his disagreement with de Montaigne’s attribution of “understanding or thought to animals” (quote on p. 28) [4]. Like the Aristotelians, Descartes separated man from animals, but he did so more decisively. Decartes presented his arguments in l’Homme (1630-1633) that was only published posthumously in Latin translation in 1662 as a consequence of Descartes’ fear for an Inquisitionary condemnation, such as Galileo Galilei experienced in 1633 [19]. For Descartes and other Cartesians, animals did not have reason
Figure 10.3: Tabula IX of the 7th book of Vesalius’ *De Fabrica* showing ‘the same amount of the brain as Tabula VIII. However, here the skull has been tipped over on the face and the portion of the hard membrane that separates the cerebrum from the cerebellum has been cut away, and the cerebellum has been grasped with the hands and pulled forward and downward from its seat in the skull so that it hangs slightly turned down, exposing the region of it that is normally in contact with the skull. The cavity of the spinal marrow that constitutes half of the fourth ventricle can be seen. [...]. A,A: Part of the brain still left in its proper position in the skull cavity. B,C,D: These three symbols mark the cerebellum bent downwards from its seat [...]. C marks the middle part of the cerebellum [vermis], somewhat resembling a worm; its ends constitute the processes likened by the ancients to worms. [...]. I: Sinus of the spinal marrow somewhat resembling the nib of a pen for writing; it constitutes the cavity in the middle of the ventricle shared by the spinal marrow and the cerebellum, that is, of the ventricle called by the experts in dissection the fourth ventricle of the brain. [...]’ (quotes on pp. 144-145) [9].
or intelligence but mimicked intelligent action. Animals, they felt, do not lack sensations or perceptions but still operate as mere machines: brutes functioned purely mechanically according to the laws of physics [18]. Aristotelians and Cartesians differed profoundly on the ultimate principles of animal psychology. They nonetheless agreed that complex animal behavior should be explained by appeal to instincts that they understood as blind, innate urges instilled by the Creator for the welfare of his creatures [5].

Descartes extensively corresponded with the French theologian, philosopher, and mathematician Père Marin Mersenne (1588 –1648), an ordained priest who had many contacts in the scientific world and has been called “the center of the world of science and mathematics during the first half of the 1600s” (quote on p. 59) [20]. Mersenne was not afraid to cause disputes among his many learned friends and, in 1642, he engaged the French priest, philosopher, and mathematician Pierre Gassendi (1592-1655) in controversy with Descartes. Again some 90 years after Vesalius, Gassendi undertook a comparative study of animal and human cognitive abilities in his *Syntagma philosophicum* (*Philosophical treatise*, published posthumously in 1658) to conclude that these were logically similar: both human and animal souls operated on sensory images to yield reasoned actions [18]. Gassendi’s objections to the fundamental propositions of Descartes appeared in print in 1642.

Thus, 50 years after de Montaigne, a second philosopher influentially supported Vesalius’ original views on animal cognition by forcefully opposing the Aristotelian and Cartesian interpretation that complex animal behavior should be explained only by appeal to instincts [5]. Mann Cureau de La Chambre (1594-1669), an associate of Gassendi, agreed and through the next century French sensationalists were reticent of the use of instinct as the sole explanation of animal behavior [5].

**Vesalius’ influence on the concept of animal cognition**

Because of his *De Fabrica*, Andreas Vesalius is generally considered a genius [21]. Genius, in general, does not acknowledge authority. The true genius is well informed on what authority proclaims, but does not unquestioningly accept these proclamations for granted or, even, as dogma’s. Only if acceptable to their own independent intelligence and deduction, do geniuses accept a thesis or a way of reasoning. Thus, Vesalius felt that “everyone who has not surrendered to the authorities but believes in the truth will agree with me” (quote on p. 191) [12]. This implicit doubt of all that is generally accepted, but never proven, to be truth is obvious from Vesalius texts. Even at age 27, Vesalius did not shun from fulminating against the separation of internal medicine, surgery and pharmacy, customary in his era (as it is today). In the preface of *De Fabrica* that was directly addressed to no one less than the “most noble emperor Charles”, Vesalius expressed to be sure of his view that the “threelfold approach to healing cannot be broken up and the whole of it is the province of each individual practitioner; and in order that he or she should properly achieve this end all the branches of medicine alike share the characteristic that their efficacy as individuals depends on their use in combination
as a unified whole. It is very rare to find a disease that does not require all three instruments together; in other words, there is an appropriate regiment to be instituted and something to be shifted by drugs and, failing that, by manual means. It therefore follows that beginners in the art must be urged in every way to take no notice of the whisperings of the physicians (if I may use the word) but to use their hands as well in treating, as the Greeks did and as the essence of the art demands, lest they convert a crippled system of treating into a curse on the whole of human life. They must the more diligently be urged to do this in that we see today people with a fully rounded medical training recoil from surgery as from a plague lest the medical Rabbis slander them before the uneducated mob as mere barbers and they be unable in consequence to attain to the income of those less-than-half-doctors or to their honour or to their status in the eyes of the common people” (quote on pp. x - ix) [22].

Likewise, he eventually parted from the Galenic tradition of his training because his observations no longer supported it: “I cannot set bounds to my astonishment at my own stupidity and excessive trust in the writings of Galen and other anatomists” (quote on p. 217) [9]. Vesalius demonstrated the flaw in the work of these previous anatomists and in particular Galen, his initial example, and proved that human anatomy could not be derived solely of animal anatomy; it has to be seen with the bare eye in human cadavers. He confessed to have been “so besotted by Galen that I had never undertaken to demonstrate a human head without the head of a lamb or ox at my public dissections; I was so keen not to gain the reputation of having been unable to the plexus whose name was familiar to everyone that I imposed upon my audience by demonstrating from a sheep’s head something I had never found in a human one” (quote on p. 217) [9]. Thus, the instruction of the ardent Galenist Sylvius to perform all anatomical dissections by yourself paradoxically led to the overthrow of Galenic authority.

Although most of Vesalius’ medical contemporaries had only the important ancient texts as the weight of their authority, the anatomists had the dissected body to confirm or contradict the authorities. Vesalius was explicitly placing this all in front of the medical authorities of his time with little talent for diplomacy [21]. The clash of the older authoritarian Curtius and the young brazen Vesalius that was minutely recorded by Heseler in his eyewitness report of a public dissection in Padua, Italy [13], showed a clear dichotomy between the traditional medieval anatomy that had been sustained by scholasticism and the revolutionary Renaissance anatomy based on direct observation that was introduced and championed by Vesalius – a difference manifestly evident to the students present [23].

The French philosopher de Montaigne was born only a decade before Vesalius first published De Fabrica. By the time he started writing his Essays in 1572, de Montaigne spent most of his days in his library that is said to have held 1000 historical and contemporary medical and philosophical books [24]. No doubt that Vesalius’ De Fabrica was one of these. De Montaigne was taught by Sylvius in Paris and [24, 25], therefore, very likely knew that this ardent Galenist fiercely rejected De Fabrica. However, rather than busying himself with Galen’s observations, de Montaigne reverted back to the pre-Galenist idea that each individual is component to govern all aspects of his own
life [26]. As such, de Montaigne referred to works of Plutarch more than 400 times in his Essays and felt that the great medical innovators of his time, notably Paracelcus (1493-1541), Leonardo Fioravanti (1517-1588), and Giovanni Argenterio (1513-1572) were changing the medical paradigm for the worse [27]. His not including Vesalius in this regard suggests that de Montaigne, just like Vesalius himself, felt that Vesalius’ work was an act of renaissance within the existing contemporary paradigm, rather than a revolution against it [28]. In all, it is very likely that de Montaigne knew (of) Vesalius’ observations on similar cognitive functions of the similar human and animal cerebral anatomy. We conclude that de Montaigne may, even, have been inspired by Vesalius’ observations when he posited that animals are fully cognitive creatures.

Some 50 years after de Montaigne, Descartes came to his arguments after having “taken into consideration not only what Vesalius and the others write about anatomy, but also many details unmentioned by them, which I have observed myself while dissecting various animals” as of 1629 (quote on p. 353) [19]. Thus, Descartes acknowledged the influence that Vesalius’ work had on his reasoning and his work is to be considered in a continuous line in the evolution of anatomical and physiological knowledge from Vesalius onwards [19].

Conclusion
We conclude that Andreas Vesalius was instrumental in breaking with two millenniums of dominance of the various concepts of lack of animal cognition, just as he was instrumental in breaking with the 1350-years-old Galenist concepts of human anatomy and physiology.
References

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