Visual Representation and the Body in Early Modern Anatomy

Sebastian Pranghofer

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Durham University
Department of Philosophy and School of Medicine and Health
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Abstract

Anatomy was crucial for the formation of modern cultural concepts of the body during the early modern period. In a process from the Renaissance to the turn of the nineteenth century, cosmological concepts of the body were secularized and gradually replaced by notions of the body as an object of modern medicine and science. This thesis argues that the visual representation of the body played a key role in this transformation. Until the end of the seventeenth century the iconography of anatomy legitimized the dissection of the body and portrayed the anatomist as an honourable, dignified and decent scholar. However, during the Enlightenment the moralizing visual language was gradually replaced by neo-classical aesthetics and art theory. Now technical skills and detailed knowledge became the defining features of the anatomist and the representations of the anatomical body.

This thesis uses a wide range of visual sources and analyzes them in the *longue durée*. The material includes illustrations from anatomical textbooks and their frontispieces, anatomical treatises and portraits of anatomists. These sources are discussed in their wider iconographic context as well as in relation to early modern concepts of the body and anatomical research. The first chapter discusses the general framework for the visual representation of the anatomical body, practice and authority, while the second chapter looks into how the visual representation of anatomy shaped the identity of the anatomist as the legitimate authority of the body. The other three chapters are case studies which use the examples of the rete mirabile, the lymphatic system and the unborn to analyze the different functions of anatomical images and how they were used to deal with uncertainty, establish new anatomical knowledge and reflected changing cultural meanings of the body.

Declaration

This thesis is the result of my own work and has not been submitted previously for a degree at this or any other institution. An earlier version of chapter four has been published in *Medical History*. Sebastian Pranghofer, '"It could be Seen more Clearly in Unreasonable Animals than in Humans": The Representation of the Rete Mirabile in Early Modern Anatomy', *Medical History*, 53 (2009), 561–586

Statement of copyright

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1. Introduction

The reflections on Rembrandt's famous painting of the *Anatomy Lesson of Dr. Nicolaas Tulp* (1632) and seventeenth-century science in W. G. Sebald's *The Rings of Saturn* present vanity, memory and identity as the key themes of the book.[1] Sebald's observations on Rembrandt's painting speak not only of early modern anatomy as an occasion of self-representation and self-affirmation, but also reflect on the dark side of early modern anatomy: the messy business of dissecting the body and the strong associations between anatomy and corporal punishment.

> The spectacle, presented before a paying public drawn from the upper classes, was no doubt a demonstration of the undaunted investigative zeal in the new sciences; but it also represented (though this surely would have been refuted) the archaic ritual of dismembering a corpse, of harrowing the flesh of the delinquent even beyond death, a procedure then still part of the ordained punishment.[2]

In this passage the writer and literary scholar Sebald addressed some of the key issues that early modern anatomy had to deal with. The ambivalence of individual and collective identities in relation to the anatomical object (the corpse) was deeply rooted in the problematic provenance of the bodies used in anatomy at this time. Until the eighteenth century the bodies used for public dissections in Europe were almost exclusively those of executed criminals. Only then was the circle of those whose corpses would be made available for public dissections gradually extended, primarily to people who had died in hospitals and workhouses.[3] In a society where the affiliation to a social rank was crucial for individual and collective identity, the presence of the body of outcasts such as criminals or the poor during the public dissections was problematic. Usually only members of dishonourable professions like undertakers or hangmen would

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1 For a high quality reproduction of Rembrandt's painting see Norbert E. Middelkoop and Petria Noble, *Rembrandt Under the Scalpel: The Anatomy Lesson of Dr. Nicolaes Tulp Dissected*, The Hague: Mauritshuis, 1998, pp. 18-19.

2 W. G. Sebald, *The Rings of Saturn*, London: Harvill Press, 1998, p. 12.

3 Karin Stukenbrock, *"Der zerstückte Cörper". Zur Sozialgeschichte der anatomischen Sektionen in der frühen Neuzeit (1650 - 1800)*, Stuttgart: Steiner, 2001, pp. 26-77.

touch these bodies.[4] It was therefore necessary to justify the public dismemberment of corpses so that the respectability of honourable men such as the learned anatomists was not jeopardized, and they could claim legitimate authority over the anatomical body.

Throughout the early modern period one of the most prominent arguments to justify anatomy was that it would reveal the secrets of nature and thus God's creation.[5] The idea that the dissection of the human body allowed the anatomist and his audience to gain a more profound knowledge of creation that would ultimately take them closer to God was ubiquitous in the prefaces and dedication poems of anatomy books or invitations to public anatomies.[6] However, this raised the question how an executed criminal's corpse could represent something as great as God's Creation. After all, the criminal had during the execution and public mutilation of his body not only lost his life.[7] Early modern practices of corporal punishment also targeted the delinquent's honour and dignity and could potentially deny him salvation if the body did not receive a Christian burial. Meanwhile, from the perspective of society and the sovereign, the punishment was regarded as a form of retribution and served as a warning while at the same time the divine order was restored.[8] In early modern anatomy various precautions

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4 On the dishonourable professions in early modern society see, for example, Jutta Nowosadtko, *Scharfrichter und Abdecker. Der Alltag zweier "unehrlicher Berufe" in der frühen Neuzeit*, Paderborn: Schöningh, 1994.

5 Andrew Cunningham, 'The End of the Sacred Ritual of Anatomy', *Canadian Bulletin of Medical History*, 18 (2001), 187-204.

6 Andreas-Holger Maehle, '"Est Deus ossa probant" – Human Anatomy and Physicotheology in 17th and 18th Century Germany', in Ä. Bäumer and M. Büttner (eds), *Science and Religion / Wissenschaft und Religion, Proceedings of the 18th Int. Congress of History of Science, Hamburg/Munich 1989*, Bochum: Universitätsverlag N. Brockmeyer, 1989, pp. 60-66; Ernst Uhsemann, 'Die Rechtfertigung der Anatomie im 17. Jahrhundert. Unter Berücksichtigung der Praefationes zeitgenössischer anatomischer Lehrbücher', MD Thesis, Universität Kiel, 1969.

7 On the nexus of early modern anatomy and capital punishment and its problematic nature see Jonathan Sawday, *The Body Emblazoned: Dissection and the Human Body in Renaissance Culture*, London: Routledge, 1996, pp. 54-84.

8 Richard van Dülmen, *Theater des Schreckens. Gerichtspraxis und Strafrituale in der Frühen Neuzeit*, Munich: C. H. Beck, 1985; Florike Egmond, 'Execution, Dissection, Pain and Infamy: A Morphological Investigation', in Florike Egmond and Robert Zwijnenberg (eds), *Bodily Extremities: Preoccupations with the Human Body in Early Modern European Culture*, Aldershot: Ashgate, 2003, pp. 92-128; Richard Evans, *Rituals of Retribution: Capital Punishment in Germany, 1600-1987*, Oxford: Oxford University Press, 1996; Michel Foucault, *Discipline and Punish: The Birth of the Prison*, Harmondsworth: Penguin, 1991.

were taken to banish the threat posed by the criminal body. Firstly, since the sixteenth century the provision of bodies for public dissections was more and more tightly regulated; secondly, the anatomized body often received a Christian burial as part of the public anatomy; and thirdly, as we shall see, the self-representation of anatomists was designed to uphold the social order.

With regards to this last aspect, the visual representation of anatomy played a crucial role. Images of pre-Enlightenment anatomy frequently identified anatomists and their audience with the dissected body that epitomized the sinfulness of man. At the same time an elaborate iconography justified such an identification by the Christian promise of salvation. The close links between corporal punishment and anatomy meant that the public dissection was often regarded as an extension of the punishment. In this sense anatomy in the public served as a moral warning to its audience and completed the just retribution as the last step in rebalancing the social order. At the same time, as sinful human beings, everyone in the audience could potentially be the corpse on the dissecting table which potentially allowed identification with the body on the slab. As a result measures had to be taken to ensure that stripping away the honour of the dead criminal was properly justified. For the anatomist this meant that he had to find a way to avoid to be identified with the dishonourable profession of the executioner. This was achieved by turning the dissection into a public investigation of natural philosophy that would demonstrate the magnificence of God and his Creation. During the event the anatomist became a master of ceremonies who used his superior skills and knowledge to reveal the secrets of God in the body of the crown of his Creation, man.

However, since the anatomical Renaissance of the sixteenth century, knowledge of the anatomical body was far from being undoubted. In an attempt to reconstruct the anatomical projects of the Ancients, "the Moderns who followed them were engaged in a number of different anatomical projects and not just one common monolithic project".[9] As a result, ever since anatomists of the sixteenth century such as Andreas Vesalius (1514-1564) had begun to critically revisit ancient authorities, especially the writings of Galen, anatomical knowledge had to deal with uncertainties about the exact appearance, structure and functions of the human body. The self-representation of

[9] Andrew Cunningham, *The Anatomical Renaissance: The Resurrection of the Anatomical Projects of the Ancients*, Aldershot: Ashgate, 1997, p. 7.

anatomists as the authority for revealing the divine knowledge of the human body allowed them to accommodate these uncertainties. Shortcomings in their understanding of the anatomical body could be explained by the fact that the magnificence of God's Creation was just too great to be comprehended by a single human mind. Yet it was the duty of the anatomists as scholars to thoroughly investigate their subject in order to develop the best possible understanding of the creation. To deal with the uncertainties that were necessarily created by anatomical research required not only rhetorical but also elaborate visual strategies that would allow anatomical illustrations a legitimate claim to be truthful representations of the body.

The aim of this thesis is to reconstruct the epistemological framework of early modern anatomical knowledge of the body based on its visual representations. This material is used to reconstruct the (visual) epistemology of the human body in early modern anatomy, exemplified by the representation of anatomy and the human body with a focus on frontispieces of medico-anatomical prints and the visual strategies used to represent old and new anatomical knowledge in anatomical illustrations. The visual representations of early modern anatomy are analyzed with regard to their potential meanings rather than their definite or intended meaning. These representations of anatomy were based on the idea that the picture was a medium which could convey an authentic perception of its object to the onlooker. This created a self-referential system within which the image could become identical with the object it depicted, and the production and reception of images followed generally accepted artistic and iconographic conventions. The meaning of an image would be determined by a series of factors such as technique and material (drawing, painting, engraving etc.), genre (e.g. portrait, history, still-life), art theory (perspective, proportions, colour) and how it was distributed and used. The eighteenth century, however, saw a shift when the artwork was more and more commodified, the artist slowly became an independent producer, and the audience became more diverse and amorphous.[10] Accordingly the new art theory no longer identified the beauty of an artwork with its effect on the audience, but saw beauty and therefore truth founded in the artwork itself.[11] While this applied to the autonomous work of art as an expression of a

[10] Martin Warnke, *Hofkünstler. Zur Vorgeschichte des modernen Künstlers*, 2nd ed., Cologne: DuMont, 1996.

[11] Wolfgang Kemp, 'Kunstwissenschaft und Rezeptionsästhetik', in Wolfgang

subjective truth, it resulted in a critical revision of the epistemological foundations of scientific images. The truthfulness of scientific images was emphasized by a stricter distinction between artworks and essentially scientific images, which necessitated a standardisation of the gaze of the observing subject and the object of scientific investigation.[12]

In this thesis I am looking at a period of about three hundred years in order to understand how early modern anatomy shaped the changing notions of the body. This requires an analysis of the cultural context of anatomy and the cultural meanings associated with the dissected body. The key questions are how the visual epistemology of early modern anatomy defined the scope of anatomy, how images shaped notions of the body and how images were used to established anatomical authority. Yet the structure and function of the body were a matter of debate during the early modern period and anatomists had to deal with uncertainties when older concepts that had become implausible had to be abandoned and new structures and theories had to be introduced to produce a coherent body of knowledge. Thus another set of questions deals with issues such as how anatomical images deal with uncertainty or claim to be truthful representations of the anatomical body and established new anatomical structures as well as how they responded to changing theoretical concepts of the body. The underlining assumption is that with the gradual shift from cosmological concepts of the body to the body as an object of scientific curiosity during the late seventeenth and eighteenth centuries the visual language of anatomy changed accordingly. This was not only reflected in the changing iconography of anatomy and the values and virtues it associated with anatomy, but also in the way enlightenment art theory was adopted for

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Kemp (ed.), *Der Betrachter ist im Bild. Kunstwissenschaft und Rezeptionsästhetik*, Berlin: Reimer, 1992, pp. 7-27, here pp. 11-13.

12 On the standardisation and objectification of the scientific gaze and its object at the end of the eighteenth and in the early nineteenth century see Lorraine Daston and Peter Galison, *Objectivity*, New York: Zone Books, 2009, pp. 55-113. Using examples from the Renaissance Martin Kemp discussed a variety of approaches to visualizing the body in early modern anatomy. He argued that the main concern for historians should not just be the question of what could be seen on illustrations but also how and why they were produced (Martin Kemp, ‘‘The mark of truth’: Looking and Learning in some Anatomical Illustrations from the Renaissance and the Eighteenth Century’, in William F. Bynum and Roy Porter (eds), *Medicine and the Five Senses*, Cambridge: Cambridge University Press, 1993, pp. 85-121, here p. 121).

both images that legitimized anatomy and illustrations that allowed anatomists to produce meaningful images of the anatomical body.

Anatomy played an important role during the formation of modern concepts of the human body and bodily identity in the early modern period and anatomy and its protagonists had influence well beyond academia. In early modern discourses about the human body they were powerful actors shaping cultural knowledge and notions of the body. Anatomy was crucial for the formation of the essentially modern idea of an authentic body as a source of absolute truth. According to such a notion, the body was – as an object of perception and an organ of perception – the precondition for perception in general. This concept made possible fundamental ascriptions that had and still have far-ranging consequences for individual identity and define the way people act as well as the attitudes of society towards the individual – for example the definition of sex and gender by anatomical criteria. The assumption of such a "genuine body" became crucial for the perception of the body in modernity. It emerged in a long process from the sixteenth to the eighteenth century and crystallised into what could be described as a "naturalized body",[13] rooted in the Cartesian division of body and soul. This division between body and soul became the precondition for "objectifying" the human body, and the concept of the modern subject is based on the belief in this division. In contrast to medieval and early modern concepts, the bodily identity of the individual was no longer

[13] Judith Butler argued that the "naturalized effects" of sex are constructed and the materialization of sex itself the product of discourses of power in a Foucaultian sense. However, in these discourses there is no reference to a "pure body" possible, which is not itself already a further formation of the discursive body (Judith Butler, *Bodies that Matter: On the Discoursive Limits of "Sex"*, New York: Routledge, 1993, pp. 9-11). In this sense the question about anatomical images cannot be whether they represent a more or less accurate idea of human anatomy, but what particular bodies the anatomical discourses form the images are part of. A few years before Butler Ludmilla Jordanova had already argued that the understanding of processes "whereby ideas, theories, experiences, languages, and so on, take on the quality of being 'natural' […] is integral to the project of delineating and explaining the precise nature of scientific and medical power" (Ludmilla Jordanova, *Sexual Visions: Images of Gender in Science and Medicine between the Eighteenth and Twentieth Centuries*, New York: Harvester Wheasheaf, 1989, p. 5). The idea that discourses of power are productive and form the body was developed in Michel Foucault, *The History of Sexuality, vol. 1: An Introduction*, New York: Pantheon Books, 1978. On the reception of Foucault's ideas by historians of medicine see Colin Jones and Roy Porter (eds), *Reassessing Foucault: Power, Medicine, and the Body*, London: Routledge, 1994.

defined by the role it played within a fixed order, but by the self-conscious idea it made of itself.[14]

Anatomical images were crucial in shaping such changing notions of the body and bodily identity. They constituted a complex web of potential meanings of anatomy which shaped their subject, the human body. This suggests a fundamental importance of visual representations for the anatomical body. However, the formative power of images of the body has to be understood within a specific historical epistemology of the image and also requires reflection on the reception of images, a question which still tends to be neglected in both historical visual studies and art history.[15] Hans-Georg Hofer and Lutz Sauerteig have emphasized that images also have to be understood as social actors: "They are not passive objects of viewing, but actors in the construction of cultural and social realities."[16] An understanding of the mediality of early modern anatomical images requires not only an understanding of the nature of those images, but also their role in a wider discourse about the anatomical body. The phenomenological definition of images in this thesis is based on a distinction between images in a strict sense, which have a materiality of their own, and linguistic or mental images. Hence the images under consideration have a sensual quality shared by their audience and are accessible in the shared environment of the public sphere.[17]

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14 Such an analysis of the effects of the "process of civilization" (Norbert Elias) has been a common theme in historical, social and cultural studies and theory for some time (see Ian Burkitt, *Bodies of Thought: Embodiment, Identity and Modernity*, London: Sage, 1999, especially pp. 45-66). Many of the chapters in Linda Kalof and William Bynum (eds), *A Cultural History of the Body*, 5 vols, Oxford: Berg, 2010 touch upon topics and themes that are discussed in my thesis. Since Kalof's and Bynum's handbook was only published very recently, the contributions that are relevant to my work could not anymore be integrated and discussed in the according passages.

15 Gottfried Boehm, 'Vorwort', in Gottfried Boehm (ed.), *Was ist ein Bild?*, Munich: Fink, 1994, pp. 7-9, here p. 7.

16 "Sie sind keine passiven Objekte der Betrachtung, sondern sie sind Akteure in der Herstellung kultureller und sozialer Wirklichkeiten." Hans-Georg Hofer and Lutz Sauerteig, 'Perspektiven einer Kulturgeschichte der Medizin', *Medizinhistorisches Journal*, 42 (2007), 105-141, pp 129-130.

17 W. J. T. Mitchell, 'What is an Image?', *New Literary History*, 15 (1984), 503-537, pp. 504-507. To refer to a "public sphere" in early modern European societies is problematic. The way I suggest to use the term does not imply that the public sphere was democratically organised and equally accessible for everyone, a space

The symbolic ascriptions to the body in the context of anatomy showed a body which was intelligible within a natural philosophy that understood the human body as complementary to God's creation. This was expressed in a series of complex analogous relations between the human body and the world well into the eighteenth century. However, the two and a half centuries between the publication of Andreas Vesalius' *De humani corporis fabrica* (1543) and the last public dissection at Bologna around 1800 saw fundamental changes in the notions, ideas and representations of the body.[18] Early modern representations of anatomy were a medium for the changing notions and

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where freedom of expression was granted, and meanings could be negotiated in a free discourse. Indeed, my understanding of the "public sphere" implies a space with its own institutions, where meanings are circulated and negotiated, with professionals (e.g. politicians, publishers, intellectuals), the aim of which was to regulate the production and circulation of knowledge. This production of knowledge, however, targeted a wider audience, whose involvement in the discourse varied from full participation to almost complete exclusion. In this sense the field of early modern anatomy was a "public sphere" where professionals (anatomists, artists, publishers, the authorities) negotiated the meanings of the human body within specific institutions (universities, guilds, etc.). The involvement of the public ranged from key players (learned anatomists), over well established participants of the discourse (members of the republic of letters) to those who were almost completely excluded from active participation (the anatomical subject). On the political theory and the transformation of the public sphere see Jürgen Habermas, *The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society*, Oxford: Polity Press, 1989; Oskar Negt and Alexander Kluge, *Public Sphere and Experience: Toward an Analysis of the Bourgeois and Proletarian Public Sphere*, Minneapolis: University of Minnesota Press, 1993. While Habermas characterised the public sphere as a space for rational discourse, which developed from the Reformation to the nineteenth century, Negt and Kluge emphasised the power relations which were negotiated in and structuring the "public sphere" as its defining feature. In historiography there is an ongoing debate on the characteristics and transformations of the "public sphere" in early modern Europe. See, for example, Peter Lake and Steve Pincus, 'Rethinking the Public Sphere in Early Modern England', *Journal of British Studies,* 45 (2006), 270-292; or Kate Loveman's review article 'Political Information in the Seventeenth Century', *The Historical Journal*, 48 (2005), 555–565. The "new science" of the seventeenth century in the public sphere is the subject of Jan C.C. Rupp, 'The New Science and the Public Sphere in the Premodern Era', *Science in Context*, 8 (1995), 487-507. On the anatomical theatre and its public function in early modern Netherlands see Jan C.C. Rupp, 'Matters of Life and Death: The Social and Cultural Conditions of the Rise of Anatomical Theatres, With Special Reference to Seventeenth Century Holland', *History of Science*, 28 (1990), 263-287.

[18] Andreas Vesalius, *De humani corporis fabrica libri septem*, Basle: Johannes Oporinus, 1543.

concepts of the human body, which was itself a medium for discourses of nature, humankind, death and transitoriness. Early modern visual representations of anatomy constructed the body as an object of the anatomist's practices and knowledge. However, when images are discussed as part of the early modern discourse on the body and not merely used as illustrations, it is vital to consider their specific quality as a medium within their historical context. To understand the contribution of images to the formation of the early modern anatomical body it is necessary to consider their reception, their iconography, function and use as explanation, argument or evidence. The meanings constructed by images must be understood in terms of their constitutive relevance for their object. It is therefore necessary to take into account concepts of the human body both in early modern science (i.e. natural history, natural philosophy and theology) and early modern art and aesthetics.

The priority of discovery has long been a major concern for historians of anatomy. Much of the older history of the discipline was focused on the discoveries of great anatomists and their contributions to the progress of anatomy as a science. An example for such a history of anatomy as a history of great men is Charles D. O'Malley's biography of Andreas Vesalius which celebrated him as the inventor of modern anatomy,[19] while an example for a history of anatomy as a continuous progress of anatomy, written along the lines of great discoveries, is F. J. Cole's work on the history of comparative anatomy.[20] The historical practices of anatomy have increasingly been discussed in their cultural context since the mid-1980s. An early example was the work of Giovanna Ferrari on the public anatomies in early modern Bologna.[21] However, Andrew Cunningham still complained in 1997 that most of the histories of anatomy were "histories of discoveries, discoveries of parts and processes; they chronicle who discovered what part, in what order, when and how".[22] Instead of continuing to write the history of discoveries and progress, Cunningham suggested to write a history of the different approaches to anatomy in the past and the kind of anatomical knowledge they

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19 C. D. O'Malley, *Andreas Vesalius of Brussels, 1514-1564*, Berkely: University of California Press, 1964.

20 F. J. Cole, *A History of Comparative Anatomy: From Aristotle to the Eighteenth Century*, London: MacMillan, 1944.

21 Giovanna Ferrari, 'Public Anatomy Lessons and the Carnival. The Anatomy Theatre of Bologna', *Past and Present*, 117 (1987), 50-106.

22 Cunningham, *Renaissance*, 1997, p. x.

produced. He put his emphasis on the practices – manual, oral and in writing –, which anatomists deployed during the Renaissance to make sense of the dissected body. This process of anatomical inquiry created anatomical objects using techniques such as dissections, injections, wet and dry specimens, drawings and prints, the discussion of the findings in lectures and finally publishing them in treatises and books. My interest is primarily in the use of visual representations of human anatomy and how they established new objects of knowledge.

The increasing interest in the anatomical body and its visual representation is reflected by a number of exhibitions on anatomy during the recent years. Apart from Gunther von Hagen's populist *Body Worlds* (touring since 1996), the history of human anatomy became the topic of exhibitions such as *The Ingenious Machine of Nature* (National Gallery of Canada, Ottawa 1996), *The Quick and the Dead* (Hayward Gallery, London 1998), *Spectacular Bodies* (Hayward Gallery, London 2000), *Dream Anatomy* (National Library of Medicine, Washington DC 2002), *Verborgen im Buch, verborgen im Körper* (Herzog August Bibliothek, Wolfenbüttel 2003) and *Anatomy Acts* (Edinburgh, Inverness and Glasgow 2006-2007).[23] The exhibitions of the Hayward Gallery and the National Gallery of Canada explored the relations between art and anatomy, while the National Library of Medicine exhibition focused on anatomy in a medical context and the realms of natural philosophy and natural history. Although the main topic of the exhibition in Wolfenbüttel was the significance of the skin between 1500 and 1800, it was based on many anatomical works and thereby underlined the important role anatomy played regarding the examination of the early modern human body. The exhibition in Scotland had a strong emphasis on anatomy and medicine, but also incorporated responses by contemporary artists to the historical objects and thus emphasized the importance of anatomy for modern understandings of the human body.

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[23] Mimi Cazort (ed.), *The Ingenious Machine of Nature: Four Centuries of Art and Anatomy*, Ottawa: National Gallery of Canada 1996; Deanna Petherbridge (ed.), *The Quick and the Dead: Artists and Anatomy*, Berkeley: University of California Press, 1997; Martin Kemp and Marina Wallace (eds), *Spectacular Bodies: The. Art and Science of the Human Body from Leonardo to Now*, Berkely: University of California Press, 2000; US National Library of Medicine, *Dream Anatomy*, URL: http://www.nlm.nih.gov/dreamanatomy/, Bethesda, 2002 (last access 08/11/2010); Ulrike Zeuch (ed.), *Verborgen Im Buch, Verborgen Im Körper. Haut Zwischen 1500 und 1800*, WolfenWiesbaden: Harrassowitz, 2003; Andrew Patrizio and Dawn Kemp (eds), *Anatomy Acts: How We Come to Know Ourselves*, Edinburgh: Birlinn, 2006.

This recent interest in the anatomical body is also reflected in more recent academic research and the significant number of substantial publications on the history of Western anatomy. Authors have written on anatomy and anatomical dissection in early modern science and medicine from different perspectives. Historians of medicine Andrew Cunningham and Roger French have made substantial contributions to the understanding of the epistemology and cultural value of early modern anatomy. In *The Anatomical Renaissance*, Cunningham explored how the attempts of the anatomists of the sixteenth century to reconstruct the ancient concepts, theories and practices formed the basis for a revival of anatomy.[24] He discussed the opinions of the different authors in their socio-cultural and religious context. In his most recent book *The Anatomist Anatomis'd* he explored these themes further and moved chronologically into the eighteenth century.[25] Roger French's focus in his book *Dissection and Vivisection in the European Renaissance* was different.[26] He asked how the significant increase of the popularity of anatomical dissections in Europe from the twelfth to the seventeenth century can be explained. French explored the various circumstances under which anatomical dissections were carried out and thereby reconstructed the different epistemological roles of anatomical dissections. In her doctoral thesis *Der zerstückte Cörper* Karin Stukenbrock explored the social history of anatomy from the middle of the seventeenth century until the end of the eighteenth century.[27] Her prime interest was the supply with corpses of university anatomists. Based on archival material – mainly from Kiel, Göttingen, Helmstedt, Halle und Jena – she discussed the social background of the individuals whose corpses ended on the dissection table. She also looked into the resistance against the compulsory handover of corpses to the anatomy by the affected classes and cultural practices surrounding the anatomical body.

Andrea Carlino, Katharine Park, Jonathan Sawday, Peter Mitchell, Kate Cregan and Rafael Mandressi addressed various aspects of the cultural history of early modern

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24 Cunningham, *Renaissance*, 1997.

25 Andrew Cunningham, *The Anatomist Anatomise'd: An Experimental Discipline in Enlightenment Europe*, Aldershot: Ashgate, 2010.

26 Roger French, *Dissection and Vivisection in the European Renaissance*, Aldershot & Brookfield: Ashgate, 1999.

27 Karin Stukenbrock, *"Der zerstückte Cörper". Zur Sozialgeschichte der anatomischen Sektion in der Frühen Neuzeit (1650-1800)*, Stuttgart: Franz Steiner Verlag, 2001.

anatomy. In *Books of the Body*, Carlino explored – with a focus on Italy – the medical, philosophical, juridical, ethical and religious framework of Renaissance anatomy.[28] By using historical materials such as anatomical literature, illustrations and representations of dissections, he obtains a differentiated understanding of the status of Renaissance anatomy both in medical education and natural history as well as natural philosophy. Also on Italy but covering a wider time span from the Middle Ages to the Renaissance, Katharine Park discussed the intersections of the anatomical discourse with other discourses of the body and how they shaped a gendered notion of the female body.[29] Jonathan Sawday's book *The Body Emblazoned* looked at the broader cultural context of anatomy. [30] He demonstrated which cultural influences shaped the history of anatomy, and how anatomists contributed decisively to the understanding of the human body in early modern Europe. Sawday not only used the relevant anatomical works but also literary texts like novels, plays and poems as well as visual material and showed how anatomy, religion and politics were relating to each other and legitimised one another. Also from the perspective of literature studies Peter Mitchell and Richard Sugg studied the metaphorical power and importance of the anatomical discourse for early modern knowledge and understanding of the human body.[31] In her book *The Theatre of the Body,* Cregan looked at anatomical practice and the theatrical aspects of public anatomical dissections in early modern London.[32] In *Le regard de l'anatomiste*, Mandressi argued that the history of the early modern anatomical dissection was the key to modern notions of the human body.[33] His study discussed the writings of the important anatomists and natural philosophers from the sixteenth to the eighteenth centuries. Mandressi came to the conclusion that anatomy gradually developed an understanding of the human body as something that could be divided into its single

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28 Andrea Carlino, *Books of the Body: Anatomical Ritual and Renaissance Learning*. Chicago & London: University of Chicago Press 1999.

29 Katharine Park, *The Secrets of Women: Gender, Generation, and the Origins of Human Dissection*, New York: Zone Books, 2006.

30 Sawday, *Body*, 1995.

31 Peter Mitchell, *The* Purple Island *and Anatomy in Early Seventeenth-Century Literature, Philosophy and Theology*, Madison NJ: Fairleigh Dickinson University Press, 2007; Richard Sugg, *Murder After Death: Literature and Anatomy in Early Modern England*, Ithaca: Cornell University Press, 2007.

32 Kate Cregan, *The Theatre of the Body: Staging Death and Embodying Life*, Turnout: Brepols, 2009.

33 Rafael Mandressi, *Le regard de l'anatomiste: Dissections et invention du corps en Occident*, Paris: Éditions du Seuil, 2003.

components and was constructed based on clear principles and working according to specific mechanisms. At the same time, he argued, the anatomical dissection as autopsy created one of the essential fundaments of modern subjectivity. Alongside these books a number of articles and book chapters dealt with regional or local aspects of anatomy or individual authors. Among these publications were the groundbreaking work of Giovanna Ferrari on the anatomical theatre of Bologna and Jan C. C. Rupp on the anatomical theatres in the Low Countries.[34] Cynthia Klestinec's research has also been important for the understanding of the anatomical theatre in Padua, another important place for early modern anatomy.[35] There are also many studies of particular authors, and the literature on Andreas Vesalius, the best known of the Renaissance anatomists, already filled a whole bibliography on its own in the 1940s.[36]

Many of these publications were illustrated and some of them used images as source material, like Carlino, who based his hypothesis of a fundamental epistemological shift in anatomy during the sixteenth century on an analysis of frontispieces of anatomical works from the end of the fifteenth century to 1559. Alongside this use of pictures as illustrations or to support an argument, some research was dedicated to the visual representation of early modern anatomy in particular. The earliest history and bibliography of anatomical illustrations is Ludwig Choulant's *Geschichte und Bibliographie der anatomischen Abbildung*, which was first published in 1852, and reedited in several amended versions.[37] The first English translation was published in 1921.[38] Choulant's catalogue is still essential for research on the visual representation of

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34 Ferrari, 'Anatomy', 1987; Jan C. C. Rupp, 'Matters of Life and Death: The Social and Cultural Conditions of the Rise of Anatomical Theatres, with Special Reference to Seventeenth Century', *History of Science*, 28 (1990), 263-287.

35 Cynthia Klestinec, 'Civility, Comportment, and the Anatomy Theater: Girolamo Fabrici and His Medical Students in Renaissance Padua', *Renaissance Quarterly*, 60 (2007), 434-463; Cynthia Klestinec, 'A History of Anatomy Theaters in Sixteenth-Century Padua', *Journal of the History of Medicine and Allied Sciences*, 59 (2004), 375-412.

36 Harvey Cushing, *A Bio-Bibliography of Andreas Vesalius*, New York: Schuman's, 1943.

37 Ludwig Choulant, *Geschichte und Bibliographie der anatomischen Abbildung. Nach ihrer Beziehung auf anatomische Wissenschaft und bildende Kunst*, reprint of the 1852 edition including the 1858 additions by the author, Schaan/Liechtenstein: Sändig, 1983.

38 Ludwig Choulant, *History and Bibliography of Anatomic Illustration in Its Relation to Anatomic Science and the Graphic Arts*, transl. and ed. by Mortimer Frank with a

anatomy. Based on Choulant's work Loris Premuda's *Storia dell'iconographia anatomica* reconstructed the iconographic tradition of anatomical illustrations.[39] The most recent catalogue of anatomical illustrations was *The Fabric of the Body* by K. B. Roberts und J. D. W. Tomlinson.[40] In their book they gave a broad overview of anatomical illustrations from the Middle Ages until the early twentieth century. They also discussed in detail the anatomical accuracy of the illustrations. Gerhard Wolf-Heidegger's and Anna-Maria Cetto's book *Die anatomische Sektion in bildlicher Darstellung* was interested in a specific genre of anatomical images.[41] They systematically catalogued visual representations of anatomical dissections from the Middle Ages to the early twentieth century. Another specific type of anatomical images was the subject of Andrea Carlino's book *Paper Bodies*.[42] He catalogued more than 60 anatomical fugitive sheets from the sixteenth and seventeenth centuries. Carlino not only catalogued the material but also used it to analyse the usage of anatomical illustrations during the Renaissance. Bernhard Schulz explored early modern anatomy from an art history perspective in *Art and Anatomy in Renaissance Italy*.[43] He looked into the relation between art and anatomy and asked the question, how artists adopted anatomical knowledge and contributed at the same time to the construction of this knowledge. Another important work on the visual representation of anatomy was William S. Heckscher's *Rembrandt's Anatomy of Dr. Nicolaas Tulp.*[44] The book explored the significance of Rembrandt's famous group portrait in the context of Dutch Baroque art based on the iconography and iconology of public anatomical dissections. This was a landmark study which for the first time not only catalogued and described the visual representations of anatomy, but used them to reconstruct the socio-cultural setting and relevance of seventeenth-century Dutch anatomy. In addition to Heckscher's

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biographical sketch of the translator and two additional sections, Chicago: University of Chicago Press, 1921.

39 Loris Premuda, *Storia dell'iconographia anatomica*, Milan: Aldo Martello, 1957.

40 K. B. Roberts, J. D. W. Tomlinson, *The Fabric of the Body: European Tradition of Anatomical Illustration*, Oxford: Clarendon Press, 1992.

41 Gerhard Wolf-Heidegger and Anna Maria Cetto: *Die anatomische Sektion in bildlicher Darstellung*, Basle: S. Karger, 1967.

42 Andrea Carlino, *Paper Bodies: A Catalogue of Anatomical Fugitive Sheets*. London: Wellcome Institute for the History of Medicine, 1999 (=Medical History Supplement 19).

43 Bernard Schulz, *Art and Anatomy in Renaissance Italy*, Ann Arbor: UMI Research Press, 1985.

44 William S. Heckscher, *Rembrandt's Anatomy of Dr. Nicolaas Tulp: An Iconological Study*, NewYork: New York University Press, 1958.

book, William Schupbach published his study on *The Paradox of Rembrandt's "Anatomy of Dr. Tulp"* and suggested a reinterpretation of the painting. He argued that Rembrandt's work was more than an anatomical group portrait, but a play on the paradoxical nature of anatomy and its moralizing memento mori message that was contrasted with a optimistic view that while the earthly remains of man might perish, his divine soul lived on.[45]

Some of the above publications such as the books by Choulant, Wolf-Heidegger/Cetto, Roberts/Tomlinson and Premuda were important in cataloguing and making accessible rare material. However, their approach was predominantly descriptive in their account of the literary sources and visual traditions of the iconography of anatomy. Their main concern was generally the question of whether the representations of the human body were anatomically accurate and how they represented progress in anatomical knowledge. However, to understand the visual representation of early modern anatomy as a part of discourses on the human body and to use them to analyse this discourse, it is necessary to develop a methodologically and theoretically reflected approach. Heckscher's study on Rembrandt's *Anatomy of Dr. Nicolaas Tulp* pointed in this direction. In order to understand Rembrandt's group portrait of a public anatomical dissection by Nicolaas Tulp, the praelector of the barber-surgeons guild in Amsterdam, he reconstructed the iconographic tradition, but also looked into the socio-cultural and political significance of anatomy in Amsterdam during the seventeenth century. Heckscher's iconological approach did not focus on whether the painting was an accurate representation of an event, and he was rather interested in understanding it as a significant expression of the state of mind of a specific society at a given time and its attitude towards, anatomy and the anatomical body.[46] Whereas Heckscher's study understood the picture as an expression of historical-specific ideas, Andrea Carlino went

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[45] William Schupbach: *The Paradox of Rembrandt's "Anatomy of Dr. Tulp"*, London: Wellcome Institute for the History of Medicine, 1982 (=Medical History Supplement 2), pp. 41-49.

[46] Heckscher's study was based on the iconographic and iconological method developed by Erwin Panofsky, who suggested three steps of interpretation of images. In the first step, the primary subject matter was determined, based on which in a second step the images, stories and allegories in the picture could be analyzed. In a third step this would lead to a synthetic view of the intrinsic meaning and symbolic values of the picture (Erwin Panofsky, *Meaning in the Visual Arts: Papers in and on Art History*, Garden City NY: Doubleday, 1955, pp. 26-41).

further in the first chapter of his *Books of the Body*. For him the visual representation of the anatomical dissection itself was part of a discourse which led to a shift in the epistemological status of the anatomical dissection at the middle of the sixteenth century. Carlino took yet another perspective in his book *Paper Bodies*. Here the starting point for the reconstruction of the early modern anatomical discourse about the human body was the usage of images on anatomical fugitive sheets, mainly from the second half of the sixteenth and the first half of the seventeenth century. Carlino showed how these prints could be used to gain a deeper understanding of the reciprocal relation between the (academic) anatomical discourse and its socio-cultural context.

For my thesis I synthesize some of this previous work in the pursuit of a better understanding of early modern anatomy and how it shaped notions of the body. The aim is to reach a deeper understanding of how anatomical knowledge was produced and what role the visual representation of anatomy played in producing knowledge of the body. From the perspective of media studies Markus Buschhaus claimed in his "media-archaeology of anatomical knowledge" that since the sixteenth century images were attributed with subject-specific authority in anatomy which in turn gave them the authority to mediate anatomical knowledge.[47] He also argued that the "visual culture of anatomy" was a particularly fruitful area for visual studies "because – particularly in contrast to art – it has no explicit visual theory and its visual knowledge is as a consequence not discussed programmatically".[48] However, such a view ignores the historical understanding, use and reception of images and how they changed over time and is at risk of ignoring the impact of cultural meanings of the dissected body on the (visual) knowledge of the anatomical body as well as the social practices that established anatomical authority.[49] This is evident in the claim that anatomy had no

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47 Markus Buschhaus, *Über den Körper im Bilde sein. Eine Medienarchäologie anatomischen Wissens*, Bielefeld: transcript Verlag, 2005, pp. 303-304.

48 "So erlaubt die visuelle Kultur der Anatomie, welche ganz wesentlich auch eine Bildkultur ist, eine Spezifizierung und Differenzierung des medienarchäologischen Konzeptes gerade deshalb, weil sie – ganz im Gegensatz zur Kunst – über keine explizite Bildtheorie verfügt und ihr Bildwissen somit nicht programmatisch zur Sprache kommt." Buschhaus, *Körper*, 2005, p. 308.

49 Buschhaus actually addressed some of these issues in the previous chapter, but remained quite inconclusive and often inconsistent in his argument when he addressed the historical dimension of anatomical images.

visual theory of its own, which is puzzling, as early modern anatomists actively engaged with contemporary artistic practices as well as art theory and aesthetics.

With this thesis, however, I will show how anatomical images produced anatomical knowledge and established authority in their historical, disciplinary as well as socio-cultural contexts. This allows me to trace historical changes in knowledge about the anatomical body in relation to the understanding, use and reception of images and vice versa. Unlike previous research such as the work of William Heckscher or Andrea Carlino, my thesis looks beyond the representation of anatomy as an academic discipline and legitimate practice by integrating the visual epistemology of, for example, anatomical group portraits and frontispieces with anatomical illustrations. These illustrations will also be analyzed with regard to the different uses of images, which partly builds on work such as *Childbirth and the Display of Authority in Early Modern France* by Lianne McTavish, who has interpreted the illustrations in early modern French midwifery books as practical images that were designed to help midwifes and physicians when attending pregnant women and births.[50] However, by looking at images from different genres it will be possible to specify the different uses of anatomical illustrations. Finally, in this thesis material from the turn of the sixteenth century to the turn of the nineteenth century is studied in the *longue durée*, which makes it possible to relate the changes in anatomical knowledge to the slow currents of cultural change.

In order to understand the changing epistemological framework of early modern anatomy, I will both discuss how images were used to establish authority over the human body and how images were used to represent the appearance, structure and functions of the body. The first part of the thesis will therefore discuss the visual paradigms of early modern anatomy with a strong emphasis on the (self-) representation of anatomists and their profession. In the second part, three case studies are used to analyze how images reflected obsolete and new anatomical objects as well as changing concepts of the nature of human anatomy. The examples I use are the rete mirabile, the lymphatics and the unborn. With the rete mirabile an organ is discussed in the

[50] Lianne McTavish, *Childbirth and the Display of Authority in Early Modern France*, Aldershot: Ashgate, 2005.

anatomical context which cannot be found in human bodies, and a study of the representation of this organ can show how obsolete knowledge was dealt with in the early modern anatomical discourse. The lymphatics on the other hand were a phenomenon which did not exist in European anatomies before the 1620s and their anatomical appearance and physiological function were uncertain until the second half of the eighteenth century. Looking into their representations can help to understand how the visual representation of the human body contributed to the early modern discourse on the anatomical body. Images of the unborn are used to show how changing ideas about generation and reproduction as well as the nature and identity of the unborn were shaped by visual representation.

Three basic assumptions underlie my work on the early modern anatomical body, rooted in its essential ambivalence. Firstly, the ambivalence of the anatomical body was founded in the tension between anatomy as natural history and natural philosophy with the hands-on anatomical experience. On the one hand, anatomists constantly claimed that their investigations would lead to a superior understanding of the creation, while on the other hand their research permanently produced uncertainties about the true appearance of the human body. Secondly, the discrepancy between the corpse and the "life" anatomy of the anatomical illustrations as well as physiological concepts formed a barrier within the anatomical discourse that had to be overcome. The transfer of knowledge from the corpse to the living human body required a representation of the anatomical body that could convincingly confirm the validity of anatomical research for the living. Thirdly, the ambiguous status of the dismembered body in early modern Europe, rooted in the practices of punishment of the time, posed a permanent challenge for the identity of both the subject of anatomy and the anatomist.

These problems were not solved until the development of a scientific notion of the body in the nineteenth century. Only then was a holistic understanding of the human body finally given up in favour of a hierarchical understanding of the structure and the physiology of the human body. In this process, anatomy played a crucial role and turned the body into a mere object of learned curiosity. In a long process that began during the Renaissance, notions of the body were tightly bound to the visual representations of the

anatomical body and the visual language of anatomy was inextricably linked to art.[51] Consequently the epistemological shifts in early modern anatomy were reflected in the images of the anatomical body. With the Renaissance, the images of the anatomical body acquired a new degree of naturalism and reflected the artistic practices of creating true images of nature through depictions *ad vivum* (after life) or following the constructing principles of perspective and proportions. These modes of representation remained guiding principles for the production of anatomical images until the end of the eighteenth century, and this visual language was employed for images that were used as arguments and evidence in anatomical controversies. Yet what those anatomical images supposedly displayed changed fundamentally during the early modern period. The representation of anatomical practice had changed at the end of the seventeenth century. In the self-representations of anatomists, which had hitherto been dominated by a moralizing iconography that often referred to the Christian narrative of salvation, mythological themes shifted the emphasis to skills and knowledge as the defining aspects of anatomy. This paved the way for the eighteenth-century "gentleman-anatomist" and released anatomy from the burden of moralizing language and allowed it to adopt the aestheticized language of neo-classical art theory to describe the human body.

How images were used in early modern anatomy and what kinds of bodies they represented is analyzed in the following chapters. The first chapter on the visual representation of the anatomical body, practice and authority discusses the specific qualities of early modern images of the body. It shows how anatomical images shaped notions of the body and established the anatomical body as a legitimate source of knowledge. Using anatomical frontispieces and group portraits this chapter also shows how anatomists used images to establish themselves as justified authorities over the

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[51] It is necessary to bear in mind that a strict division of the domains of art and science did not exist until the nineteenth century and that during the early modern period distinct scientific modes of representation did not exist (Martin Kemp, *The Science of Art: Themes in Western Art from Brunelleschi to Seurat*, New Haven: Yale University Press, 1990). However, making this distinction for the early modern period only became contentious and led to controversies about the relation between scientific and artistic images after the Second World War (Caroline A. Jones and Peter Galison, 'Introduction: Picturing Science, Producing Art', in Caroline A. Jones and Peter Galison (eds), *Picturing Science, Producing Art*, New York: Routledge, 1998, pp. 1-23, here pp. 2-5).

human body. Subsequently I analyze how the changing identity of the anatomist was reflected in self-representations of anatomists on frontispieces and portraits and how it was related to changing ways of doing anatomy. I argue that honour, dignity and decency as the traditional core values of anatomy were less and less determining for the identity of the anatomist by the end of the seventeenth century. Alongside the anatomist as the authority that could reveal a Divine truth hidden in the anatomical body, the image of the anatomist as a learned gentleman became more and more dominant. As a result the focus shifted from the anatomist as a moral authority to the anatomist as a virtuous man embodying virtues such as technical skills, artistry and in-depth knowledge of the body. Both chapters form the basis for the following three case studies on the representation of changing anatomical knowledge in outlining the epistemological frameworks for anatomical images.

The third chapter examines the (visual) representation of obsolete anatomical knowledge in the case of the *rete mirabile*. The *rete mirabile* posed a significant problem to early modern anatomists, since it was described in Galen's anatomical texts with considerable detail and played a crucial role in Galenic physiology, but could not be found during the dissection of human corpses. Nevertheless illustrations of this organ could be found in the anatomical texts of the sixteenth and seventeenth centuries. Starting from tracing the visual representations of the *rete mirabie* in various publications, these illustrations are related to different theories on the character of the organ in those writings. With new discoveries a different problem arose, which will be discussed in the fourth chapter. The problem was now not how to deal with out-dated knowledge, but how to visually represent new knowledge in relation to the well established conventional anatomical illustrations. Hence the fourth chapter looks into how the newly discovered lymphatic system was visually represented and integrated within established anatomical knowledge since the seventeenth century. In this chapter the interplay of aesthetics and the visual representation of anatomy is studied. Thereby the impact of early modern aesthetic theory on the visual taxonomy of the anatomical body is shown.

The fifth chapter asks how early modern images of the unborn related to changing notions of processes of generation and the identity of the unborn. This chapter not only shows how changing ideas about generation were reflected in images, but also how

visual representations limited discourses about generation. It also discusses how the different functions of images shaped the identity of the unborn. The key argument I make is that by the end of the eighteenth century the neo-classical aesthetics of obstetrics and embryology had turned the unborn into a mere biological object of scientific research. Together the three case studies show what specific visual strategies were employed by anatomists to deal with uncertainty. Together with the first two chapters on the nature of early modern visual representations of anatomy and the representation of anatomical authority and expertise, this thesis gives a comprehensive account of the visual culture of anatomy from the sixteenth to the end of the eighteenth century. It shows that anatomical images not only helped anatomists to maintain their personal honour and social status. As part of anatomy as an important social practice in early modern European culture they both represented and shaped the human body.

2. The visual representation of the anatomical body, practice and authority

Images of early modern anatomy, and especially of anatomical dissections, cannot be regarded as mere illustrations of historical practices. They mediated a cosmological understanding of the body that saw the anatomical body as a reflection of the Creation as a whole and vice versa. Illustrated title pages of anatomical prints, for example, already prefigured the human body that was subsequently described in the texts. In this first chapter I will outline some of the fundamental aspects of the visual representation and notions of the body in early modern anatomy. The mediality of anatomical images was defined by a specific iconography which had constitutive effects on the possible notions of the body. Prints showing anatomical dissections circulated widely and often made very general statements about the nature of anatomy. Less than paintings such as the Dutch anatomical group portraits of the seventeenth century, their meaning was not so much bound to their immediate institutional context and display. Moreover, especially on anatomical frontispieces the images potentially linked the anatomical knowledge in the text and illustrations of books to the more general issues of natural philosophy that anatomy dealt with. But frontispieces were not only summaries of the essential contents of the book, but also a means of advertising and a place where the author could prominently explain his motives and aims.[52] They were therefore also the perfect place for legitimizing anatomical practice as well as marketing the author.

In recent years the frontispieces of early modern scientific publications have received increased attention by historians and art historians in studies such as Volker Remmert's book on illustrated title-pages in the scientific revolution.[53] Frontispieces of anatomical books have been discussed, for example, by Andrea Carlino in *Books of the Body*, who used them to demonstrate an epistemological

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[52] On the function of frontispieces in early modern medical- and scientific publications see Wolfgang Harms, 'Programmatisches auf Titelblättern naturkundlicher Werke der Barockzeit', *Frühmittelalterliche Studien*, 12 (1978), 326-355.

[53] Volker Remmert, *Widmung, Welterklärung und Wissenschaftslegitimierung. Titelbilder und ihre Funktionen in der wissenschaftlichen Revolution*, Wiesbaden: Harrassowitz, 2005.

shift in anatomy in the sixteenth century. Especially after the publication of Vesalius' *De humani corporis Fabrica* (1543), more and more anatomists started to critically revise the ancient authorities of Hippocrates and Galen and put emphasis on the evidence gathered during anatomical dissections.[54] Recently Daniela Bohde has taken a closer look at the iconography of the human skin on anatomical frontispieces in a couple of articles on the moralising meanings of the human skin in Dutch anatomical theatres of the seventeenth century.[55]

This chapter considers the fundamental narratives underlying early modern anatomy with a focus on Northern Europe and asks how anatomists established themselves as authorities of knowledge of the body through images. This will be mainly done from the perspective of the anatomists themselves, while lay people, the subjects of anatomical dissections and their perception of anatomy will come into play as objects of inquiry and implicit audiences. In order to understand the strategies anatomists developed to legitimize anatomy and establish their authority over the anatomical body, it is necessary to come to terms with the ambiguous status of the anatomised body as both the subject of a scholarly exercise and contemporary practices of punishment. In order to secure the social status of the anatomists, it was necessary for them to distinguish themselves from dishonourable professions. They therefore had to represent themselves as a profession with the capacity to maintain their own as well as their subjects' dignity, honour and decency. These were key elements of the early modern anatomical discourse that tied together the anatomists, their audience and the anatomized body which was at the centre of the discourse. In order to secure his social status the anatomist had to subject the body to his authority and credibly deal with the intervention of the sheer materiality of the body as well as its symbolic meanings.[56]

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54 Vesalius, *Fabrica*, 1543; Cunningham, *Renaissance*, 1997, p. 131; Carlino, *Books*, 1999, pp. 53-68.

55 Daniela Bohde, 'Abgeschunden, gegerbt und beschriftet – die menschliche Haut als mahnendes Schaustück in der niederländischen Anatomietradition', in Ulrike Zeuch (ed.), *Verborgen im Buch, verborgen im Körper. Haut zwischen 1500 und 1800*, Wiesbaden: Harrassowitz, 2004, 131-137; Daniela Bohde, 'Pellis Memoria Peccatorum. Die Moralisierung der Haut in Frontispizen und Anatomietheatern der Niederlande im 17. Jahrhundert – ein blinder Fleck in der Medizingeschichte nach 1945', *Zeitsprünge*, 9 (2005), 327-358.

56 For the concept of subjectivity I am using the transcendental self-conscious and autonomous subject as only one side of the coin. The flipside of the coin is a subjectivity that is reflected by the etymology of the term when it can be

With a focus on the function of frontispieces and the iconography of early modern anatomy this chapter will show how the visual representation of anatomy both reflected and shaped notions of the human body. In the first section I will discuss the mediality of the image and the body in early modern anatomy. Using anatomical frontispieces, I will show how they mediated specific notions of the body in relation to the texts they preceded, but also conveyed more general ideas of anatomical cosmologies.[57] The second section will look into how such prefigured notions related to practices concerned with the anatomical body such as dissecting, preparing and collecting anatomical specimens. It will be shown that the values and ideas associated with the early modern anatomical body were not fixed notions, but reflected a variety of possibilities. In the third section I will discuss how the reservations early modern anatomy faced were reflected in the iconography and visual strategies of representations of anatomical dissections in the sixteenth and seventeenth centuries. It will introduce some of the key motifs of early modern anatomy and show how they were used to legitimize anatomy and protect its core values of honour, dignity and decency, while ensuring the professional authority of the anatomist.

2.1 Body, image, mediality

In 1660 an English translation of Jacopo Berengario da Carpi's (c1460-1530) *Mikrokosmographia* was published in London.[58] The work had first been published by the Italian surgeon and anatomist as *Isagogae breves* in 1522 and was an

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conceptualized as being subject to and determined by power relations. For the idea of the subject being torn between transcendental subjectivity and power-relations see Michel Foucault, 'Afterword: The Subject and Power', in Hubert L. Dreyfus and Paul Rabinow, *Michel Foucault: Beyond Structuralism and Hermeneutics*, Chicago: University of Chicago Press, 1982, pp. 208-226. On the history of ideas of the modern subject see Charles Taylor, *Sources of the Self: The Making of Modern Identity*, Cambridge: Cambridge University Press, 1989.

57 The idea of a mediated body is based on the assumption that images of the body not simply reproduce empirical observations, but that the visual representations themselves shape notions of the body (Renée van de Vall, 'Introduction: The Body Within: Art, Medicine and Visualization', in Renée van de Vall and Robert Zwijnenberg (eds), *The Body Within: Art, Medicine and Visualization*, Leiden: Brill, 2009, pp. 1-13, here pp. 5-6).

58 Jacopo Berengario da Carpi, *Μικροκοσμογραφια or a Description of the Body of Man*, London: Livewell Chapman, 1664.

abbreviated version of a longer commentary on Mondino de Liuzzi's *Anatomia*, a key text of fifteenth- and early sixteenth-century anatomy, which Berengario intended to replace with his work as an anatomical manual.[59] The English translation came with a frontispiece which showed a dissection scene in a big hall above which the title was inscribed on a cartouche, which was covering the top quarter of the print (figure 2.1). In the foreground a naked male body, on which the first abdominal incision had been made, lay on its back on a pedestal, in front of which stood a big bowl. Behind the body stood a group of seven men, four of them were wearing academic gowns and hats, while the other three did not wear long gowns and caps. The two men closest to the pedestal were directly engaged with the body. While the left man with the cap and the short skirt was holding up a knife, the man with the academic dress directed a pointer towards the genitals of the dissected body. Slightly set back to the right was a group of three more academics; two seemed to be engaged in a conversation, while the third person was sitting behind a pulpit with an open book.

The scene represented an academic anatomical dissection and thereby reflected the nature of Berengario's book as an anatomical manual. The frontispiece of 1660 was based on images which had previously been prefixed to anatomical works of the same author (figure 2.2 and figure 2.3), of which the title vignette used for the 1535 edition of the *Isagoge breves* had obviously been used as a model for the frontispiece of the English edition.[60] These images represented the same setting and scene that was the subject of the frontispieces to Mondino dei Liuzzi's *Anatomia* (figure 2.4), which Berengario's text explicitly referred to. Woodcuts of this kind were frequently reproduced at the end of the fifteenth and in the early sixteenth century and showed a professor of anatomy lecturing from behind the pulpit with a group of men and a dissected body at his feet. One of those men was usually holding a knife and dressed in a non-academic dress, representing a surgeon, while another, dressed in an academic gown would use a pointer to demonstrate the anatomy of the dissected body; most of the audience could also be identified as

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59 Carlino, *Books*, 1999, p. 22; Heidegger/Cetto, *Sektion*, 1967, pp. 204-205 and 250.

60 Heidegger/Cetto, *Sektion*, 1967, p. 250.

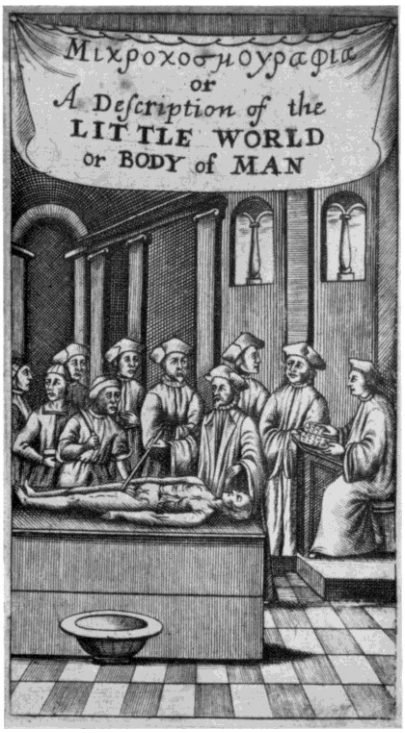

Figure 2.1

Figure 2.2

Figure 2.3

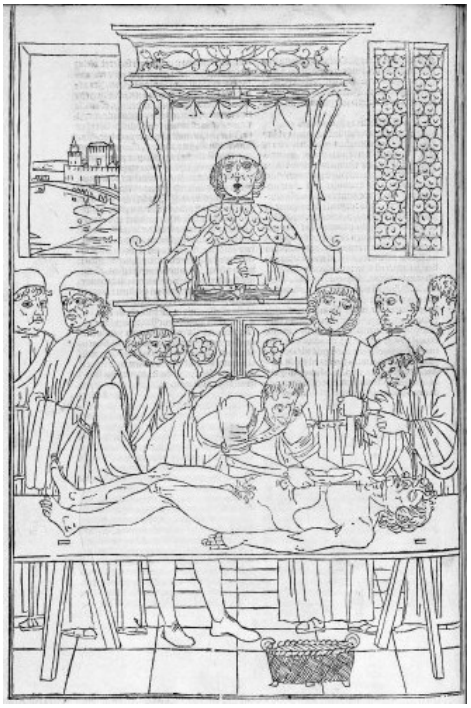

Figure 2.4

Figure 2.5

academics by their dress.[61] Such frontispieces of anatomical works were a defining feature in advertising the book, explaining its purpose and outlining the contents. On the title page of Berengario's *Isagogae breves* of 1523 a similar dissection scene was represented (figure 2.2), where the pulpit was merely moved to the left of the dissected body. Almost 140 years later the basic arrangement was still regarded as an adequate introduction to Berengario's book on Mondino's anatomy and strongly associated the text with both authors.

However, the woodcut used for the 1535 edition of Berengario's *Isagogae breves* (figure 2.3) and the frontispiece of the 1660 English translation differed significantly from the older versions and the frontispieces of Mondino's *Anatomia* by splitting up the group behind the dissection table into two. While one group surrounded the dissector and the demonstrator, another group was engaged into a discussion at the pulpit. Thereby these illustrations referred to another type of image, which represented a group of academics engaged in a discussion over the dissected body (figure 2.5). Such images were based on a medieval manuscript tradition and could often be found in early prints of the *Proprétaire des choses*, a thirteenth-century encyclopaedia by the Anglo-French author Bartholomaeus Anglicus.[62] The vignette of 1535 and the frontispiece of 1660 to Berengario's *Isagogae breves* amalgamated the two motifs: the representation of anatomy teaching and academic disputation. It thereby reflected changes in anatomical practice during the first half of the sixteenth century, when the hierarchical division of dissector, demonstrator and lecturer became blurred. These three roles were gradually united in the anatomist who at the same time dissected, demonstrated and discussed the anatomy of the human body during his lectures, which was epitomized in the frontispiece to Andreas Vesalius's *De humani corporis fabrica* of 1543 (figure 2.6).[63]

When Vesalius and his printer Johannes Oporinus published the *Fabrica* they used every tool of sixteenth-century marketing to create a publishing sensation. By the time of its publication Vesalius was already known for publishing high quality

61 Carlino, *Books*, 1999, pp. 12-13.
62 Heidegger/Cetto, *Sektion*, 1967, p. 154-159.
63 Carlino, *Books*, 1999, pp. 39-53.


ANDREAE VESALII
BRVXELLENSIS, SCHOLAE
medicorum Patauinæ professoris, de
Humani corporis fabrica
Libri septem.
CVM CAESAREAE
Maiest. Galliarum Regis, ac Senatus Veneti gra-
tia & priuilegio, ne in diplomatis eorundem continetur.
BASILEAE.

Figure 2.6

anatomical illustrations with his *Tabulae anatomicae sex*,[64] and the publication of the *Fabrica* was accompanied by the publication of the *Epitome*,[65] an abridged version of the *Fabrica* with a focus on the illustrations, in a smaller format and thus cheaper and affordable for a wider audience. The *Fabrica* itself was printed on high quality paper in a large folio format, set in beautiful typography and illustrated with high-quality woodcuts. The book was dedicated to the emperor Maximilian V and introduced by a letter of Vesalius to his publisher that discussed many aspects of the complicated production of this elaborate work. All these features were part of marketing the *Fabrica* as one of the most outstanding printed books and underline its importance on the sixteenth-century print market.[66]

Vesalius' ambitions with the *Fabrica* were made clear from the start on its frontispiece. The elaborate and beautifully carved woodcut represented the anatomical dissection in a very different way compared to previous dissection scenes. The image of a highly formalized dissection in front of a relatively small academic audience with clear hierarchies in sombre surroundings was replaced by a public anatomy in front of a vibrant and diverse crowd inside a richly decorated anatomical theatre and, sensationally, with a female body being dissected by the author, Andreas Vesalius, who was simultaneously demonstrating and lecturing.[67] Thereby Vesalius created a new identity of the anatomist by uniting the previously separated roles of the lecturer, the demonstrator and the dissector. However, the frontispiece of the *Fabrica* not only showed that Vesalius intended to create a new

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64 Andreas Vesalius, *Tabulae anatomicae sex: Six Anatomical Tables of Andreas Vesalius*, London, privately printed for Sir William Stirling-Maxwell, 1874 (1st ed. 1538).

65 Andreas Vesalius, *De humani corporis fabrica librorum epitome*, Basle: Johannes Oporinus, 1543.

66 On the publication history of the *Fabrica* and the *Epitome* as well as their influence on later anatomical publications see Cushing, *Bio-Bibliography*, 1943.

67 On the majority of anatomical frontispieces a male body or a body of indistinctive sex was depicted. Katharine Park has argued that the female corpse on the frontispiece of Vesalius's *Fabrica* was not only supposed to increase the appeal of the book to a predominantly male readership, but also allowed to objectify the female body by widening the gendered gap between the male onlookers and the corpse on the dissecting table. Park, *Secrets*, 2006, pp. 249-259. However, the public display of an anatomized female body raised particular issues of decency related to female sexual honour that had to be protected (see section 2.2 in this chapter).

way of doing anatomy but also to rewrite anatomical knowledge. At the table Vesalius was surrounded by three men dressed in ancient togas who represented the authorities of Aristotle, Galen and Herophilus or Hippocrates.[68] He was not only teaching his audience, but these three men in particular about their errors, and had pen, ink and empty pages ready on the table to rewrite anatomy based on his dissections. The frontispiece of the *Fabrica* created an iconography that became typical for anatomy in a Vesalian manner, while it drew on the practice of using the prominent typographical place of the title page to outline the contents of the book and its key message.

The motif of 1535 vignette and the 1660 frontispiece for Berengario's *Isagogae breves* not only represented changes in Renaissance anatomy which predated and did not yet go as far as Vesalius' new approach to anatomy. The vignette and the frontispiece also gave clues to the contents of the book. When their motif was used for the seventeenth century English translation of Berengario's *Isagogae breves*, this frontispiece differed significantly from contemporary anatomical frontispieces, which usually represented an anatomy in a Vesalian manner, with the anatomist uniting the three roles of lecturer, dissector and demonstrator which were often accompanied by a complex iconography representing ancient authorities, vanitas motifs and Christian cosmology, as well as set in an anatomical theatre before an audience or as a group portrait. On the frontispiece of Berengario's *Microcosmographia* of 1660 only the title cartouche referred to cosmological ideas about the relation between the microcosm of the body and the macrocosm of the wider world. Therefore images such as this frontispiece were not only programmatic images or represented changes in anatomical practice, but they also shaped ideas about the nature of the human body. Early modern representations of anatomical dissections were mediations of the human body which was in turn itself a medium of discourses about nature, the Creation, what it meant to be human, death and salvation. Using sometimes complex analogies, anatomical images could relate the microcosm of the human body to the macrocosm and vice-versa.

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[68] Cunningham, *Renaissance*, 1997, p. 126.

Such rhetoric of representation, which linked everything to everything by metaphors and other linguistic and visual devices, found in the early modern period its equivalent in the cosmological theories of natural philosophy, in which the human body was an essential element. This was epitomized, for example, by the frontispiece of the *Anatomiae amphitheatrum* by the English physician and natural philosopher Robert Fludd (1574-1637, figure 2.7).[69] The book was published in 1623 as the second part of a three-volume history of the macro- and the microcosm and discussed the microcosm of the human body. The first volume, which had been published in 1617, was on the metaphysical, physical and technical history of the macrocosm, while the third volume of 1626 discussed the *Philosophia sacra* of meteorology and cosmology.[70] Fludd's philosophy was a hermetic system within which every object and phenomenon was related to everything else and could be understood through analogies. It was based on a macro-microcosm scheme, in which the universe and the divine found their correspondence in the human world. Reflecting the holy trinity, everything in the macro- and the microcosm was ordered according to a threefold principle. Fundamental antagonisms such as good and evil found their equivalent in light and darkness, while heat and cold would be associated with God breathing in and out, and thereby setting the universe in motion. This would then set in motion the transformation of the third component of the universe, the elements, which were formed under the influence of heat and cold out of water, the primary element. According to Fludd the relations established in this way had their equivalent in the divine principle of the universal nature in the microcosm of the human world. This microcosm was accordingly divided by a threefold principle into animals, plants and minerals, whose universal nature was embodied most perfectly in man, wheat and gold respectively.[71] With his cosmology and occult beliefs, Fludd was not an outsider, but socially well

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69 Robert Fludd, *Anatomiae amphitheatrum effigie triplici, more et conditione varia, designatum*, 2 vols, Frankfurt: Theodor de Bry, 1623.

70 William H. Huffman, *Robert Fludd and the End of Renaissance*, New York: Routledge, 1988, pp. 52-53.

71 On Fludd's natural philosophy see in detail Huffman, *Fludd*, 1988, pp. 100-134. On Fludd's medical concepts and medical practice see also Lauren Kassell, 'Magic, Alchemy and the Medical Economy in Early Modern England: The Case of Robert Fludd's Magnetical Medicine', in Mark S. R. Jenner and Patrick Wallis (eds.), *Medicine and the Market in England and its Colonies, c. 1450-c. 1850*, Basingstoke: Palgrave Macmillan, 2007, pp. 88-107.

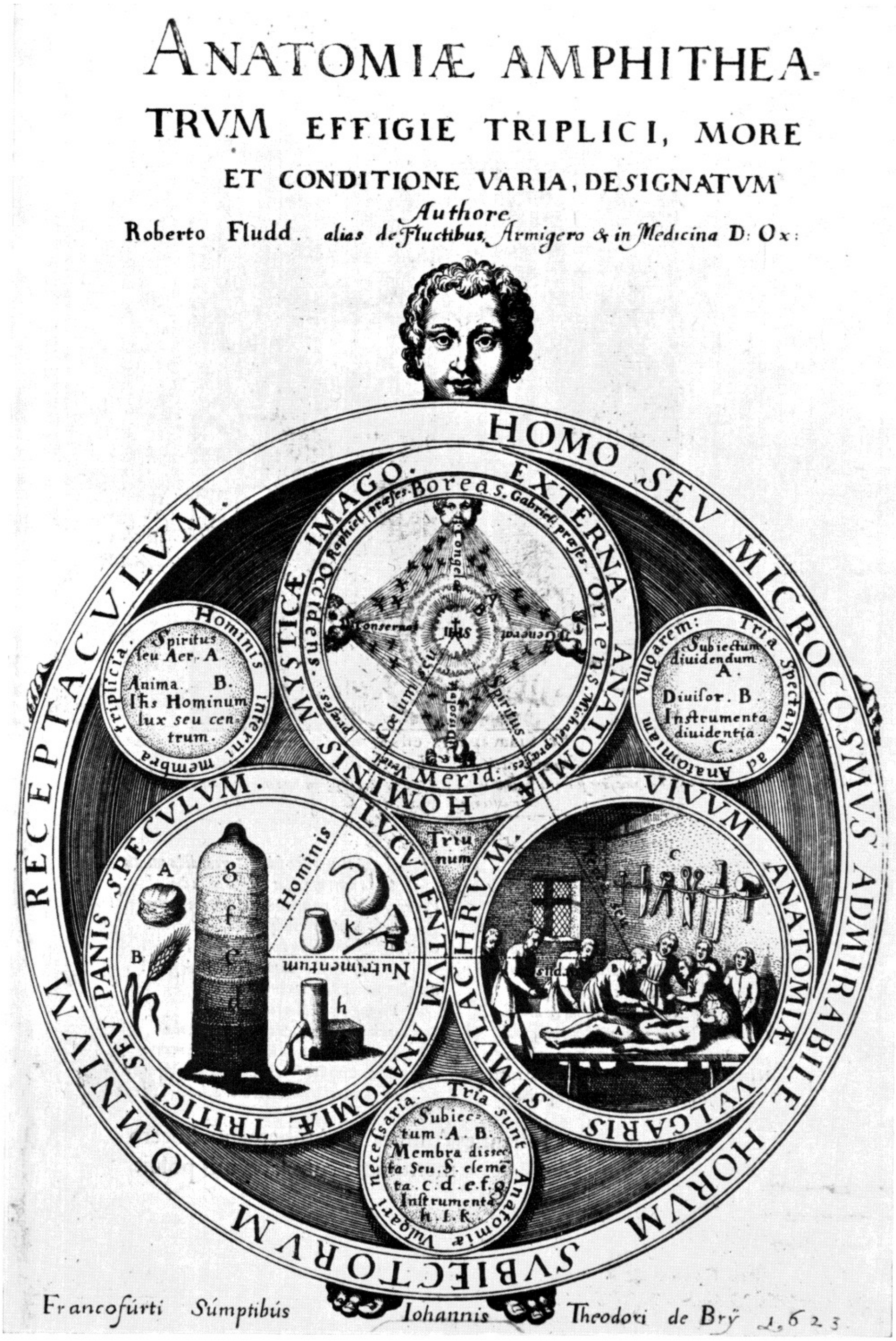
ANATOMIÆ AMPHITHEA-
TRVM EFFIGIE TRIPLICI, MORE
ET CONDITIONE VARIA, DESIGNATVM
Authore
Roberto Fludd. alias de Fluctibus, Armigero & in Medicina D: Ox:
HOMO SEV MICROCOSMVS ADMIRABILE HORVM SVBIECTORVM OMNIVM RECEPTACVLVM.
MYSTICÆ IMAGO. EXTERNA ANATOMIÆ HOMINIS
LVCVLENTVM ANATOMIÆ TRITICI SEV PANIS SPECVLVM.
VIVVM ANATOMIÆ VVLGARIS SIMVLACHRVM.
Boreas
Merid:
Spiritus seu Aer. A.
Anima. B.
Ihs Hominum lux seu centrum.
Subiectum diuidendum. A.
Diuisor. B.
Instrumenta diuidentia. C.
Subiectum. A. B.
Membra dissecta Seu. S. elementa. c. d. e. f. g.
Instrumenta h. i. k.
Triu num
Hominis
Nutrimentum
Francofurti Sumptibus Iohannis Theodori de Bry 1623

Figure 2.7

established as a rich nobleman and well-respected scholar. This was also the case for his Christian Neo-Platonic philosophy, in which science and philosophy, religion and metaphysics were not yet separated.[72]

A system based on the number three was also represented on the frontispiece of Fludd's *Anatomiae amphitheatrum*. It showed a human figure holding a circle, representing the microcosm, which was almost completely covering his body, in which six further circles are enclosed. The bigger circle in the top centre represented the soul, which had the divine light at its centre. It was surrounded by the four directions, which were in turn associated with the archangels Gabriel, Michael, Uriel and Raphael. The larger circle at the bottom right showed an anatomical dissection, representing the fabric of the human body, while the third circle to the bottom left represented nutrition and alchemy, standing for the material basis and fundamental processes of human existence. The three bigger circles were connected by indexed lines, while the smaller circles gave further explanations on the bigger ones. The frontispiece of Fludd's *Anatomiae amphitheatrum* represented an anthropocentric system based on analogy and *convenientia*.[73] In this system the human body was the basis for the identification of similarities with the macrocosm and in turn reflected those analogies when the three spheres of the "externa anatomiae", the "vivum anatomiae" and the "luculentum anatomiae" were united in the microcosm of man.[74]

From the sixteenth into the early eighteenth century the visual rhetoric of representations of anatomical dissections often incorporated a principle of

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72 Huffmann, *Fludd*, 1988, pp. 1-2.

73 Foucault described *convenientia* (identity, harmony) as a form of similarity, which associated objects on the basis of their spatial proximity (Michel Foucault, *The Order of Things: An Archaeology of the Human Sciences*, London: Routledge, 1970, pp. 28-29). On the use of images in Fludd's work see Olaf Breidbach, 'World Orders and Corporal Worlds: Robert Fludd's Tableau of Knowing and its Representation', in Helmut Schramm, Ludger Schwarte and Jan Lazardzis (eds), *Instruments in Art and Science: On the Architectonics of Cultural Boundaries in the 17th Century*, Berlin: Walter de Gruyter, 2008, pp. 38-61.

74 The central role of the relations between microcosm and macrocosm for early modern systems of knowledge was emphasized by Michel Foucault (Foucault, *Order*, 1970, pp. 30-34).

similarities, based on which everything could be associated with everything else in a cosmological system.[75] Such an order based on similarities was not only reflected in representations of anatomical dissections and the anatomical body, but could also be found in contemporary anatomical texts. In a German adaption of Vesalius's works by Jacob Baumann,[76] for example, the parts of the human body were also described in a way, which was based on the principle of similarity:

> Firstly it is to remember and to know that all parts of the human body are of two kinds. They are either the same that is that also the smallest parts are as a kind, appearance and name similar to the whole. As it is the case for bone, flesh, cartilage, membrane, ligaments, fibres, grease and fat. Or they are dissimilar and real ones, by the means of which man is capable to do things (and when they are dissected, the individual parts of each are dissimilar from the whole in name and appearance. Because not every part of a finger is called a finger, and is also not similar to a finger). Such dissimilar parts are blood- and air vessels, nerves, muscles, finger and other instruments of the whole body, which become the better and nobler instruments to use, the more they consist of different individual similar and real members and pieces."[77]

In this passage Baumann grouped together things which could potentially appear in very different forms (bones, flesh, cartilages, skin, etc.) because of a shared material quality (kind, appearance and name). Meanwhile he also arranged the parts of the

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75 Foucault, *Order*, 1970, pp. 25-26,

76 Jacob Baumann, *Anatomia Deudsch. Ein kurzer Auszug der beschreybung aller Glieder menschlichs Leybs aus den buchern des Hochgelerten Herrn D. Andree Vesalij von Brüssel / Rö. Key. May. leyb arzts / sampt den Figuren und derselben außlegung / allen dieser löblichen kunst liebhabern / so das unaussprechliche wunderwerk Gotte in der natur zuerfaren lust haben und fördelich wunderaerzten Deutscher nation zu nutz ins deutsch gebracht*, Nuremberg: J.P. Fabricio [printer], 1551.

77 "Erstlich ist zu mercken vnnd zu wissen das alle theil des menschlichenn leybs zwayerley sindt. Entweder gleychformig / also das auch die kleinsten stuecklein seinem ganzen theil / an art / aussehen / vnnd namen gleich vnd enlich sein. Als Beyn / Fleisch / krospel / heutlein / bande der glieder / zeserlein / schmaltz vñ faistigkeyt. Oder sindt vngleich vñ wirckliche / welche ein werckzeug sein des leybs / durch welche der mensch etwas vermag zuthun (vnd so sie zerteylt werden / sind dieselbigen theil einyedes seinem gantzen an namen vnnd ansehen / nit gleich. Dann es wirdt nicht eyn yedes stuecklein von einem finger ein finger genant / ist einem finger auch nicht enlich) Solche vngleiche tayl sind Blůt vnnd luft adern / senn adern / meußle / finger / vnd andere des ganzen leybes instrument / welche desto bessere vnnd edlere werckzeug zum brauch werden / ye mehr sie von gleichformigen vnd wircklichen gliedern vñ stuecken zusammengesetzt werden." Baumann, Anatomia, 1551. If not indicated otherwise the translations are mine.

body as tools of the body, according to their function (vessels, nerves, muscles, etc.). The human body was not described as a self-contained entity, which was self-explanatory. The parts of the body were either defined by the expert who could identify their quality, knew their name, or understood their function.

It was not only the complex compositions such as Fludd's frontispiece that were based on the principle of similarities. The animals, plants, allegories and mythological figures frequently depicted on anatomical frontispieces and other images of anatomical dissections, for example on the title page of Jacques Guillemeau's *Tables anatomiques* (1586, figure 2.8) or the prints representing the anatomical theatre in Leiden from the early seventeenth century (figure 2.9), followed a similar principle. In the context of anatomy, the animals could, for example, represent the four elements which were in turn associated with the four humours as on Guillemeau's frontispiece, but they could also represent the four key virtues, the five senses, as well as the seven deadly sins or identify allegories or mythological figures.[78] Animals representing cosmological concepts such as humoural theory were prominent in the iconography of anatomy into the first half of the eighteenth century, while figures from ancient mythology remained on anatomical frontispieces until their disappearance from medical-scientific prints at the turn from the eighteenth to the nineteenth century.[79] The iconographic shift in the early eighteenth century represented a gradual loss of importance of cosmological concepts of the body to concepts, which understood the body not anymore based on its different qualities and their relation to each other, but based on the principle of causality.[80] Until then the iconographically complex early

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78 A more detailed iconographic account of the symbolic meaning of the various animals, plants, etc. in the context of anatomy will subsequently be discussed in relation to specific images. A systematic account of the symbolism of early modern anatomy would go beyond the scope of this thesis and have resulted in a different account. However, it is important to remember that they could be more than mere attributes and could represent fundamental ideas about the anatomical body. A more focused account of plant and animal iconography in early modern science can be found in Anne G. Wertz, 'Zur Titelblatt-Ikonographie von Arznei- und Kräuterbüchern des 16. bis zum Ende des 18. Jahrhunderts', PhD Thesis, University of Marburg, 1993, pp. 67-97.

79 This observation is based on a survey of the prints reproduced in Heidegger/Cetto, *Sektion*, 1967.

80 On this fundamental epistemological shift see for example David M. Levin,

Figure 2.8

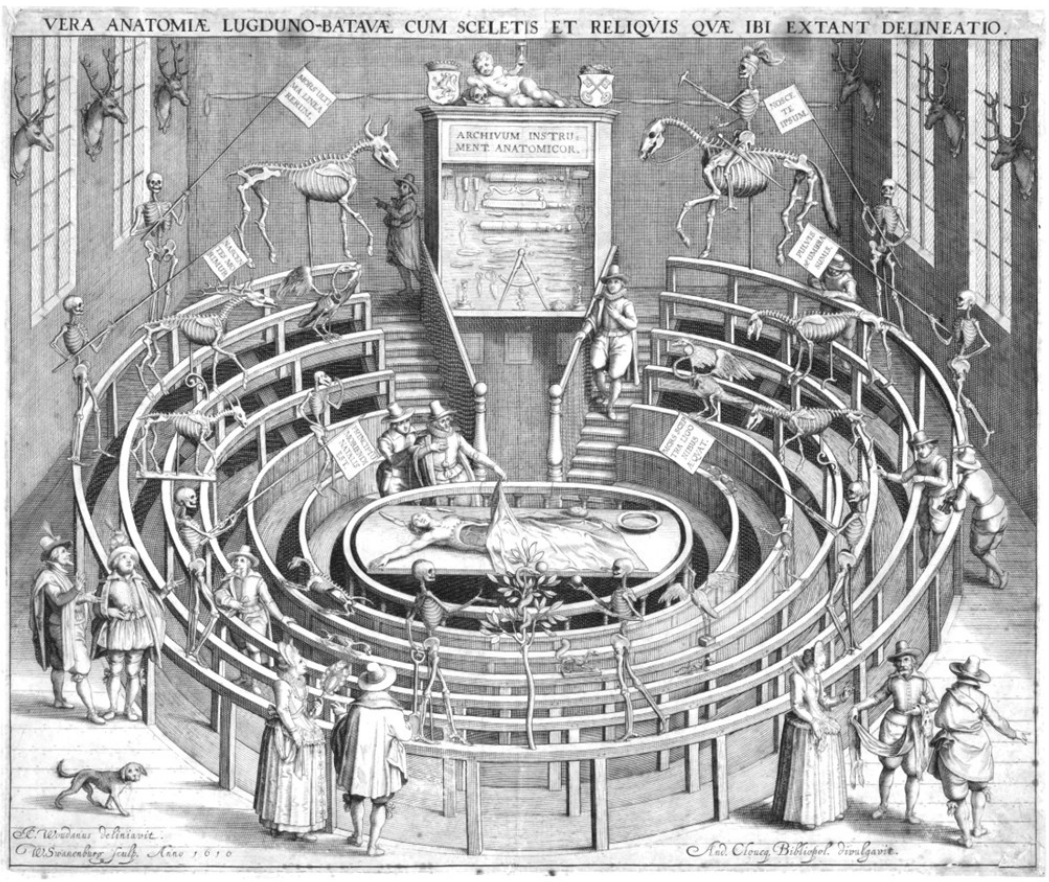

Figure 2.9

modern representation of anatomical dissections and the anatomical body could only claim truthfulness against the background of a new understanding of the visual image since the Renaissance, which assumed an identity between the ability to see and the sense of vision and the outside world, which it perceived. The decisive step towards such an understanding of visual images was the invention of perspective at the beginning of the Italian Renaissance. The illusion of perspective was not merely regarded as an appropriate way to depict the natural world more accurately. By representing our sense of vision and imagination perspective could also convey the true nature of the rational soul.[81]

From our contemporary perspective images such as the frontispiece to Fludd's *Anatomiae amphitheatrum* appear at first glance to consist of mysterious and randomly assembled elements, which only start to make sense if seen in the context of early modern cosmological ideas. Our contemporary puzzlement with such images partly results from an understanding of visual images which differentiates between the image and the object it represents. Yet in the early modern visual culture the mediality of the image was defined by visual conventions such as rules of perspective or iconography, which themselves were of a defining nature for the understanding of the human body. In the case of anatomical frontispieces they already defined a framework for the way claims could be made about the body. Thereby the anatomical body as a microcosm was in itself a medium which expressed a higher, divine principle. Consequently, images of the human body always represented images of what it meant to be human and created a "double referentiality of the body". This double referentiality is created by our understanding of the physical medium of an image as the virtual embodiment of an object, while the media themselves leave their marks on our embodied perceptions and modify them.[82] If this idea is applied to early modern visual representations of the anatomical body, the early modern discourse of the body materialised in the

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'The Discursive Formation of the Body in the History of Medicine', *Journal of Medicine and Philosophy*, 15 (1990), 515-537, pp. 521-523.

81 Erwin Panofsky, *Perspective as Symbolic Form*, New York: Zone Books, 1991, p. 72.

82 Hans Belting, *Bild-Anthropologie. Entwürfe für eine Bildwissenschaft*, Munich: Wilhelm Fink, 2001, p. 13.

images and simultaneously permeated them as an object of perception of the discursive body.

2.2 The anatomized body

In the historical context of early modern anatomy this leaves us with the question of what defined the possible meanings of the anatomical body and how they were shaped by the practices related to the dissected body. Since the late Middle Ages, corpses were opened on a fairly regular basis, and not only during the public dissections at the universities. Anatomists gave private anatomy lessons, and dissections were also conducted as part of anatomical research. At such events no audience was present, beyond a handful of colleagues and students. This practice originated from the Italian medical schools of Salerno and Bologna at the turn of the fourteenth century, where physicians began to dissect the human body systematically.[83] Besides such academically motivated dissections, human corpses were opened for a variety of other reasons, for example when individuals who were regarded as saints and had to be embalmed after their death or signs of their holiness were expected to be found inside their bodies.[84] Another occasion on which corpses were opened were autopsies to determine the cause of death in criminal cases or which were requested by relatives to identify the disease one of their kin had died from.[85] Such dissections were usually only attended by a small and immediately concerned audience, like private students, officials or relatives, and had a clearly defined purpose.

Already the statutes of the medical school of Salerno in 1224 required anatomical knowledge as a precondition for medical practice. Although anatomical dissections are recorded at universities of the fourteenth and fifteenth century (the first teaching dissection at a central European university was carried out in Vienna in 1404), they were not part of systematic anatomy teaching with dissection as an integral part. Only for the University of Bologna there is evidence of regular dissections under

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83 Katharine Park, 'The Criminal and the Saintly Body: Autopsy and Dissection in the European Renaissance', *Renaissance Quarterly*, 47 (1994), 1-33, p. 6.
84 Park, 'Body', 1994, pp. 1-2.
85 Park, 'Body', 1994, pp. 6-7.

the anatomy professor Mondino di Liuzzi during the first two decades of the fourteenth century.[86] From the end of the fifteenth century, the number of dissections increased gradually. However, they only slowly became part of anatomical teaching, especially north of the Alps. At the University of Wittenberg, for example, a chair for anatomy was established with the re-foundation in 1536, yet public dissections only took place sporadically.[87] In Wittenberg at the end of the sixteenth century the question which texts should be read in the anatomy lectures still received more attention than the implementation of teaching dissections.[88] Only in 1606 the state authorities issued clear regulations how and how often anatomical dissections had to be carried out. While previously anatomical dissections had merely been mentioned as one of the duties of the medical faculty, now it was expected that the professor of surgery would "in a public anatomy every year at least once in a human body demonstrate and show what he has read".[89] In order to give the anatomists an incentive to actually carry out the dissections they were allowed to charge their audience fees, "since he has to burden half of the expenses for the instruments, besides the big laboratory and a substantial displeasure".[90] The anatomists' rather limited enthusiasm can be partly explained by the inconveniences anatomical dissections brought with them. Besides the cold – because of a lack of

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86 Alfred Gisel, 'Überwindung der Widerstände gegen die Sektion', in Norbert Stefenelli (ed.), *Körper ohne Leben. Begegnung und Umgang mit Toten*, Vienna: Böhlau, 1998, pp. 562-566, here p. 562.

87 Walter Friedensburg, *Geschichte der Universität Wittenberg*, Halle: Niemeyer, 1917, pp. 209-210. On anatomy in Wittenberg and the relation between anatomy and theology in the Reformation see Jürgen Helm, 'Religion and Medicine: Anatomical Education at Wittenberg and Ingolstadt', in Jürgen Helm and Annette Winkelmann (eds), *Religious Confessions and the Sciences in the Sixteenth Century*, Leiden: Brill, 2001, pp. 51-68; Vivian Nutton, 'Wittenberg Anatomy', in Ole Peter Grell and Andrew Cunningham (eds), *Medicine and the Reformation*, London: Routledge, 1993. pp. 11-32.

88 See the statutes of the University of Wittenberg of 1572 and 1588, as well as the visitation report of 1587 to the Duke of Saxony in Historische Kommission für die Provinz Sachsen und Anhalt (ed.), *Urkundenbuch der Universität Wittenberg. Teil 1 (1502-1611)*. Magdeburg: Historische Kommission für die Provinz Sachsen und Anhalt, 1926, pp. 382-383, 536 and 563.

89 "in einer publica anatomia alle jahr zum wenigsten einmal in einem humano corpore [...] was er gelesen demonstrieren und weisen", Historische Kommission für die Provinz Sachsen und Anhalt, *Urkundenbuch*, 1926, p. 661.

90 "sintemal er die unkosten der instrumenten halb neben grossen laboribus und einem zimlichen unlust tragen muss", Historische Kommission für die Provinz Sachsen und Anhalt, *Urkundenbuch*, 1926, p. 661.

cooling dissections could only be held during the winter months – the anatomists and their audience had also to suffer from the stench of the rotting corpses.[91]

Besides such practical issues, anatomy was still a contested practice at the turn of the seventeenth century. Although no religious taboo or legal ban restricted anatomical dissections, anatomists had to be careful not to violate their own or their subject's and audience's honour, dignity and decency.[92] In December 1599 the anatomy professor Johann Jessenius (1566-1621) dissected a woman without obtaining a special privilege in the German university town of Wittenberg. The dissection was disturbed by the crowd and caused a scandal, which led to a letter of complaint by the theology professor Aegidius Hunnius (1550-1603) to the bailiff of Wittenberg, Kaspar Mainer.[93] In his letter Hunnius suggested clearer regulations for public anatomies to avoid such turmoil in the future:

> But if someone is supposed to be hanged, […] and his body is refused a [Christian] grave because of the nature of this punishment, and if

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91 Karin Stukenbrock, 'Der sezierte Leichnam als Objekt der (Körper-)Erfahrung in der Frühen Neuzeit', in Paul Münch (ed.), "*Erfahrung" als Kategorie der Frühneuzeitgeschichte*, München: Oldenbourg, 2001, pp. 73-88, here p. 85. On the strategies early modern medical men used to come to terms with the messy side of their business, especially in surgery and anatomy see Lynda Payne, *With Words and Knives: Learning Medical Dispassion in Early Modern England*, Aldershot: Ashgate, 2007.

92 The myth of a ban of anatomical sections is astonishingly persistent in the literature. Anna Bergmann, for example, still argued in a book chapter in 1996 on the basis of the assumption of a religiously motivated taboo of dissections, which was based in Christian ideas about corporal resurrection (Anna Bergmann, 'Die Verlebendigung des Todes und die Tötung des Lebendigen durch den medizinischen Blick', in Elisabeth Mixa, et al (eds), *Körper – Geschlecht – Geschichte. Historische und aktuelle Debatten in der Medizin*, Innsbruck: Studien-Verlag, 1996, pp. 77-95, here pp. 86-87). However, such prejudices might have more to do with contemporary debates surrounding Gunther von Hagen's exhibition *Body Worlds* and its fierce criticism by both Catholic and Protestant clergy (Cunningham, *Anatomist* 2010, pp. 14-15). They are contrasted by an anatomical tradition going back to the thirteenth century and medieval ex voto practices and the devotion of reliquaries. Caroline Walker-Bynum has shown that for medieval people the fragmentation of the body did not necessarily jeopardise corporal resurrection on judgement day (Caroline Walker-Bynum, *Fragmentation and Redemption: Essays on Gender and the Human Body in Medieval Religion*, New York: Zone Books, 1992). Regarding an alleged papal ban of dissections see Park, 'Body', 1994, p. 4.

93 Historische Kommission für die Provinz Sachsen und Anhalt, *Urkundenbuch*, 1926, pp. 616-618.

> now the body is taken down for dissection and buried afterwards, thereby spared the bigger shame that he is not left hanging at the gallows for deterrence and to be eaten by the raven, therefore I maintain that in this case of punishment the anatomy could be carried out rather in such a case and also with a better conscience.[94]

In the case of a hanged criminal Hunnius regarded a public anatomical dissection as perfectly justified. Furthermore he argued that in such a case the dissection was even for the benefit of the executed person, because he would be spared the shame of hanging at the gallows and being refused salvation. The concerns Hunnius had regarding public anatomies related to their potential to violate public decency, but also their threat to honour and dignity. To avoid the violation of public decency he suggested stricter limitations especially on the use of female bodies. Apparently the public display and mutilation of a naked female body was even a trickier business than the dissection of a male body. "Because of their [the female bodies] dissection's numerous concerns which in part affect maintenance of decency and honour,"[95] Hunnius demanded that in the case of female bodies further requirements had to be fulfilled. Firstly the anatomist had to obtain an official permission for the dissection of the particular female body, and secondly, consent had to be obtained from and compensation agreed with the family and friends of the dissected woman.[96] Hunnius also argued that the public dissection should be an explicit part of the verdict to prevent unjustified infringements of the dignity of the convicted person. Apparently, early modern anatomists could not just rely on learned authority and the patronage of the authorities to legitimize anatomical dissections. Although there was no religious taboo on dissecting human bodies, anatomists had to respond to other issues which resulted from the close links between anatomy and corporal punishment through the use of the bodies of executed criminals

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94 "So aber jemand mit dem Strang gerichtet werden soll […] und seinem cörper hoc suplicii generi die sepultura vermög in theils negirt wirdet und also, wenn der cörper zur section herundergenommen und nachmals begraben wirdt, hierdurch er der größeren schand erlediget wirdt, daß er nicht zum scheusal darf am gericht hangen bleibenund von den raben verzehret werden, so halte ich dafür, daß in diesem casu suspendii die anatomia desto eher und mit besserem gewissen concediert werden kann." Historische Kommission für die Provinz Sachsen und Anhalt, *Urkundenbuch*, 1926, p. 617

95 "weil ihrer section halber allerhand bedenkhen, so zum theil erhaltung zucht und erbarkeit anlanget", Historische Kommission für die Provinz Sachsen und Anhalt, *Urkundenbuch*, 1926, p. 617.

96 Historische Kommission für die Provinz Sachsen und Anhalt, *Urkundenbuch*, 1926, p. 617.

during public anatomies. In order not to jeopardize their social status anatomists had to make sure that violation of the honour and dignity of the anatomized body was justified and decency maintained.

Reservations and resistance against anatomy were phenomena which only appeared to increase with the development and growing number of public dissections and were more rooted in the dishonouring display of the fragmented naked body than religious ideas.[97] Legal objections also played a minor role since the provision of bodies to the anatomy became more and more tightly regulated.[98] For the primary audience of anatomists, however, the dissected body was not so much a matter of concern, especially since anatomy was well established and practiced on a regular basis by the turn of the eighteenth century. In the view of many learned men the anatomical body was not only the source of knowledge about the Divine, but as much an object about which they wanted to gather as much information as possible. For them the anatomical body was not primarily something that could teach them a moral lesson, but something that could satisfy their learned curiosity. One of the most important places for learned men to gather such knowledge about the body were anatomical theatres and collections. When men of letters, such as the German scholar Zacharias Conrad von Uffenbach (1683–1734),[99] for example, went on their travels, they often had tightly packed itineraries of people and places they wanted to visit; among them prominently were anatomical theatres, anatomists and their collections.

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97 Park, 'Body', 1994, S. 17-21. A similar point is made for England in the eighteenth century by Peter Linebaugh, 'The Tyburn Riots Against the Surgeons', in Douglas Hay, Peter Linebaugh, John G. Rule, EP Thompson and Carl Winslow (eds), *Albion's Fatal Tree: Crime and Society in Eighteenth-Centuty England,* London: Allen Lane, 1975, pp. 65-117.

98 Rupp, 'Matters', 1990, p. 267. On the legal regulations in the early modern German states see Stukenbrock, *Cörper*, 2001, pp. 26-78. On Renaissance Italy see Carlino, *Books*, 1999, pp. 77-85.

99 Zacharias Conrad von Uffenbach was from a patrician family in Frankfurt. He had studied in Strasbourg and Halle, and held a doctorate in law. Uffenbach was also interested in theology, philosophy, natural history and medicine. Later in his life he became a member of the town council, deputy-mayor and judge in his hometown. Among his contemporaries Uffenbach was most famous as a man of letters and collector of manuscripts and books. He had a widespread network of correspondence. On Uffenbach's biography, scholarly interests and collections see Konrad Franke, 'Zacharis Conrad von Uffenbach als Handschriftensammler. Ein Beitrag zur Kulturgeschichte des 18. Jahrhunderts', *Archiv für Geschichte des Buchwesens*, 15 (1965), 1235-1338.

When Uffenbach started his two-year journey of Northern Germany, England and Holland from Frankfurt in November 1709 he first headed north, before he travelled from Hamburg along the shores of the North Sea to the Netherlands. From North Holland he set sail to England, where he arrived in the summer of 1710. In autumn 1710 he travelled back to the continent, where he stayed in the Netherlands until spring 1711. During his journey Uffenbach bought about four thousand books and all sorts of curiosities. Apart from book stores, libraries, churches, arsenals and other landmarks, he showed particular interest in cabinets of curiosities and especially anatomical theatres. These visits were well prepared, and he had made himself familiar with the collections by way of reading of catalogues and descriptions of the collections. In his travel journal Uffenbach made qualified comments on the collections and the people he met there. In order to illustrate his understanding of the collections and how they reflected Uffenbach's notion of the human body, I will focus on Uffenbach's visits to two different types of collections: the public anatomical theatre in Leiden and the private collections of the anatomists Frederik Ruysch (1638-1731) and Johannes Rau (1668-1719) in Amsterdam.

Uffenbach visited the anatomical theatre in Leiden on the 23rd of January 1711. He spent half a day there and went through the whole collection following the Latin catalogue of 1709.[100] During his visit Uffenbach was accompanied by his brother and the curator of the anatomical theatre and author of the catalogue, Gerard Blancken. In his notes of the visit Uffenbach only referred to what he regarded as the most remarkable objects in the collection. Apart from exotic objects like a Chinese tambourine and snow-shoes, Egyptian mummies or the skeleton of a whale, these were in particular curious human specimens. Uffenbach admired the skeletons from executed criminals and the stuffed skin of a woman, he identified as a gypsy, as well as the bladder of a man which supposedly held about eight litres. Another object that caught his attention was a human skin in a frame, which was attributed to a dissection by the former professor of anatomy Otto Heurnius in 1623. On the skin an inscription read

[100] Zacharias Conrad von Uffenbach, *Merkwürdige Reisen durch Niedersachsen, Holland und Engelland*, 3 vols, Ulm: Gaum, 1753-1754, vol. 3, p. 438; Gerard Blancken, *Catalogus antiquarum et novarum rerum: ex longe dissitis terrarum oris congestarum: quarum visendarum copia Lugduni in Batavis in Anatomia Publica*, Leiden: Hubert vander Boxe, 1709.

"Zoroaster / O homo confidentissimae / Naturae machinae", which could be translated as "Zoroaster / Oh most arrogant man / Nature's work". However, to Uffenbach these words appeared, as he put it "dark and making little or almost no sense".[101] A little later, when both were looking at a shirt made from human intestines, Blancken told Uffenbach that out of curiosity he had recently prepared a human skin to make slippers. Uffenbach remarked on this story that superstitious people might be frightened by this, but admired the rationality of the Dutch who would not be be bothered by such prejudices.

Apart from the exceptional rarity and odd nature of the specimens, Uffenbach also showed great interest in the quality of the objects. He was particularly impressed by the specimens from the collection of Govert Bidloo (1649-1713), who was professor of anatomy in Leiden at the time. Uffenbach praised the outstanding quality of the preparations of the human urinary tract and the human skin. But he seemed to have been most excited by several objects in two display cabinets, which had not yet been included in the printed Latin catalogue. Uffenbach emphasised their outstanding quality, especially of "a piece of skin which was exceptionally delicate and curious to look at. Even the small hairs were unhurt".[102] Afterwards Uffenbach was led to the basement, where he saw among other things an object described in Blancken's catalogue as "a French noble man who ravish't his sister, and also murdered her"[103]. Satisfied by what he had seen Uffenbach concluded: "We have spent this morning happily admiring God's marvellous creation. However, to see everything in detail, more than one morning would have been necessary."[104]

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[101] "welche Worte aber dunkel und wenig oder keinen Verstand haben", Uffenbach, *Reisen*, 1753-1754, vol. 3, p. 441.

[102] "Ein Stück von präparierter cuticula war besonders zart und curiös zu sehen. Es waren sogar die Härgen noch unverletzt darauf", Uffenbach, *Reisen*, 1753-1754, vol. 3, p. 453.

[103] Gerard Blancken, *A Catalogue of All the Cheifest Rarities in the Publick Theater and Anatomie-Hall, of the University of Leyden*, Leiden: Hubert vander Boxe [printer], 1707, p. 16.

[104] "Wir haben hiermit diesen Morgen gar vergnügt in Betrachtung der wunder würdigsten Geschöpfe Gottes zugebracht, wiewohl alles recht zu betrachten, mehr als einen Morgen erfordert hätte." Uffenbach, *Reisen*, 1753-1754, vol. 3, p. 453.

On the 13th of March Uffenbach visited Rau in Amsterdam, who was a member of the guild of surgeon-anatomists and a rival of Ruysch, the praelector of the guild.[105] Rau gave private anatomy lectures at the time and later became professor for anatomy in Leiden. Uffenbach described him as a show-off who owned many good anatomical specimens, but did not keep them neat and tidy. Some of the jars did not contain enough spirits, and the specimens were rotting. Despite the poor condition of the collection, Uffenbach praised Rau's ability to prepare the human bones in a way that made them white and look like ivory as well as Rau's injections of vessels and organs with wax and mercury.[106] Three days later Uffenbach visited Frederik Ruysch, who was praelector of the Amsterdam guild of surgeon-anatomists at the time. When he arrived, Ruysch was giving a private anatomy lecture to a few Englishmen. Uffenbach stayed for the lecture which he described as not very good, but was immediately impressed by the specimens Ruysch showed. Afterwards Ruysch guided him around his collection which occupied five rooms with display cabinets lined up at every wall. In his notes Uffenbach pointed out children's heads which almost appeared to be alive, the vast collections of embryos and the curiously decorated insects. He was very impressed and wondered "how this man could collect so many specimens, and how neat and tidy everything was at the same time."[107] For a more detailed description Uffenbach referred to Ruysch's *Thesauri anatomici*, printed descriptions of the collection. Uffenbach was very disappointed that he did not have enough time to see everything properly, because Ruysch claimed after a while that he had to attend a funeral and asked him to leave.

The example of Uffenbach was significant in several ways and shows how an audience of learned men engaged with the anatomical body. Firstly, the way he prepared for the journey and organised the visits to the anatomical theatres and private collections

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105 Private anatomy lessons appeared to be a flourishing business in late seventeenth and eighteenth centuries not only in Amsterdam but also slightly later in London (Anita Guerrini, 'Anatomists and Enterpreneurs in Early Eighteenth-Century London', *Journal of the History of Medicine and Allied Sciences*, 59 (2004), 219-239). For anatomists who gave private lessons their collections were important assets and became highly valued commodities (Dániel Margócsz, 'Advertising Cadavers in the Republic of Letters: Anatomical Publications in the Early Modern Netherlands', *British Journal for the History of Science*, 42 (2009), 187-210).

106 Uffenbach, *Reisen*, 1753-1754, vol. 3, pp. 621-625.

107 "daß dieser Mann so viele praeparata machen und zusammen bringen können, ingleichen, wie nett und sauber alles angeordnet", Uffenbach, *Reisen*, 1753-1754, vol. 3, pp. 640-641.

demonstrates that Uffenbach was familiar with contemporary anatomy. He had certainly read relevant anatomical literature, used available catalogues and was aware of particularly interesting specimens in the collections he visited. Secondly, Uffenbach was still aware of the moral implications and popular prejudices towards anatomy. He recounted the stories about the misdemeanours of those whose bodies had been anatomized and were now put on display at the theatre in Leiden and contrasted unspecified superstitious views about anatomy elsewhere with Blancken's and his fellow countrymen's more rational approach when they used the body to create useful objects. Thirdly, Uffenbach attached great importance to the quality of the anatomical objects and the anatomists' ability to produce high quality specimens. Next to the richness of the collections he visited, the aesthetic appeal and accuracy of the work of anatomists such as Bidloo or Ruysch was his most important criterion to judge what he had seen.

The account Uffenbach gave of his visits to the anatomical theatre in Leiden and the collections of Ruysch and Rau reflect gradually changing attitudes to the anatomical body. Although he was still aware of the moral implications of anatomy he found the cosmological references in the Zoroaster inscription on the skin obscure and difficult to decipher. Uffenbach also had little concern for matters of dignity and decency when he was handling body parts or reflecting on Blancken's slippers made from human skin. It appears that at least in the perception of the learned man Uffenbach, the moral values of honour, dignity and decency that were so closely associated with early modern anatomy did not matter very much. For Uffenbach at least the anatomist had emancipated himself from their constraints and what really defined his status were his rational mind, skill and detailed knowledge of the human body. The key criterion Uffenbach used to assess the work of Rau and Ruysch was the quality of the presentation of their specimens and lectures. The most iconic venue in which people could form their notions of the roles of the anatomist and the anatomical body was the anatomical theatre. In the performance of the public dissection the relations between anatomist, audience and the dissected body were re-enacted on a regular basis.[108]

[108] On the theatrical aspects of early modern anatomy see Cregan, *Theatre*, 2009; Stefanie Stockhorst, 'Unterweisung und Ostentation auf dem anatomischen Theater der Frühen Neuzeit. Die öffentliche Leichensektion als Modellfall des *theatrum mundi*', *Zeitsprünge*, 9 (2005), 271-290.

2.3 The public display of the anatomical body

The earlier public dissections, which were performed at universities throughout Europe, were not primarily designed to carry out research, but to help students and doctors to understand the textual knowledge of the human body in the anatomical books available to them.[109] The course of these dissections was modelled on the conventions of academic lectures and disputations. During the lecture the professor would read anatomy, often from Galen or Mondino, while a surgeon would dissect the body, following the directions of the demonstrator. This traditional didactic concept was represented already on early prints of anatomical manuals and became associated with a traditional way of doing anatomy (figure 2.4).[110] However, an important innovation to anatomical teaching was introduced in the middle of the sixteenth century by Andreas Vesalius. He no longer read anatomy from behind the pulpit, but dissected himself, while he was lecturing and demonstrating simultaneously. Vesalius also encouraged his students to actively participate in the dissections. This hands-on approach to anatomical dissections became the dominant model for teaching anatomy by the end of the sixteenth century at many European universities.[111]

Besides their didactic function, anatomical dissections were also an academic ritual with legitimizing and representative functions. While during the fifteenth century the audience of anatomical dissections was still mainly restricted to the members of the universities, public dissections developed since the sixteenth century into social

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109 Park, 'Body', 1994, p. 14.

110 Carlino, *Books*, 1999, pp. 8-27.

111 At the universities of the German territories anatomical teaching in the Vesalian manner was only introduced relatively late. At the end of the sixteenth century Vesalius' works had been introduced as the basis of anatomical teaching only in the regulations of the universities of Basel, Heidelberg and Wittenberg. By the early seventeenth century, however, most German universities probably taught anatomy in the Vesalian manner, even if this was not required in their statutes (Klaus Pielmeyer, 'Statuten der deutschen medizinischen Fakultäten im Mittelalter. Ein Beitrag zur Geschichte des medizinischen Unterrichts an deutschen Universitäten anhand der Statuten der ersten 16 medizinischen Fakultäten von ihrer Gründung bis zum Ende des 16. Jahrhunderts', MD Thesis, University of Bonn, 1981, pp. 64-78).

events which were also attended by the social elite such as the aristocracy, members of the town councils and other wealthy citizens.[112] Early visual evidence of this representative function of public anatomies, which became an iconographic model for visual representations of anatomical dissections, was the frontispiece to Andreas Vesalius' *Fabrica* (1543, figure 2.6). The large format of the print, and the high quality of the woodcut emphasized the representative character of the occasion. The whole image was designed to make clear that only the author, Vesalius, had the fascinating ability to dissect the body in the right way and convey its true anatomy to both his audience in the theatre and the readers of his book.

However, the public anatomical dissection was not only a stage for the anatomist to show off his skills. As a festive ritual, for which special invitations were handed out and programmes would be printed, it also intended to raise the profile and increase the esteem of the corporations which held them, such as universities or surgeons guilds.[113] These events often took place in specially designed, at first temporary, but later on permanent, anatomical theatres.[114] The first permanent anatomical theatre was built in Padua (1594) and a plain and simple design of an oval of raising tiers around the dissection table. A different type developed in Bologna (1595, rebuilt in 1649) and the Netherlands at the turn of the seventeenth century. Beyond their pragmatic use as places for anatomical dissections the anatomical theatres in Leiden (1597), Delft (1614), and Amsterdam (1619), which also had their own libraries, served as cabinets of curiosities and held art collections.[115] The richly decorated anatomical theatre in Bologna became the place of lavish public dissections during carnival.[116]

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112 Robert Jütte, 'Die Entdeckung des „inneren" Menschen, 1500-1800', in Richard van Dülmen (ed.), *Die Erfindung des Menschen. Schöpfungsträume und Körperbilder, 1500-1800*, Vienna: Böhlau, 1998, pp. 248-249.

113 Otto Ulbricht, 'Die Sektion des menschlichen Körpers als Feier. Anatomie und Geselligkeit im Barockzeitalter', in Wolfgang Adam (ed.), *Geselligkeit und Gesellschaft im Barockzeitalter*, 2 vols, Wiesbaden: Harrasowitz, 1997, vol. 1, pp. 365-378, here pp. 366-367.

114 On the development of anatomical theatres throughout Europe see Gottfried Richter, *Das anatomische Theater*, Berlin: Emil Ebering, 1936.

115 Rupp, 'Matters', 1990, pp. 263-264.

116 On the anatomical theatre in Bologna in particular and its representative function for the university as well as an important public place in urban life see Ferrari, 'Anatomy', 1987. Other The didactic concepts of the anatomical theatre

The significance of the Dutch anatomical theatres was epitomized by an early seventeenth-century engraving showing the Leiden anatomical theatre (figure 2.9). It belonged to a series of prints representing the landmarks of the University of Leiden. Apart from the anatomical theatre, these were the library, the botanical garden and the gymnasium.[117] The print showed an anatomical theatre built around the dissecting table, on which lay a corpse, which was covered by a blanket from the groins down.[118] Two men were standing at the table and inspecting the anatomical body. Behind the table at the back of the room was a display cabinet with anatomical instruments, which was decorated with a cherubim leaning on a skull and holding an hourglass. On the tiers rising around the table stood both human and animal skeletons, and the human skeletons were holding poles with moralising banners reading:

> mors ultima linea rerum [est].
> nascentes morimur.
> principium moriendi natalis est.
> mors sceptra ligonibus aequat.

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of the Company of Barber-Surgeons of London is discussed in Kate Cregan, 'Teaching the Anatomical Body in Seventeenth-Century London', *Medicine Studies*, 2 (2010), 21-36.

117 Claudia Swan, 'Medical Culture at Leiden University ca. 1600: A Social History in Prints', in Jan de Jong, Mark Meadow and Bart Ramakers (eds), *Prentwerk, Print Work, 1500-1700*, Zwolle: Waanders Uitgevers, 2001 (=Netherlands Yearbook for History of Art 52), pp. 217-239, here pp. 229-231. On the iconography of the two prints of the anatomical theatre in Leiden see Th. H. Lunsingh Scheurleer, 'Un amphithéâtre d'anatomie moralisée', in Th. H. Lunsingh Scheurleer and G. H. M. Posthumus Meyjes (eds), *Leiden University in the Seventeenth Century: An Exchange of Learning*, Leiden: E. J. Brill, 1975, pp. 217-277.

118 On the absolute majority of anatomical frontispieces and anatomy paintings from the seventeenth and eighteenth centuries the private parts of the dissected bodies were hidden, while there seem to be relatively more images of anatomical dissections from the sixteenth century where the genitals of the anatomical subjects were uncovered. This indicates changing attitudes towards nakedness in early modern culture under the influence of the Reformation and Catholic Counter-Reformation when nakedness and the exposure of the body and its function became more and more regarded as a shameful taboo and occasions where naked bodies could be seen in public places more and more restricted (Sara F. Matthews Grieco, 'The Body, Appearance, and Sexuality', in Natalie Zemon Davis and Arlette Farge (eds), *A History of Women in the West: III. Renaissance and Enlightenment Paradoxes*, Cambridge MA: Harvard University Press, 1993, pp. 47-84, here pp. 64-66).

pulvis [et] umbra sumus.
nosce te ipsum![119]

A further skeleton was sitting on a horse at the right back, while in the foreground two skeletons left and right of a tree represented the fall of man. On the left Adam was leaning on a spade, on the right stood Eve offering him the forbidden fruit, while the snake was winding upwards the tree between them.[120] The anatomical

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[119] These mottos were common proverbs and often taken from classical literature:
Everything ends with death (Horace, *Satires, Epistles and Ars Poetica*, with an English translation by H. Rushton Fairclough, Cambridge MA: Harvard University Press, 1970, I.xvi.79, pp. 356 and 357).
Already from birth we are beginning to die (Manilius, *Astronomica*, ed. and transl. by G.P. Goold, Cambridge MA: Harvard University Press, 1992, 4.16, pp. 222 and 223).
Death renders equal the sceptre and the hoe (This motto also appeared in an early seventeenth-century emblem book form the Netherlands (Arthur Henkel, Albrecht Schöne (eds), *Emblemata. Handbuch zur Sinnbildkunst des XVI. und XVII. Jahrhunderts*, special edition, Stuttgart, Weimar: J. B. Metzler, 1996, col. 1000) and was a frequently used provrb since the middle ages (Kuratorium Singer der Schweizerischen Akademie der Geistes- und Sozialwissenschaften (ed.), *Thesaurus proverbiorum medii aevi = Lexikon der Sprichwörter des romanisch-germanischen Mittelalters*, 13 vols, Berlin: Walter de Gruyter, 1995-2002, vol. 11, p. 330)).
We are but dust and shadow (Horace, *Odes and Epodes*, ed. and transl. by Niall Rudd, Cambridge MA: Harvard University Press, 2004, IV.7.16, pp. 240 and 241).
Know thyself! (According to the Greek traveller and geographer Pausanias this was also the motto of Apollo's oracle at Delphi. Pausanias, *Description of Greece*, with an English translation by W. H. S. Jones, Cambridge MA: Harvard University Press, 1935, X.xxiv.1, pp. 506 and 507).

[120] Beyond the implications for salvation, the fall of man was also an important narrative for defining gender roles (Sabine Bark, *Auf der Suche nach dem verlorenen Paradies. Das Thema des Sündenfalls in der altdeutschen Kunst (1495-1545)*, Frankfurt: Peter Lang, 1994, pp. 85-116). Not only on the Leiden print, but anatomical images played a key role in defining sex and gender. Jonathan Sawday discussed in detail the eroticized female body in early modern anatomy (Sawday, *Body*, 1996, pp. 188-213), while Londa Schiebinger's paper on the visual representation of female osteology and the construction of the female sex based on her anatomy (Londa Schiebinger, 'Skeletons in the Closet: The First Illustrations of the Female Skeleton in Eighteenth-Century Anatomy', *Representations*, 14 (1986), 42-82) as well as the work of Thomas Laqueur (Thomas Laqueur: *Making Sex: Body and Gender From the Greeks to Freud*, Cambridge MA: Harvard University Press, 1990) formed the background to a controversy on the role of early modern anatomy in the construction of dualistic concepts of sex and gender, which were founded in a naturalized body. Michael Stolberg pointed out that both Laqueur and Schiebinger had been very selective in their choice of sources when they argued for the predominance of the one-

theatre was populated by fifteen people and a dog. Some of these people were wandering around and inspecting the objects in the display cabinets around the room, while a woman on the left was holding a mirror and at the bottom right three people were looking at a human skin.

The print did not give a realistic impression of a particular event in the Leiden anatomical theatre but showed the multiple functions of the theatre as both venue for anatomical dissections, represented by the body on the dissecting table, and gallery.[121] In all those functions, however, the anatomical theatre was not just a place of learning and intellectual endeavour, but also the stage for the representation of power and a moral institution similar to the cabinets of curiosity at the early modern European courts.[122] While during the winter months the anatomical dissections would be held, objects such as the skeletons, animal specimens and other "curiosities" were put on display during the rest of the year. The anatomical theatre in Leiden was also decorated with paintings representing biblical, historical, allegorical, and vanitas themes and kept, according contemporary catalogues, also the leg of a sea monster and the hand of a mermaid.[123] The character of the anatomical theatre in Leiden as a cabinet of curiosities turned it into a microcosm, which represented the macrocosm of the Creation, and the power of the university in capturing it. Such cosmological ideas were key to early modern natural

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sex model well into the eighteenth century (Michael Stolberg, 'A Woman Down to Her Bones: The anatomy of Sexual Difference in the Sixteenth and Early Seventeenth Centuries', *Isis*, 94 (2003), 274-299; Thomas W. Laqueur, 'Sex in the Flesh', *Isis*, 94 (2003), 300-306; Londa Schiebinger, 'Skelettestreit', *Isis*, 94 (2003), 307-313). The gendered nature of early modern anatomy will be discussed in this thesis in more detail in chapter 6 on the representation of the unborn.

121 A year before this print another version showing a crowded anatomical theatre during a dissection was published in 1609. On this other version of the print see Swan, 'Culture', 2001, pp. 231-233; Tim Huisman, *A Theatre for Anatomy: The Leiden theatrum anatomicum, 1594-1821*, Leiden: Museum Boerhaave, 2002, pp. 22-24.

122 On the theory and significance of early modern cabinets of curiosities see Horst Bredekamp, *The Lure of Antiquity and the Cult of the Machine: The Kunstkammer and the Evolution of Nature, Art and Technology*, Princeton: M. Wiener, 1995. For an overview of the topic see Arthur MacGregor (ed.), *Curiosity and Enlightenment: Collectors and Collections From the Sixteenth to the Nineteenth Century*, New Haven: Yale University Press, 2007.

123 Rupp, 'Matters', 1990, p. 272.

philosophy and man took in this system centre stage, which was represented by the anatomical body in the centre of the print.[124]

But man's status in the world was not only a question of the correspondence between the micro- and the macrocosm and being the crown of the Creation modelled on the image of God. Being human was also defined by sinfulness, transistoriness and mortality. This was drastically demonstrated in the print representing the anatomical theatre in Leiden with the dissected body in the centre of the composition. In front of it the fall of man represented the ultimate reason for man's mortality and inherent sinfulness. The banners held by the skeletons on the tiers with their mottos reminded of the transistoriness of everything worldly and encouraged the onlooker to remember his own mortality. This self-reflective warning was emphasized by the woman holding the mirror, a personification of self-knowledge, and typical vanitas symbols such as the skull and the hourglass. Such ideas were also represented by the flayed skin some of the visitors of the anatomical theatre were looking at. Together with the references to Christian salvation history this gave the representation of anatomy in the context of the Leiden anatomical theatre a decidedly moralising dimension, inviting to self-reflection.[125]

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124 Alfred Walz, 'Eine Einführung', in Susanne König-Lein (ed.), *Weltenharmonie. Die Kunstkammer und die Ordnung des Wissens. Ausstellung im Herzog Anton Ulrich-Museum Braunschweig vom 20. Juli bis zum 22. Oktober 2000*, Braunschweig: Herzog-Anton-Ulrich-Museum, 2000, pp. 9-21, here pp. 9-11.

125 Heckscher, *Rembrandt*, 1958, pp. 98-99. Human skins were not only part of the anatomical collection in Leiden but also on display in other Dutch anatomical theatres such as Amsterdam (Heckscher, *Rembrandt*, 1958, pp. 98-99). In the German territories anatomists also had human skins prepared (Christel Heckhausen, *Anatomen und Anatomie im Urteil der Öffentlichkeit seit 1500*, Berlin: 1966, pp. 66-67). In the next chapter the topos of the flayed human skin in early modern anatomy will be further explored the context of the discussion of anatomy and the identity of the anatomical subject and the anatomist. Daniela Bohde has shown that in the representation of flaying and the flayed skin in sixteenth-century art the skin became a crucial signifier of individual identity (Daniela Bohde, 'Skin and the Search for the Interior: The Representation of Flaying in the Art and Anatomy of the Cinquecento', in Florike Egmond and Robert Zwijnenberg (eds), *Bodily Extremities: Preoccupations with the Human Body in Early Modern European Culture*, Aldershot: Ashgate, 2003, pp. 10-47, here pp. 25-31).

On the print showing the anatomical theatre in Leiden the human body was woven into a discursive net, which made it the place for the representation of truth and knowledge and the power of the urban elites. The access to the anatomical theatre was restricted and visits to the public dissections or the collections were rituals which allowed access to this discourse of power. Some copies of the earlier 1609 print representing the anatomical theatre in Leiden came with a short text and index in Latin, Dutch, French and English. The text described the hierarchy of the audience on the tiers. While the first rank was reserved for the professors and lecturers at the University, local elites and noblemen, the second rank was for the students in the medical faculty. The rest of the tiers were for the general public. However, it was required that the people attending the public dissections were either "scholars, or persons of honest disposition".[126] While the University of Leiden and especially the anatomical theatre were an access point to the anatomical discourse about the human body, active participation was tightly regulated and gave primacy to the contributions of learned anatomists and local authorities.[127] The claims which could be made in the anatomical discourse on the human body were also defined by the iconography on the prints, which tied anatomy to cosmological concepts of the body and embedded it within the Christian salvation narrative. Yet by moving the physical anatomical body into the centre of the image, the anatomists claimed their authority by emulating the sovereign power present in early modern practices of punishment. In representing themselves as those who were holding knowledge and power over life and death the anatomists in particular and the social elites visiting the anatomical theatre in general identified themselves with the sovereign power.[128]

Images of public anatomies, however, were also a medium which was used to negotiate professional identities and authority. On Dutch anatomical group portraits such as *The*

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126 The Rijksprentenkabinet in Amsterdam has a copy including the text and index (Rijksprentenkabinet, RP-P-OB-9827). While in the early seventeenth century access was apparently still rather restricted, in the 1720s, according to the Swiss scholar Albrecht von Haller (1708-1777), even peasants seemed to be regular visitors to the anatomical theatre (Albrecht von Haller, *Albrecht Hallers Tagebücher seiner Reisen nach Deutschland, Holland und England (1723-1727)*, ed. by E. Hintzsche, St. Gallen: Hausmann, 1948, pp. 33 and 103).

127 Rupp, 'Matters', 1990, pp. 264 and 268.

128 On the political ritual of corporal punishment in (re-)establishing the souvereign power in the seventeenth and eighteenth centuries see Foucault, *Discipline*, 1979, pp. 54-65.

Anatomical Lesson of Dr Willem van der Meer by Michiel and Pieter (?) van Mierevelt's (1567-1641 and 1596-1623) (1617, figure 2.10), images of public anatomies were used to legitimize anatomy. In this case the usual iconographic features such as the skeletons on the top left were used to allude to the Christian values incorporated in anatomy. Meanwhile the presence of a member of the municipal authorities, Dirck Robbrechtsz Schilperoot (1586-1651), the figure in the top row on the right, secured the legitimacy of the dissection. Schilperoot was not only member of the town council but also patron of the surgeons' guild in Delft.[129] Anatomical group portraits were deliberate displays of authority over the body and, in the case of the *Anatomy Lesson of Dr Willem van der Meer*, the anatomical knowledge represented by the surgeons of Delft was a decidedly modern kind of anatomy, which was emphasized by the contrast between the closed book of Galen held by the second figure from the left in the foreground and the opened book on the top left which showed an illustration of one of the muscle men in Vesalius's *Fabrica*.[130] The whole scene was presided by Delft's chief anatomist, Willem van der Meer (died 1624), who was in the centre of the painting above the corpse and holding a knife in his right hand. This emphasis on the hand of the anatomist reinforced the authority of van der Meer and his way of doing anatomy in a Vesalian manner. In early modern and especially in Dutch anatomy, with its emphasis on the manual skill of dissecting, the hand symbolised the mastery of the subject and was evidence of the skill of the anatomist.[131]

However, the *Anatomy Lesson of Dr Willem van der Meer* not only established legitimacy and authority, but also a peculiar relation between the members of the surgeons' guild, the dissected body and the audience. With most of the figures on the painting turning their gaze to the onlooker, a bond was formed between them and their audience on an equal level. At the same time the gaze of the onlooker was drawn to the corpse on the dissecting table in the centre of the painting, which allowed him to enter the circle of the surgeons and share their anatomical knowledge. Unlike the men around

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129 Hans Houtzager, 'De anatomische les van Dr Willem van der Meer, geschilderd door Michiel en Pieter van Mierevelt in 1617', in Hans Houtzager and Michiel Jonker (eds), *De snijkunst verbeeld: Delftse anatomische lessen nader belicht*, Delft: Reinier de Graaf Groep, Zwolle: Waanders Uitgevers, 2002, p. 98.

130 Julie V. Hansen, 'Galleries of Life and Death: The Anatomy Lesson in Dutch Art, 1603-1773', PhD Thesis, Stanford University, 1996, pp. 68-69.

131 Hansen, 'Galleries', 1996, pp. 128-130.

Figure 2.10

the table, who could be identified, the naked anatomized body remained with his face covered, anonymous as the object of the inquisitive curiosity of the anatomist. This objectification of the anatomized body created a certain distance between the surgeons and their audience on the one hand and the corpse on the other hand which allowed them to maintain their honour, dignity and decency in the presence of the corpse of the executed criminal. On *The Anatomy Lesson of Dr Willem van der Meer* this distance was further emphasized by the fact that no one on the painting was actually touching the corpse. From the perspective of the onlooker this distance was created by both the physical boundary of the canvas but also the barrier surrounding the table at which in the front a place was left for the onlooker. However, the drawing of such clear boundaries was subverted by the invitation to *nosce te ipsum* (know thyself), the omnipresent motto of early modern anatomy which was epitomized by the skeletons. This motto suggested that anatomy was a means by which the individual would learn about himself and recognize his sinfulness and mortality but also the magnificence of God's Creation in the body of man.[132]

2.4 Conclusion

Images of early modern anatomy reflected and responded to the challenges anatomy faced, especially through the associations with its subject, the criminal body. In response to such challenges, anatomists developed their own visual strategies to represent themselves as honourable, dignified and decent men. In so doing they distanced themselves from their subject, the anatomical body and objectified it as their object of learned curiosity and established themselves as authorities of anatomical knowledge. Yet the iconography of anatomy also required both the anatomists and their audience to reflect on their own existence as an essential core value of anatomy and identify with the anatomical body. However if one had to identify with the dissected body, what were the implications of the corpse being the dishonoured body of a criminal, which during the dissection would be step by step stripped of its identity? This also raised complex questions for the anatomist, who himself, as a sinful human being, had to identify with the anatomized body, but at the same time embody the superior knowledge that would allow him to lay bare the Divine truth of anatomy.

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[132] Sawday, *Body*, 1996, pp. 96-110; Andrea Carlino, '"Knowe thyself": Anatomical Figure in Early Modern Europe', *RES*, 27 (1995), 52-69, pp. 64-67.

3. Early modern anatomy and the identity of the anatomist

Dissecting, publishing, teaching and collecting were four essential activities by which anatomists made themselves socially distinctive and through which they regulated the access to anatomical knowledge. Anatomical theatres and collections in guild halls, universities and grammar schools were the institutional setting in which the anatomists addressed their audiences. These audiences were usually made up of persons from the anatomists own learned background and belonged to the social elites. The regulation of the access of the lower classes to the anatomical theatre helped to maintain social distinctions of the anatomists in the public sphere. However, the anatomists' need for legitimizing self-representation also resulted in the production of a wide range of objects for display, including anatomical collections, instruments, architecture, books, prints, drawings, and paintings. Although images had a particular significance in constructing individual and professional identity they were until recently a rather neglected genre. Richard Wegner's *Das Anatomenbildnis* (1939) was an early exception, but followed a rather descriptive approach and collected portraits (paintings and prints) of anatomists from the sixteenth to the end of the eighteenth century which were grouped together chronologically and according to the nationality of their sitters.[133] The issue of representation of individual and collective identity arose with William Heckscher's study of Rembrandt's group portrait of Nicolaas Tulp and other members of the Amsterdam guild of surgeon-anatomists. Heckscher showed how the painting was used to legitimise anatomy, but represented Tulp in particular as an honourable man and master of his art.[134] Other research on portraits of anatomists during the last thirty years mainly focused on the frontispiece and author portrait of Andreas Vesalius' *Fabrica* or Dutch paintings from the Golden Age.[135] Only recently has the question of how portraiture forged individual and collective identities of

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133 Richard N. Wegner, *Das Anatomenbildnis. Seine Entwicklung im Zusammenhang mit der anatomischen Abbildung*, Basle: Schwabe, 1939.

134 Heckscher, *Rembrandt*, 1958, pp. 117-121.

135 On the *Fabrica* frontispiece see Andrew Cunningham and Tamara Hug, *Focus on the Frontispiece of the Fabrica of Vesalius, 1543*, Cambridge: Cambridge Wellcome Unit for the History of Medicine, 1995; Cunningham, *Renaissance*, 1997, pp. 124-130; Carlino, *Books*, 1999, pp. 39-53; Park, *Secrets*, 2006, pp. 207-221. On anatomical group portraits in the Dutch Golden Age see Middelkoop/Noble, *Rembrandt*, 1998; Hansen, 'Galleries', 1996; Schupbach, *Paradox*, 1982.

scientists come into focus, for example in Ludmilla Jordanova's book *Defining Feature*s, which was written in conjunction with an exhibition in 2000 at the National Portrait Gallery in London on scientific and medical portraiture since the seventeenth century.[136] Other research by Jordanova and Aris Sarafianos has recently explicitly focused on portraiture and the professional identity of Enlightenment doctors.[137]

With my own analysis I will concentrate on anatomists in particular, but look at a longer period from the late Renaissance to the end of the eighteenth century. This approach allows me to understand how the professional identity of early modern anatomists underwent a series of changes and how these changes affected the production and representation of anatomical knowledge. The first section of this chapter discusses how anatomists deliberately styled themselves as authorities of the body and developed a distinct identity during the sixteenth and seventeenth centuries. It will look into how anatomists responded to the challenges of the potentially dishonourable physical contact with the criminal body in the anatomical theatre and tried to protect honour, dignity and decency as the key values of anatomy. In the second section of the chapter I will analyze how at the turn of the eighteenth century the notion of anatomy began to change and how anatomists recalibrated their image as self-consciously learned men. I will show that towards the end of the seventeenth century, the notion of anatomy as a discipline with a distinct subject, methods and knowledge was well established and that anatomists had a coherent concept of their professional identity. Moving further into the eighteenth century, I will argue that new anatomical virtues such as expert knowledge, manual and intellectual skills became the source of a shared identity for the "gentleman anatomist".

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136 Ludmilla Jordanova, *Defining Features: Scientific and Medical Portraits 1660-2000*, London: Reaktion Books 2000, pp. 18-19.

137 Aris Sarafianos, 'The Natural History of Man and the Politics of Medical Portraiture in Manchester', *Art Bulletin*, 88 (2006), 102-118; Ludmilla Jordanova, 'Portraits, People and Things: Richard Mead and Medical Identity', *History of Science*, 41 (2003), 293-313; Ludmilla Jordanova, 'Medical Men 1780-1820', in Joanna Woodall (ed.), *Portraiture: Facing the Subject*, Manchester: Manchester University Press, 1997, pp. 101-115.

3.1 Honour, dignity and decency

The flayed human skin was of key significance to three of the main topoi of visual representations of dissections: anatomy as punishment, the (self-)representation of anatomists and the legitimisation of anatomy as a way of gaining self-knowledge.[138] It was a staple feature especially of Dutch images of anatomical dissections from the seventeenth century, such as the prints showing the anatomical theatre in Leiden, on which some of the visitors were inspecting a human skin, and many anatomical frontispieces feature human skins, often as cartouche for the title.[139] Against the background of images of justice such as Gerard David's painting representing the Flaying of Sisamnes (1498, figure 3.1) the flayed human skin could be understood as a "memoria peccatorum" that is a reminder of sinfulness and warning against misdemeanours and their consequences. Such images were particularly popular in early modern Northern Europe and usually part of the iconographic programme of town halls, where they could often be found in the court rooms.[140] According to the ancient Persian myth the king Cambyses sentenced the judge Sisamnes to death and had him flayed for his injustice and corruption. Afterwards Cambyses had the judge's skin draped on a bench and appointed Sisamnes' son as the new judge. At the appointment the king warned the new judge with regard to the skin to always remember his father's fate when he was making a judgement. In a popular late fifteenth-century version of the tale the warning was phrased even more vividly, when the new judge was threatened with the same punishment as his father, should he ever leave the righteous way.[141] Yet at a more general level this moralizing story about the consequences of injustice could also be understood as "a kind of symbol of the Last Judgement. The Emperor, no longer a

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138 More general on the cultural meanings of the skin see Steven Connor, *The Book of Skin*, Ithaca: Cornell University Press, 2004.

139 Robert Herrlinger, 'Die geschundene Haut im barocken Titelkupfer', in Heinz Goerke and Heinz Müller-Dietz (eds), *Verhandlungen des XX. Internationalen Kongresses der Geschichte der Medizin. Berlin, 22.-27. August 1966*, Hildesheim: Olms, 1968, pp. 474-496.

140 Ursula Lederle, *Gerechtigkeitsbilder in deutschen und niederländischen Rathäusern*, Philippsburg, J. Kruse, 1937, pp. 42-45.

141 Hans J. van Miegroet, *Gerard David*, Antwerp: Mercatorfonds, 1989, pp. 143-144.

Figure 3.1

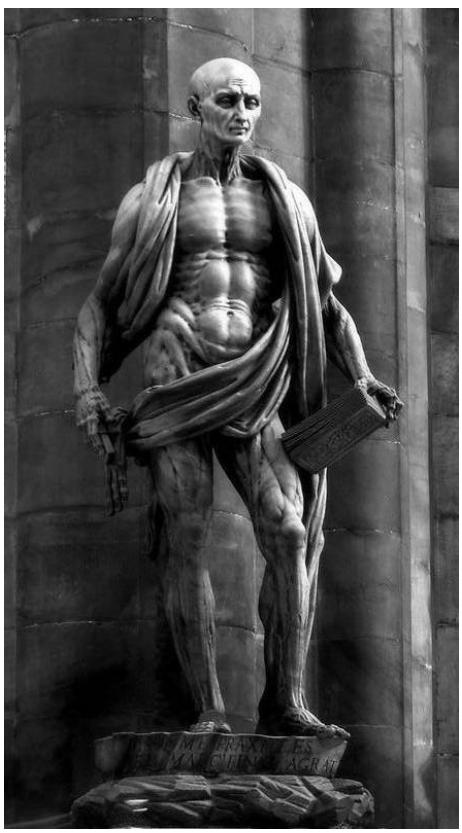

Figure 3.2

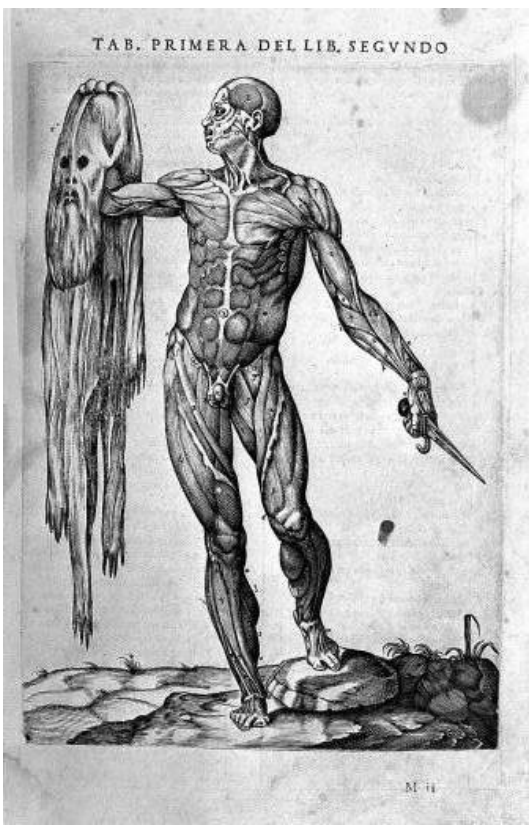

Figure 3.3

prince of this earth, signifies Jesus Christ, while the Unjust Judge stands for Everyman, who is stripped of his evil *humores*".[142]

The Christian idea that the skin was merely the shell for the sinful earthly man and was stripped off at death and replaced by a new skin after resurrection was also present in images of St Bartholomew from the late middle ages and the early modern period.[143] A particularly significant image was the representation of St Bartholomew in Michelangelo's *Last Judgement* in the Sistine Chapel in Rome.[144] It showed the saint in heaven at the feet of Christ wearing a new skin while he was holding his old skin, as if he was about to drop it into the abyss of hell and thereby leave behind his earthly-sinful existence.[145] In Italy the motif of St Bartholomew was adopted in anatomical illustrations showing écorchés holding their own skin, which were strikingly similar to images and statues of the saint such as the statue of the St Bartholomew in the Milanese cathedral (figures 3.2 and 3.3), and the story of Cambyses and Sisamnes was particularly popular in Northern Europe.

The ancient story of the flaying of Marsyas which was a popular topic in late Renaissance and Baroque art became even more important for the meaning of skin in the context of anatomy across Europe.[146] According to the story in Ovid's *Metamorphoses*, the satyr Marsyas was defeated by Apollo in a musical competition, when the muses, who were acting as judges, deemed the god's lute play and singing superior to the satyr's flute play. The price for Apollo's victory was that he could do to Marsyas whatever he wanted and opted for flaying the satyr

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142 Heckscher, *Rembrandt*, 1958, p. 89.

143 L. Price-Amerson, 'Marco d'Agrate's San Bartolomeo: An Introduction to some Problems', in Maria L. Gatti-Perer (ed.), *Il Duomo di Milano. Congresso Internazionale. Milano – Museo della Scienza e della Tecnica – 8, 12 Settembre 1968*, Milan: La Rete, 1968, pp. 189-206, here pp. 190-191.

144 For a easily accessible reproduction of the fresco see Vatican Museum, *Collections Online: Sistine Chapel*, 2003, URL: http://mv.vatican.va/3_EN/pages/CSN/CSN_Main.html (last accessed 08/11/2010).

145 Daniela Bohde, *Haut, Fleisch und Farbe. Körperlichkeit und Materialität in den Gemälden Tizians*. Emsdetten: Ed. Imorde, 2002, pp. 327-328.

146 Jonathan Sawday, 'The Fate of Marsyas: Dissecting the Renaissance Body', in Lucy Gent and Nigel Llewellyn (eds), *Renaissance Bodies: The Human Figure in English Culture, c. 1540-1660*, London: Reaktion Books, 1995, pp. 111-135; Claudia Benthien, *Skin: On the Cultural Border Between Self and the World*, New York: Columbia University Press, 2002, pp. 74-81.

alive.[147] Subsequently the skin was put on display in a temple (or a river, respectively, depending on the version of the story) as a warning to those who were presumptuous enough to challenge the gods and attempt to raise themselves above them.[148] Renaissance interpretations of the ancient myth corresponded to such an interpretation when the fate of Marsyas was regarded as an appeal to modesty and a warning not to make pretentious attempts to leave one's natural place in the world. Accordingly a sixteenth-century emblem which represented the flaying of Marsyas read (figure 3.4):

> When you, Marsyas, would not be content in your own skin, you were flayed by Apollo. […] If you are wise, be happy with your fate and learn to stay [within the boundaries] of your destiny! Be contented with the place nature has allocated you![149]

In the context of anatomy, the motif of the flaying of Marsyas was for the first time explicitly referred to in Vesalius' *Fabrica*. The very first initial of the first book was a large "V", not by coincidence the first letter of the author's name, on which an impression of the story is given (figure 3.5). In the centre Apollo and Marsyas had their musical competition, with the muses as the judges to the left. On the right the outcome was depicted with the satyr tied to a tree and flayed by Apollo. The topos of penal anatomy is repeated in this motif. The victim of the flaying, Marsyas, represented the criminal whose body would be used in the anatomy. While Marsyas

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147 Ovid, *Metamorphoses*, with an English translation by Frank Justus Miller, 2 vols, Cambridge MA: Harvard University Press, 1971, vol. 1, VI, 380-400, pp. 314 and 315.

148 Daniela Bohde, 'Tizians "Schindung des Marsyas". Zur Vielschichtigkeit einer Häutung', M.A. dissertation, University of Hamburg, 1993, p. 10.

149 "Marsya, dum propria non vis in pelle quiesse: / Phoebeis digitis excoriatus obis. / [...] / Si sapis, esse tua contentus sorte memento: / Intra fortunam disce manere tuam. / Quem natura locum tribuit, satis esse putato: /" Nicolaus Reusner, *Emblemata*, 3 vols, Frankfurt: Sigismund Feyerabend, 1631, vol. 3, p. 139; see also Arthur/Schöne, Emblemata, 1996, col. 1744. Emblems are a very important source for the interpretation of early modern images. They usually consisted of three parts with an image in the middle, the *pictura* and with a sometimes cryptic title above, the *inscriptio*. They were usually accompanied by a longer text below, the *subscription*, which was often in verses and gave hint to the interpretation of the picture and the inscription. From the sixteenth well into the eighteenth century emblem books were very common in artist workshops and libraries (Henkel/Schöne, *Emblemata*, 1996, pp. XVI-XVIII). For a detailed account of the origins and development of early modern emblematic see Carsten-Peter Warncke, *Symbol, Emblem, Allegorie. Die zweite Sprache der Bilder*, Cologne: Deubner Verlag, 2005, pp. 43-79.

Figure 3.4

Figure 3.5

Figure 3.6

was punished for his hubris, the criminal was to be punished for his misdemeanours and dissected by the anatomist, who was identified with Apollo, the patron god of medicine.[150] Hence representations of the flayed human skin became in early modern anatomy a complex metaphor, which confirmed the legitimacy of anatomical dissections by a higher divine authority. At the same time the identification of the anatomist with Apollo prevented from the anatomist being identified with the executioner or being associated with other dishonourable professions by his handling of corpses. Meanwhile the flaying and display of the skin could also be interpreted as a warning to all those who doubted the legitimacy of anatomical dissections.[151]

On a title page of an anatomical print the flayed human skin first appeared in the 1586 edition of Juan Valverde de Hamusco's *Anatomia del corpo umano* (figure 3.6).[152] The title was surrounded by an architectural frame with two skeletons in the base sitting to the left and the right of a dissection scene and two men arguing over an opened book. Left and right of the title two écorchés wearing laurel wreaths were made part of the columns which were holding the pediment. Above the capitals, decorated with hourglasses and skulls, an ape and a pig were on top of the edges of the tympanum, and a flayed human skin was stretched between them like a trophy. While the hourglasses and skulls were typical vanitas symbols, the ape and the pig referred to anatomical practice, since during public anatomical dissections not only human bodies were dissected. Towards the end of such events often an animal would be dissected; usually pigs or dogs, but sometimes also apes, which were reputed to have been Galen's favourite subject for dissections.[153]

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150 Carlino, *Books*, 1999, pp. 217-221.

151 Mathias Pozsgai, 'Unmittelbare Vermittlung. Anatomie und Autorschaft in De humani corporis fabrica (1543)', *Zeitsprünge*, 5 (2001), 254-282, p. 281.

152 Juan Valverde de Hamusco *La anatomia del corpo umano*, Venice: Giunti, 1586.

153 Heidegger/Cetto, *Sektion*, 1967, pp. 215-216. In his lecture notes of Vesalius' anatomy lessons in Bologna, for example, Baldasar Heseler described the dissection of a dog (Baldasar Heseler, *Andreas Vesalius' First Public Anatomy at Bologna: An Eyewitness Report by Baldasar Heseler, medicinae scolaris, Together With His Notes on Matthaeus Curtius' Lectures on Anatomia Mundini*, ed. with an introduction by Ruben Erikson, Uppsala: Almqvist and Wiksells Boktryckeri, 1959 pp. 291-292).

The frontispiece to Valverde's *Anatomia* is not merely evidence of anatomical practice and how it was morally legitimized by vanitas motifs. The two écorchés and especially the flayed skin in the tymphanon raised issues of self-knowledge and identity. The usefulness of anatomy as a way of achieving self-knowledge, which was stressed by anatomists time and again, required penetrating the skin. With Valverde the autopsy was understood literally and became a symbol of self-knowledge, which was further emphasized by the illustration showing a standing écorché with its own skin in the raised right hand and the knife as a reference to the self-flaying in the left hand (figure 3.2). In anatomy books of the sixteenth and seventeenth centuries the motif of self-dissection featured regularly and was evidence of a understanding of the skin which referred to a relatively modern concept of the autonomous individual with the skin forming the boundaries of this individual and representing its identity.[154] Although the skin was thought of as a permeable membrane until the turn of the eighteenth to the nineteenth century, penetrating and removing the skin nevertheless signified first and foremost the destruction individual identity.[155] This key role of the skin in representing individual identity was also reflected in Marsyas when he was flayed by Apollo asked the god: "Why do you tear me from myself?"[156] In Marsyas' question the skin was referred to as the defining feature of individual identity, and the satyr's desperate cry indicated self-reflective awareness of this meaning of the skin.

Claudia Benthien interpreted Marsyas' defeat at the hands of Apollo psychoanalytically as the victory of the *ego* over the *id*, whereby the flaying had to be understood as the act when the dualistic self came into existence.[157] However plausible this interpretation of the representation of the ancient mythological story of Apollo and Marsyas and its representation in the context of early modern anatomy might appear, it requires a modern dualistic understanding of subjectivity, based on the hierarchical division of body and consciousness with the latter superior to the former. Yet such an idea of subjectivity was not fully formed until the eighteenth century in images of the dissected body and anatomical dissections. The

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154 On the motif of self-anatomy see Sawday, *Body*, 1996, pp. 110-129.
155 Benthien, *Skin*, 2002, pp. 37-53.
156 "quid me mihi detrahis?" (Ovid, *Metamorphoses*, VI, 385-386).
157 Benthien, *Skin*, 2002, p. 81.

individual and his body remained part of an iconographic programme that established authority over and knowledge of the body through references to ancient authorities, mythological topics, moralising memento mori and the promise of salvation. Both the cosmological analogies and the moralising implications of images of the anatomized body made sure that the fragmented body had a meaning. In itself the fragmented body would not have had any value that could have legitimized anatomical practice and the anatomist as mediators of Divine knowledge.[158]

Such a view was represented earlier by the frontispiece of Thomas Bartholin's (1616-1680) *Anatomia reformata* (1651, figure 3.7).[159] It showed a human skin mounted to a frame which was in a macabre way reminiscent of the crucified Christ. Behind the skin with the author's name and the title of Blankaart's book written on it was a niche in which the reader could look between the legs. Benthien interpreted this skin as a "curtain in front of a mysterious world, nothing of which is yet revealed on the title page".[160] This interpretation might explain the original design of the frontispiece for Bartholin's *Anatomia*, but ignored that the gaze of the onlooker was guided into the space behind the skin where nothing was hidden. What could be seen was rather an explicitly empty space yet to be filled. Therefore this image was an image of transition. The body was no longer integrated into a cosmological model. It could be identified with and consequently lacked the usual iconographic features which would have established common micro-macro-cosmos analogies. What remained with the skin, though, was a moralizing reminder and warning as well as the open question of what constituted human bodily identity. However, the void that was created on Bartholin's frontispiece was not yet filled and it took another two to three decades until a new type of image appeared on the frontispieces of medical-anatomical texts. These images focused on mythological figures, especially Apollo, Athena/Minerva and Chronos.[161]

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158 Sawday, *Body*, 1996, p. 116.

159 Thomas Bartholin, *Anatomia reformata, ex Caspari Bartholini Parentis*, Leiden: Franciscus Hackius, 1651.

160 Benthien, *Skin*, 2002, p. 45.

161 On the iconography of Chronos see Erwin Panofsky, *Studien zur Ikonologie der Renaissance*, Cologne: DuMont, 1997, pp. 117-118. On the iconography of Apollo and Athena/Minerva see Wertz, 'Bildwelt', 1993, pp. 100-103 and 124-

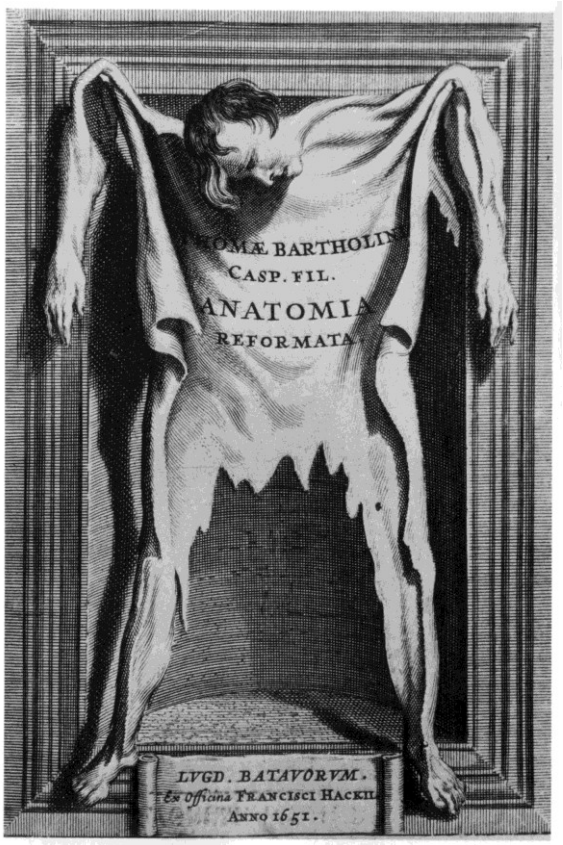

Figure 3.7

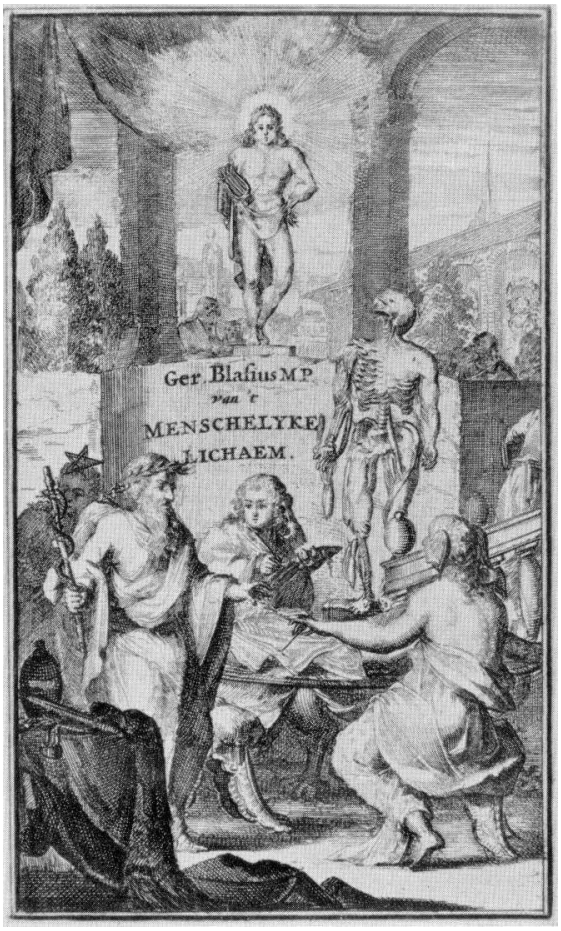

Figure 3.8

The representation of Apollo and Athena/Minerva were hinting at a new understanding of the human body. Apollo was the god of wisdom and healing, Athena/Minerva represented rationality and knowledge and Chronos represented the course of time. He was also regarded as a destroyer but also a revealer of true knowledge. An early example was the frontispiece of Gerard Blasius' (early seventeenth century-c1682) *Ontleeding des menschelyken lichaems* (1675, figure 3.8).[162] In the foreground an anatomical dissection was taking place, which was attended by a personification of anatomy (the female figure with the winged head), Aesculapius on the right and, standing behind him, Hygieia. The fourth person standing behind the table was the author who followed Aesculapius' words and took notes.[163] To the right of the author stood a whole-body specimen, half skeleton, half écorché. So far the frontispiece largely followed contemporary conventions and also Blasius' publications gave no clues to suggest that he held unconventional views about human anatomy and the body.[164] However, the introduction of Apollo as Sol-Apollo standing above the dissection scene signified a decisive shift. He represented the rational human soul separated from the body. This Cartesian division of body and soul not only liberated the rational soul but also created a situation where the body could be subjected by reason as a mere object and naturalized body.[165]

3.2 The identity of the anatomist

Against the background of this Cartesian division of body and soul images such as the frontispiece of Stephan Blankaart's (1650-1704) *Nieuw-hervormde anatomie* (1678, figure 3.9) were ambivalent images that represented the antagonism of the

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125; Hanson Lee, *Kunsttheorie in der Kunst. Studien zur Ikonographie von Minerva, Merkur und Apollo im 16. Jahrhundert*, Frankfurt: Peter Lang, 1996; Patricia Fara, 'Minerva/Athene', *Endeavour*, 34 (2010), 4-5.

162 Gerard Blasius, *Ontleeding des menschelyken lichaems*, Amsterdam: Abraham Wolfgangh, 1675.

163 Heidegger/Cetto, *Sektion*, 1967, pp. 262-263.

164 Heidegger/Cetto, *Sektion*, 1967, figures 182 und 183, p. 486.

165 On the impact of Cartesian philosophy in the Dutch Republic see Jonathan I. Israel, *The Dutch Republic: Its Rise, Greatness, and Fall*, Oxford: Clarendon Press, 1995, pp. 582-587.

Figure 3.9

fragmentation of the body on the one hand and bodily identity on the other hand.[166] Stephen Blankaart's *Anatomia* was a fairly successful book and had seven editions during the last quarter of the seventeenth century in Dutch, Latin and German. However, it could not replace the more popular *Syntagma anatomicum* by Johann Vesling (1st ed. 1647) or Thomas Bartholin's *Anatomia* (1st ed. 1651) as the standard anatomical handbooks.[167] On the contrary, Blankaart was a quite controversial author, and was heavily criticized for his plagiarism by, for example, Philip Verheyen, anatomy professor at Leeuwen at the time. Verheyen complained:

> recently I came across the famous D. Steph. Blancardi Anatomia reformata, the improved or skilful dissection of the human body (I would have said illegible and clumsy, if I was not obliged to accurately report the author's words), in which I found 69 figures taken from mine, and which had been the result of my efforts and been produced on my expense, and because he has not mentioned me at all, or the others derived from mine.[168]

Furthermore Verheyen claimed that Blankaart had not just plagiarised his material and that of other authors, but was also unable to distinguish "the good from the bad, the right from the wrong, and thus he did not care where he would insert which illustration",[169] and thus produced a work full of errors. Nevertheless Blankaart's work is significant in the sense that it represented with its incoherence the breadth of the

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166 On the Cartesian circle around the publisher ten Hoorn, to which Steven Blankaart belonged, and Blankaart's relation to the Dutch physician and promoter of Cartesian ideas Cornelius Bontekoe (1647-1685) see C. Louise Thijssen-Schoute, *Nederlands cartesianisme*, Amsterdam: Noord-Hollandsche Uitg. Mij., 1954, pp. 318-341.

167 Steven Blankaart, *Nieuw-hervormde anatomie*, Amsterdam: Johannes ten Hoorn, 1678; Johann Vesling, *Syntagma Anatomicum: locis plurimis actum, emendatum, novisque iconibus diligenter exornatum*, Padua: Frambotti, 1647.

168 "es ist mir neulich des berühmten D. Steph. Blancardi Anatomia reformata, die verbessert oder die geschickte zergliederung des menschlichen leibes vorkommen, (ich hätte die verderbte und ungeschickte gesaget, wenn ich nicht die worte des Autoris treulich hätte müssen anziehen) in welcher ich 69. Figuren von denen meinen hergenommen, und durch meine mühe und unkosten abgeschildert angetroffen, da er meiner nicht ein einiges mahl darbey erwehnet, noch irgend wo angezeiget, daß die übrigen wären von denen meinen herbracht worden", Philip Verheyen, *Anatomie, oder Zerlegung des menschlichen Leibes, worin alles, was so wohl die alten als neuen Anatomici entdecket und erfunden haben, leicht und deutlich beschrieben, und in kupffer fürgebildet wird*, Leipzig: Thomas Fritschen, 1708, pp. 692-693.

169 "das gute vom bösen, und das wahre vom falschen nicht unterscheiden kann, so sorget er auch wenig darum, welchem er dieses oder jenes bild beyfüget:" Verheyen, *Anatomie*, 1708, pp. 693-694.

anatomical discourse at the end of the seventeenth century and was equipped with dedication poems, author portrait and a frontispiece, some important features of early modern anatomical publications.

The frontispiece of Blankaart's *Anatomia* showed an anatomical dissection, the composition of which is reminiscent of the print *The Anatomy Lesson of Dr. Pieter Pauw* (1615, figure 3.10). It was a copper engraving of average quality by an unknown artist printed in the relatively small octavo format. In the centre stood a table with a dismembered corpse on it, a tub underneath the table and the anatomist to the left of the table. With his left hand the anatomist pointed at a skeleton behind the table while his right hand pointed to the corpse and his face turned towards the onlooker. A young assistant stood in the foreground and offered a plate to the anatomist. On the tiers around the table were more than thirty spectators, who followed the dissection and discussed or studied books – some of the books containing anatomical plates. One person in an elegant dress in the foreground on the left was singled out from the audience in the theatre, and turned towards the reader. On the balustrade, behind the audience, stood two animal skeletons – probably a pig and a dog – and two human skeletons. One of the human skeletons was holding a pole; the other one was leaning on a spade. Those skeletons, just like the animal skeletons at their feet, cited the earlier prints of the anatomical theatre in Leiden (figure 2.9), and the skeletons of the pig and the dog could be understood as references to the animal dissections of the authorities Galen and Vesalius. Between the skeletons hung a flayed human skin with the title of the book written on it.

The decorated anatomical theatre as a setting for an anatomical dissection became a very popular motif for frontispieces of medical and anatomical publications in the Netherlands in the second half of the seventeenth century. By this time the Netherlands were the leading place in Europe, not only for sciences and medicine,[170] but also for the

[170] Harold J. Cook, *Matters of Exchange: Commerce, Medicine, and Science in the Dutch Golden Age*, New Haven: Yale University Press, 2007, p. 2-3. More general on the development of early modern sciences and medicine in Northern Europe see in Harold J. Cook, 'The Cutting Edge of a Revolution? Medicine and Natural History Near the Shores of the North Sea', in J. V. Field and Frank A. J. L. James (eds), *Renaissance and Revolution: Humanists, Scholars, Craftsmen and Natural*

Figure 3.10

book trade.[171] The frontispiece of Blankaart's *Anatomia* has to be seen within the Dutch tradition of representations of anatomical theatres such as the aforementioned *Anatomy Lesson of Dr. Pieter Pauw*, a copper engraving by Andreas Stock (c1580-c1648) after a drawing by Jacques de Gheyn (1565-1629) from 1615 (figure 3.10), which showed a dissection by the Leiden anatomy professor Pieter Pauw (1564-1617).[172] On this print Pauw was shown teaching anatomy in the Vesalian manner in the crowded anatomical theatre in Leiden. He was standing at the table and giving a hands-on lecture to his audience. This new way of doing anatomy was emphasized by the young assistant behind Pauw, who was comparing a text he was holding with the body on the table which was contrasted by the figure of an old man wearing a cap and glasses and reading from a book in the front row to the right without paying attention to the dissection.[173] The scene was dominated by the skeleton holding a banner which read "mors ultima linea rerum" (death is the end of all things). Together with the figure of a young man looking into a mirror on the left which evoked the anatomical motto "nosce te ipsum", which also made the print a stern reminder of the mortality of man. However, as William Schupbach has shown, while in Pauw's case the anatomical motto "know thyself" could be understood as a dark memento mori, the motto could also be interpreted as an encouraging invitation to recognize the divine nature of man.[174]

Philosophers in Early Modern Europe, Cambridge: Cambridge University Press, 1993, pp. 45-61.

171 Rietje van Vliet, 'Print and Public in Europe, 1600-1800', in Simon Elit and Jonathan Rose (eds), *A Companion to the History of the Book*, Chichester: Blackwell, 2009, pp. 247-258; Christiane Berkvens-Stevelinck (ed.), *Le magasin de l'univers: The Dutch Republic as the Centre of the European Book Trade*, Leiden: E. J. Brill, 1992.

172 Cazort/Kornell/Roberts, *Machine*, 1996, pp. 202-206; Hansen, 'Galleries', 1996, pp. 45-46. Hansen dated the print a year later, 1616, when it appeared in a Dutch edition of Vesalius's *Epitome*.

173 A third member of the audience was shown with a book at the top right of the tiers. He was keeping the book, a big folio, firmly closed while arguing with the spectators around him. The three figures using a book in different ways represented different more or less appropriate the uses of book knowledge in anatomical practice, which was expressed in their respective distance from the dissecting table. While the argumentative know-all at the top right was ignorant of book knowledge, the ancient scholar in the front row was completely absorbed by his reading and ignored the actual dissection in front of him. The young assistant, however, diligently compared the empirical results with the text in front of him. Yet the anatomist himself remained closest to the ultimate source of anatomical knowledge, the dissected body in the centre of the image.

174 Schupbach, *Paradox*, 1982, pp. 32-35.

In the Dutch context such pictures put a particularly strong emphasis on the memento mori and memento peccario (reminder of sinfulness), and placed the anatomical dissection within the realms of Christian narrative of salvation. On Blankaart's frontispiece these aspects were referred to through the dissected body, the skeletons on the tiers at the back, and the flayed skin, which served as a cartouche. Yet to understand the function and potential meanings of the frontispiece it is necessary to place it within the wider typographical context of the book. Between the frontispiece and the title page and the main text of the book were Blankaart's dedication of the book to his father, a preface to the reader, an author-portrait, and five dedication poems celebrating the author. The preface and the dedication poems are of particular interest since they legitimized anatomy and attributed the author with the necessary authority. They set out the key topoi of early modern anatomy that were crucial to the interpretation of the frontispiece: self-knowledge, divine knowledge and the relation to the ancient authorities. In the preface to the reader, for example, Blankaart introduced a recurring reference to the ancient Greek philosopher Demonax:

> When Demonax was asked when he would become a wise man, he answered: when he would begin to know himself. This should mean that it would be a big folly to look into high and unknown things, as long as one does not know oneself.[175]

This reference to the Greek philosopher set the tone for what Blankaart regarded as fundamental not only for anatomical knowledge but also for the person of the anatomist himself. For him, as for many other early modern scholars, anatomy was a tool of self-knowledge that would lead to a deeper insight into the nature of creation. To be in a position to gain this higher knowledge Blankaart had to represent himself as a legitimate anatomical authority. In his *Anatomie* this authority was established not at least by a number of dedication poems in which colleagues celebrated Blankaart's skills and knowledge. The physician E. v. Yperen, for example, described the human body in geographical terms as a microcosm which represented the divine creation and was the

[175] Blankaart, *Anatomie*, 1678. Such references to Demonax to justify anatomy as a philosophical exercise in self-knowledge were a common place in sixteenth- and seventeenth-century publications (Schupbach, *Paradox*, 1982, pp. 69, 74, 76 and 78).

temple of the Divine spirit. For him Blankaart had the capability to reveal this knowledge and let his audience access the sacred knowledge of anatomy.[176]

The authority to demonstrate this divine knowledge of the body was attributed to Blankaart also in another dedication poem by his colleague Willem Millandt, a surgeon from Leuwaarden:

> For the sake of Medicine, read BLANCKAART cover to cover,
> He shows the way, and puts you on the track,
> To dissect the most artful Fabric of Nature.
> The experience of the Lord, demonstrates the true reason
> For bringing such a Masterpiece to light,
> Which does not yield for Greek or Roman-Catholic frowned heads;
> So that every Doctor and Master, is fully grateful,
> who promptly dissects and heals, following the directions of Mister BLANCKAART,"[177]

This poem placed Blankaart's work within the contemporary North European discourse of natural philosophy which was based on self-knowledge as the underlying paradigm of anatomical research. Since the fall man was – although created as an image of God – imperfect. Accordingly, knowledge was also imperfect, yet every new anatomical finding would lead to a better understanding of both oneself and the divine creation and would take man closer to God and salvation. Therefore the publication of new books such as Blankaarts' *Anatomia* was justified. At the same time Millandt's dedication poem gave Blankaart even greater authority by rating his knowledge higher than the ancient authorities, i.e. Hippocrates, Galen and Aristotle. The divine nature of Blankaart's anatomy was alluded to by the ambiguous use of the reference to the "heer" in the fourth line, which could refer to both God and Blankaart, and was repeated in the

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176 Blankaart, *Anatomie*, 1678.

177 De Heel-konst tot haar end, lees BLANCKAART door en door;
Hy wijst de weg, en brengt u op het spoor,
Om d'allerkonstigste Natuurs-gebouw t'ontleden.
D'ervarentheyt dees' HEERS, vertoont de waren reden
Om zulken Meester-stuk te brengen in het ligt,
Dat voor geen Grieks of Rooms-gefronste Hoofden zwigt;
Zoo dat een yder Arts en Meester, volle dank baart,
Die stip ontleede en heelt, na, t voorschrift van Heer BLANCKAART
Blankaart, *Anatomie*, 1678. I would like to thank Arlette Fredrik for help with the translation and helpful comments.

last line of the poem.[178] However, this required a high degree of self-reflection on behalf of the anatomist, which was represented by the frontispiece where Blankaart made clear that he was well aware of the religious implications of anatomy and had the necessary self-knowledge that would allow him to reveal the Divine secrets of the human body while remaining humble and conscious of his own sinfulness and mortality.

Key to this self-reflexive understanding of anatomy was on the frontispiece to Blankaart's *Anatomie* the flayed human skin. It showed the ambivalence of the anatomical discourse, as well as its far reaching consequences for the early modern human body and identity. On the one hand it represented individual identity, which was reflected in Ovid's *Metamorphoses* by Marsyas. On the other hand the labelled skin on the frontispiece of Blankaart's *Anatomie* made the anatomical dissection a practice, where the anatomist objectified the body by inscribing his name on the skin, and thereby claimed his authority to produce knowledge of the dissected body. However, the flayed skin also gave the anatomical dissection a moralising meaning and raised the question of the anatomist's identity. A closer look at the face of the anatomist by the table and the face on the flayed skin revealed striking similarities. The long hair, the short fringe, the high cheekbones, the bulbous nose and the sharp dimpled chin repeated the author's portrait on the flayed skin.[179] These significant features could also be found on the author portrait in Blankaart's 1678 edition of his anatomical handbook (figure 3.11). The double portrait of the author on the frontispiece meant that the representation of the anatomical dissection on the frontispiece not only stood for the objectification of the human body.

At first glance the self-identification of the anatomist with the anatomised body – usually the corpse of an executed criminal – seems bizarre: Why should an honourable man like the successful physician Blankaart identify himself with a criminal? The double portrait of the author represented the self-appropriation and self-identification of the anatomist with the objectified body, which hinted at the paradox of early modern bodily identity. While the subject was identified with the body, the body itself had been objectified by science and medicine. At the same

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178 This ambiguity results from the various meanings of the Dutch word "heer", which can mean anything from gentleman and sir to mister to lord.

179 Heidegger/Cetto, *Sektion*, 1967, p. 246.

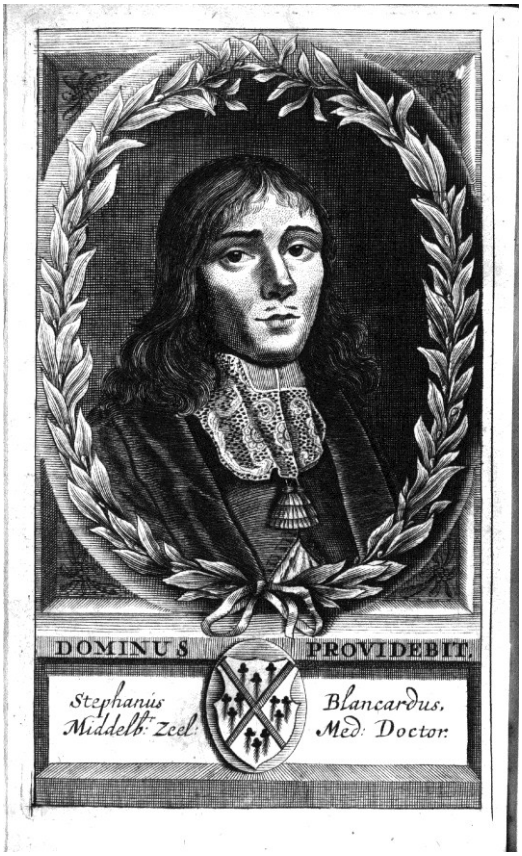

Figure 3.11

Figure 3.12

Figure 3.13

Figure 3.14

time the skin as a title cartouche represented the key role of the anatomical discourse to make the body meaningful. Without the context of anatomy and its cosmological and moral implications, the body would have remained an empty shell, which was filled by the knowledge of the anatomist. In the case of Blankaart's *Anatomie* the double portrait of the author was not due to inconsistent iconography, but a deliberate decision which was meant to underline the authority of the author. The anatomist not only represented himself with the authority to reveal the secrets of God's creation in the human body. He also represented himself as someone who was aware of his own sinfulness and subjected himself to the will of God. Thus he appeared as someone who had already acquired a higher level of self-awareness. The skin on the frontispiece with the author's portrait could therefore be interpreted as a skilful play with the motif of self-knowledge. The labelled skin underlined the importance of signification to develop an understanding of the body. Furthermore, the iconography of early modern anatomy separated the anatomist from the executioner by linking him to Apollo. It also put the anatomical dissection within the realms of Christian salvation history and banished the threat the criminal body posed to the honour of the anatomist. The authority of the anatomist was strengthened by representing him as a self-aware individual. This then put him into a position where he was in charge of both the anatomical knowledge of the human body and his own identity.

Blankaart's strong desire for legitimisation could be explained by the fact that he was not in a position which would have allowed him to publicly dissect in the anatomical theatre of the Guild of Surgeon-Anatomists of Amsterdam. He was neither praelector for the guild, nor was he in any other position that would have allowed him to use the title "professor". Blankaart was merely a physician in Amsterdam, though one with a flourishing practice. His publications could have been an attempt both to advertise his medical practice and achieve a higher position in the medical hierarchy in Amsterdam.[180] However, the second Dutch edition of Blankaart's *Anatomie*, edited by the same publisher, Johannes ten Hoorn, came with a different frontispiece (figure

[180] Harry A. M. Snelders, 'Steven Blankaart (1650-1702), Verfasser des von Johann Heinrich Schulze (1687-1744) herausgegebenen Lexicon medicum', in Wolfram Kaiser (ed.), *Johann Heinrich Schulze (1687-1744) und seine Zeit*, Halle: Abteilung wissenschaftliche Publizistik der Martin-Luther-Universität Halle-Wittenberg, 1988, pp. 163-172, here p. 163.

3.12).[181] Now the scene of the dissection could no longer so easily be associated with the anatomical theatre in Leiden. On the frontispiece of the German edition of Blankaart's *Anatomie* (1691, figure 3.13),[182] for which the former image had been used as a model, a significant change had been made to the appearance of the anatomist, who was now dressed like a university professor, with academic gown and hat. It seems that by illegitimately adopting the identity of a university professor, Blankaart was trying other strategies to give his authorship the necessary authority. This was probably to a certain extent economically motivated, and intended to increase the sales potential of his book. After all Blankaart's *Anatomie* was moderately successful and he was even more successful with other projects, especially his medical dictionary, which saw at least twenty-six editions by the end of the eighteenth century.[183] Whether Blankaart also tried to obtain a higher position in the surgeons' guild in Amsterdam or an academic position remains unclear. In any case, the different frontispieces to Blankaart's *Anatomie* represented legitimate strategies to establish his authority as a self-conscious, honourable and learned anatomist.

3.3 Skill, knowledge and the aesthetics of anatomy

During the last four decades of the seventeenth century a significant number of anatomical frontispieces were published in the Netherlands that used key features of the frontispiece to Blankaart's *Anatomie*.[184] The first of these frontispieces was printed for Johann Vesling's *Ontleedinge des menscheliken lichaems* (1661, figure 3.14).[185] It showed a dissection in a crowded anatomical theatre with a group of men, one of them holding an open book with anatomical plates, immediately around the table with the anatomist, who was giving a hands-on demonstration. On the rear wall of the theatre was mounted a cabinet with surgical instruments and the scene was flanked by a

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181 Steven Blankaart, *Nieuw-hervormde anatomie ofte ontleeding des menschen lichaams*, Amsterdam: Johannes ten Hoorn, 1686. The frontispiece of the 1687 Latin edition was identical (Heidegger/Cetto, *Sektion*, 1967, Cat. 184, p. 486).

182 Steven Blankaart, *Reformierte Anatomie, oder Zerlegung des menschlichen Leibes*, Leipzig: Moritz Georg Weidmann, 1691.

183 Snelders, 'Blankaart', 1988, pp. 171-172.

184 Heidegger/Cetto, *Sektion*, 1967, catalogue numbers 162, 163, 165, 176, 184, 185, 188, 190, 194 and 195.

185 Johann Vesling, *Ontleedinge des menscheliken lichaems*, Amsterdam: Gerrit Sweerman, 1661 (1st ed., Latin, 1647).

skeleton with a spade to the left and an écorché wearing its own skin over the right shoulder to the right. The key motifs of the dissection in an anatomical theatre in the Vesalian manner, the human skin again referring to the flaying of Marsyas, the judgement of Cambyses or St. Bartholomew, and finally the skeleton leaning on a spade as a symbol for the fall of man appeared to be commonplace. Their association with anatomy and their legitimizing function seemed to be widely accepted, at least among the learned readership of medical and anatomical texts.

During the same period an iconography became more important in Dutch anatomical frontispieces which was less preoccupied with the moral value of anatomy and since the 1670s more and more images were published that featured Sol-Apollo, Minerva, Chronos, Asclepius, Hygeia and other allegorical figures as key figures. Although some of these figures such as Asclepius, Hygeia and allegorical figures of anatomy, diligence and ingenuity had been introduced to the iconography of anatomy in the sixteenth century (figure 3.8), this indicated a shift which suggested that for a learned audience virtues such as anatomical skills and knowledge became more important. Minerva was the goddess of wisdom and knowledge and the triumphant Sol-Apollo the patron of medicine who also symbolized rationality, while Chronos stood for the ability to reveal the hidden knowledge inside the body. Some aspects of moralizing anatomy were still represented by these figures, when Chronos on the frontispiece of Govert Bidloo's *Anatomia humani corporis* (1685, figure 3.15),[186] for example, could also be understood as a memento mori symbolizing with his hourglass the passing of time and mortality. However, the lack of an explicitly moralizing iconography on other frontispieces suggests that there was less of a necessity for anatomists to constantly worry about the legitimacy of anatomical practice and their social status as honourable and dignified men. This would also explain why moralizing motifs appeared on anatomical frontispieces only infrequently during the early eighteenth century after their peak in the last third of the seventeenth century.

Further evidence of the beginning of changes in the notion of anatomical practice and anatomists were two anatomical group portraits of 1670 and 1683 that featured Frederik

[186] Govert Bidloo, *Anatomia humani corporis centum et quinque tabulis tabulis par artificiosissimum G. de Lairesse ad vivum delienatis illustrate*, Amsterdam: Widow of J. à Someren, Heirs of J. à Dyk, H. & Widow of T. Boom, 1685.


GODEFRIDI BIDLOO
Medicinæ Doctoris et Chirurgi
ANATOMIA
HUMANI CORPORIS
Centum et quinque tabulis
ILLUSTRATA.

Figure 3.15

Ruysch, praelector of the guild of surgeons-anatomists in Amsterdam at the time (figures 3.16 and 3.17).[187] The first painting by Adriaen Backer (c1636-1684) showed the young Ruysch, who had only been appointed to his post in 1666, demonstrating the lymphatics which he pulled from an incision on the upper left thigh of the young looking male body on the table in front of him.[188] He was surrounded by six surgeons and in two niches in the wall of the surgeon's theatre behind the dissecting scene stood sculptures of Apollo on the left and Asclepius on the right. The second painting by Jan van Neck (1634-1714) showed a different and more intimate scene in an unspecified room. Ruysch was now painted holding the umbilical cord of a newborn that was still attached to the placenta. The child was placed in front of him and he was surrounded by a number of surgeons who were moved a lot closer to the table than the audience on the previous group portrait. The boy holding the skeleton of an infant was a portrait of Ruysch's son Hendrik who was at the time already twenty years old.[189]

Both paintings of Ruysch's anatomies hung in the building of the anatomical theatre in Amsterdam and still addressed issues of mortality and could be understood in a memento mori tradition. In the 1673 painting matters of life and death were made obvious in the almost untouched body on the table which had not yet lost its life-like colour and appeared to be sleeping rather than dead, but had already been subjected to the knife of the anatomist. The 1683 painting was even more explicit in introducing the skeleton of an infant. This was not just typical memento mori iconography but also played on Ruysch's anatomical collection in which he kept numerous wet and dry specimens of foetuses and infants, often arranged together with moralizing mottos.[190] However, at least as important as these aspects were the skills and knowledge of Ruysch as a master anatomist that were the main topic of the paintings. On the earlier painting

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187 For a comprehensive account of Frederik Ruysch's biography and work in their context of Dutch medical culture of the late seventeenth and early eighteenth century see Luuc Kooijmans, *De doodskunstenaar: De anatomische lessen van Frederik Ruysch*, Amsterdam: Bert Bakker, 2004.

188 Norbert E. Middelkoop, ''Large and magnificent Paintings, all pertaining to the Chirurgeon's Art': The Art Collection of the Amsterdam Surgeon's Guild', in Norbert E. Middelkoop, Petria Noble, Jørgen Wadum and Ben Broos (eds*), Rembrandt Under the Scalpel: The Anatomy Lesson of Dr. Nicolaes Tulp Dissected*, The Hague: Mauritshuis, pp. 9-38, here p. 28.

189 For more details on the two paintings see Hansen, 'Galleries', 1996, pp. 33-38.

190 Julie V. Hansen, 'Resurrecting Death: Anatomical Art in the Cabinet of Dr Frederik Ruysch', *Art Bulletin*, 78 (1996), 663-679, pp. 670-671.

Figure 3.16

Figure 3.17

this was on the one hand emphasized by the two statues in the background that gave Ruysch authority. On the other hand what he was actually demonstrating was equally important.

In the painting by Baker, Ruysch was pulling lymphatic vessels from the incision he had made on the thigh, which was a reference to his superior anatomical skills and knowledge. Preparing these delicate vessels was extremely difficult and Ruysch was well known for being engaged with research on the lymphatics after his dispute with the Flemish scholar Louis de Bils (1624-1670) on whether the lymphatics contained valves or not.[191] Equally, the dissected newborn on the table and the infant skeleton in the painting by van Neck were references to Ruysch's anatomical skills and knowledge. When visitors of Ruysch's anatomical collection reflected on their visits they frequently used aesthetic rather than moral categories to describe their experience. Zacharias Konrad von Uffenbach was not the only one who was fascinated by the high quality of Ruysch's specimens, which were valued highly across learned Europe for their lifelike quality, and in 1717 Ruysch managed to sell his complete collection to Tsar Peter the Great of Russia.[192] With the explicit reference to his anatomical achievements, Ruysch shifted the emphasis away from moral values associated with anatomy to other virtues. In this public statement he stressed that what defined him as a learned anatomist were primarily his skills and expertise.

On the two portraits by Backer and van Neck, both Ruysch as anatomist and his anatomical specimens embodied a period of transition in early modern anatomy. While they still represented the values of traditional moralizing anatomy, they also marked a shift towards a stronger focus on aestheticized anatomy. In the two group portraits with Ruysch moralizing anatomy was still present in the setting of the anatomical theatre as well as the moral implications of the dissection of an executed criminal and the juxtaposition of Ruysch's son depicted as a young boy with the skeleton of an infant he was holding.[193] Meanwhile both paintings focused on Ruysch's anatomical achievements, skills and knowledge, which was also reflected in contemporary

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191 On Ruysch's work on the lymphatics and his dispute with de Bils see chapter 5.2 and Cunningham, *Anatomist*, 2010, p. 282.

192 Hansen, 'Death', 1996, p. 673.

193 The corpse on the dissecting table was the body of the criminal Joris van Iperen, who had been executed by hanging. Hansen, 'Galleries', p. 35.

responses to Ruysch and his work, which often praised the artistry of his specimens.[194] However, with their focus on craftsmanship the two portraits were also embedded in a visual culture in the Netherlands that valued highly skilled and detailed realistic depictions of the natural world.[195] Yet this different approach to the representation of anatomy had significant effect on Ruysch's (self-)image when he was first and foremost regarded as a scholar, artist and entrepreneur rather than a moral authority.

During the eighteenth century the notion of anatomy as art became crucial in reshaping the identity of the anatomist. Art and anatomy had been closely intertwined since the Renaissance and anatomists frequently sought the help of artists to produce anatomical illustrations, while artists attended anatomical dissections or even dissected themselves.[196] Art and anatomy also shared an interest in how to adequately represent the human body and drew on similar aesthetic ideas.[197] Yet both were restricted by conventions such as the moralizing meanings associated with anatomy. Art, however, was defined by the genres and iconography but also neo-classical art theory which regarded ideal beauty as the highest artistic achievement. This new aesthetic language closely linked beauty to truth and gave anatomists a new vocabulary to discuss their

194 Hansen, 'Death', 1996, pp. 673-674. Hansen argued that Ruysch's anatomical specimens were by his contemporaries considered as works of art.

195 Svetlana Alpers, The *Art of Describing: Dutch art in the Seventeenth Century*, London: Penguin, 1989. Ruysch's daughter Rachel (1663-1750) was herself one of the leading still-life painters in late seventeenth- and early eighteenth-century Dutch art, specializing in almost hyper-realistic flower arrangements (Bob Haak, *The Golden Age: Dutch Painters of the Seventeenth Century*, Zwolle: Waanders Publishers, 2003, p. 500).

196 Schultz, *Art*, 1985; Deanna Petherbridge, 'Art and Anatomy: The Meeting of Image and Text', in Deanna Petherbridge and Ludmilla Jordanove (eds), *The Quick and the Dead*: Artists and Anatomy, Berkeley: University of California Press, 1997, pp. 7-98; Kemp/Wallace, *Bodies*, 2000.

197 In the case of Vesalius' Fabrica, for example clear connections can be made between antique sculpture as well as Renaissance architecture and the representation of the anatomical body (Glenn Harcourt, 'Andreas Vesalius and the Anatomy of Antique Sculpture', *Representations*, 17 (1987), 28-61; Matteo Burioni, '*Corpus quod est ipsa runia docet*. Sebastiano Serlios vitruvianisches Architekturtraktat in seinen Strukturäquivalenz zum Anatomietraktat des Andreas Vesalius', *Zeitsprünge*, 9 (2005), 50-77). The relation between art theory and anatomy and how it affected the visual representation of the anatomical body will be discussed in more detail in the chapters 5 and 6.

subject, the human body.[198] With the aestheticized discourse of anatomy a different image of the anatomist evolved, when he was no longer portrayed as the revealer of secret divine knowledge hidden in the human body, but rather as a gentleman of refined manners, taste and/or scholar of exceptional intellectual virtues such as detailed knowledge and great manual skills.

Such a new image was epitomized, for example, in three portraits of the British anatomist, man-midwife and successful entrepreneur William Hunter (1718-1783).[199] The earliest portrait (c1764-1765, figure 3.18) by the Scottish painter Allan Ramsay (1713-1784), a friend of Hunter's, showed the sitter in elegant dress as member of polite society. The simple composition, lack of attributes that would indicate Hunter's profession and the soft colours underlined this. Ludmilla Jordanova interpreted this painting as an icon of upward mobility.[200] More about the profession of the sitter was revealed in another portrait by Mason Chamberlain (c1722-1787), which he painted for

198 A number of the most influential anatomists of the eighteenth century such as Siegfried Albinus, William Hunter, Petrus Camper and Samuel Thomas Soemmering century were engaged with art theory and important contributors to the neo-classical aesthetic discourse (Hendrik Punt, *On 'Human Nature': Anatomical and Physiological Ideas in Eighteenth Century Leiden*, Amsterdam: B.M Israël B.V., 1983; Martin Kemp, 'True to Their Natures: Sir Joshua Reynolds and Dr William Hunter at the Royal Academy of Arts', *Notes and Records of the Royal Society of London*, 46 (1992), 77–88; Miriam Claude Meijer, *Race and Aesthetics in the Anthropology of Petrus Camper (1722-1789)*, Amsterdam: Rodopi, 1999; Sigrid Oehler-Klein, 'Anatomie und Kunstgeschichte. Soemmerings Rede Über die Schönheit der antiken Kinderköpfe vor der Société des Antiquités in Kassel (1779)', in Manfred Wenzel (ed.), *Samuel Thomas Soemmering in Kassel (1779-1784). Beiträge zur Wissenschaftsgeschichte der Goethezeit*, Stuttgart: Steiner, 1984, pp. 189-239). See also Chapters 5.4, 5.5 and 6.5.

199 William F. Bynum, Roy Porter (eds), *William Hunter and the Eighteenth-Century Medical World*, Cambridge: Cambridge University Press, 1985. William Hunter was just like his brother John (1728-1793) a keen collector who gathered a huge collection of anatomical objects, natural history and art. The Hunterian anatomy school in London was a centre of polite society in the eighteenth century and housed the collection. William Hunter's collection went to Glasgow after his death, while John Hunter's collection today belongs to the Royal College of Surgeons in London (Lawrence Keppie, *William Hunter and the Hunterian Museum in Glasgow, 1807-2007*, Edinburgh: Edinburgh University Press, 2007; Simon Chaplin, 'John Hunter and the 'museum oeconomy' 1750-1800', PhD thesis, Kings College London, 2009).

200 Jordanova, *Features*, 2000, pp. 158-163; Jordanova, 'Men', 1997, pp. 109-110.

Figure 3.18

Figure 3.19

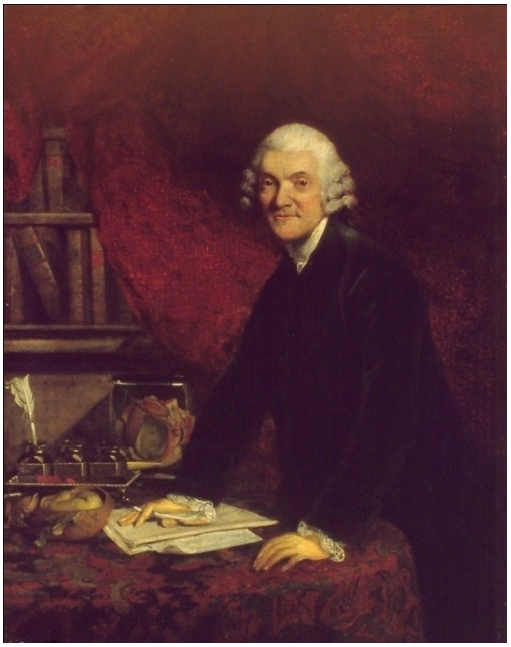

Figure 3.20

Figure 3.21

his diploma work at the Royal Academy in 1769 (figure 3.19).[201] It showed Hunter holding an écorché which indicated his involvement at the newly founded academy as lecturer for anatomy and represented Hunter's professional role. However, it also showed that he was a connoisseur of art when he was holding a typical attribute of artists.[202] The last portrait by Sir Joshua Reynolds (1723-1792), commissioned posthumously by the University of Glasgow, to which Hunter had donated his collection, represented another aspect of Hunter's professional identity (1787, figure 3.20).[203] It showed Hunter standing at a table with a quill in his hand and paper as well as a cast or anatomical model of a child in the womb, a wet specimen of a gravid uterus and a book shelf behind him. The portrait used a similar visual language as Reynolds had employed just about a year earlier in a portrait of William Hunter's brother John (1786, figure 3.21). Aris Sarafianos and Ludmilla Jordanova have argued that the portrait of John Hunter provided the model for a new image of medicine which idealized the "new medical scientist".[204] Similarly, the portrait of William Hunter represented him as a scholar working on a topic where he had his greatest achievements which culminated in his most famous publication, his *Anatomia uteri humani gravidi* (1774),[205] a series of large and exquisitely drawn prints of the pregnant uterus.[206] Hunter's anatomical skills were represented by the specimens on the table while his

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201 Since the Royal Academy is not prepared to waive copyright fees for PhD theses and insists on a ten-years time limit applying to the version of this thesis in the online repository of Durham University a reproduction of this image has not been included. Instead an enamail copy of the portrait kept at the Hunterian Museum in Glasgow has been used in this thesis. For a good-quality reproduction of Chamberlin's original painting see, Peter Black (ed.), *"My Highest Pleasures": William Hunter's Art Collection*, London: The Hunterian, University of Glasgow in association with Paul Holberton Publishing, 2007, p. 47.

202 The relation between art and William Hunter's anatomy is discussed in Peter Black, 'Taste and the Anatomist: William Hunter's Art Collections: His Paintings, and the Representation of Art in his Library', in Peter Black (ed.), *"My Highest Pleasures": William Hunter's Art Collection*, London: The Hunterian, University of Glasgow in association with Paul Holberton Publishing, 2007, pp. 63-97, here pp. 93-97. On William Hunter at the Royal Academy see Martin Kemp, *Dr William Hunter at the Royal Academy of Arts*, Glasgow: University of Glasgow Press, 1975. For an example of the écorché as a typical attribute for artists see chapter 5.5 (figure 5.17).

203 Lawrence, *Hunter*, 2007, p. 37.

204 Sarafianos, 'History', 2006, pp. 105-107; Jordanova, 'Men', 1997, pp. 110-112.

205 William Hunter, *Anatomia uteri humani gravidi*, Birmingham and London: J. Baskerville, & S. Baker & G. Leigh, et al, 1774.

206 On Hunter's plates of the pregnant uterus and the aesthetic values they represented see chapters 6.1 and 6.5.

knowledge and the innovative character were evident in the blank page in front of him, ready to be filled by words describing his new findings the closed books behind him could not reveal.

The three portraits of William Hunter were painted by some of the leading British portrait painters of the eighteenth century, who also belonged to the circles in which Hunter socialized.[207] While the first portrait by Ramsay might have been an expression of Hunter's social ambitions, Mason's painting was an acknowledgement of Hunter's authority; not only as an anatomist but also as an artist. The portrait commissioned by the University of Glasgow, however, was a celebration of Hunter's scientific achievements and allowed the faculty to claim him as one of their own. Together, the portraits of William Hunter embodied an image of the anatomist as gentleman and member of polite society, connoisseur and master of art as well as skilful and learned anatomist.

Such a (self-)image of the anatomist originated from a shift in the perception and representation of anatomy and a changing notion of those who practiced anatomy from the end of the seventeenth century onwards. By the second half of the eighteenth century, anatomy as a profession which regarded skill, knowledge and elegance as its highest virtues had found a congenial partner in neo-classical art theory which highly valued the skilful imitation of classical art in the pursuit of true beauty. The new Enlightenment aesthetics not only reshaped the image of the anatomist but also the representation of the anatomical body.[208] In the three portraits of William Hunter the body was literally in the hands of the artist-anatomist when Hunter was holding the écorché in the portrait by Chamberlin. Meanwhile for the man of science on Reynold's

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[207] Ramsay and Reynolds were two of the leading British artists of their generation and Reynolds became president of the new Royal Academy in 1768 (on their work see Alastair Smart, *Allan Ramsay: A Complete Catalogue of His Paintings*, New Haven: Yale University Press, 1999; David Mannings, *Sir Joshua Reynolds: A Complete Catalogue of His Paintings*, New Haven: Yale University Press, 2000). Mason Chamberlain was slightly less prominent, but still painted portraits of illustrious sitters such as Benjamin Franklin, Prince Edward and Princess Augusta. On all three artists as well as Hunter's involvement with the London art scene see William T. Whitley, *Artists and Their Friends in England, 1700-1799*, 2 vols, London: The Medici Society, 1928.

[208] For a detailed discussion of the relation between neo-classical art theory and the production of "truthful" visual images of the body see chapters 5.4 and 6.5.

painting the anatomical subject remained a blank page which only he could fill with his defining knowledge of the nature of the human body. As far as Hunter was concerned, the anatomical body in turn had no longer defining power for his own identity as a member of polite society, which was obvious in the conspicuous absence of references to Hunter's profession in the portrait by Ramsay. The body did no longer raise issues of honour, dignity or decency but appeared in the three portraits only as an aestheticized object of the curiosity and knowledge of William Hunter as a respectable man of science.

3.4 Conclusions

The objectifying (visual) discourse of eighteenth-century anatomy drew heavily on the language of contemporary art theory and artistic practices.[209] It was driven by the aim to achieve ideal beauty that was in turn associated with truth, both to be found in nature. "Nature was the model, the final court of appeal for all art and science – but nature refined, selected, and synthesized."[210] Therefore the role of the Enlightenment anatomist became fundamentally different from that of his predecessors when he no longer revealed a truth hidden inside the body, but became the creator of anatomical knowledge. The epistemological shift towards this new role began towards the end of the seventeenth century and was significant for overcoming the problems created by the anatomical renaissance. The philological approach of Renaissance anatomy had sought to go back to the original source of anatomical knowledge, the human body itself, but created doubts and uncertainties. The aim of anatomy in the Vesalian manner was to correct the mistakes of ancient Hippocratic and Galenic anatomy and create a true idea of the human body. However, the results of the dissections carried out by sixteenth- and seventeenth-century anatomists raised numerous questions about the exact appearance, structure and functions of the body.

From the middle of the sixteenth century, the understanding of human anatomy and physiology underwent fundamental changes. Anatomical structures that used to be integral to the human body and its functions disappeared while new structures appeared. At the same time physiological concepts, for example, the production of blood and

[209] Sarafianos, 'History', 2006, pp. 103-105.
[210] Daston/Galison, *Objectivity*, 2007, p. 82.

blood circulation or the understanding of reproductive processes, changed fundamentally. The uncertainties about the early modern anatomical body were also reflected in the visual representations of the anatomical body, and in the following chapters I will discuss how they were reflected in the visual representations of anatomical objects that became obsolete such as the rete mirabile or new anatomical objects such as the lymphatics. The example of the unborn will be used to show how the visual representations shaped notions and ideas about the anatomical body when the particular object of inquiry maintained its presence, but was conceptualized in new ways. These case studies will allow me to show how anatomists tried to deal with the uncertainties of their subject. I will argue that cosmological concepts of the body became a less and less convincing model to accommodate uncertainty and that by the end of the eighteenth century the aestheticized anatomical body had become a more successful model that allowed people to treat the body as an object of scientific inquiry.

4. Representations of the rete mirabile in early modern anatomy[211]

In this chapter the rete mirabile, conceived of as a conglomerate of arterial vessels at the base of the skull in Galenic anatomy, will be used as an example to discuss the visual and rhetorical strategies used by early modern anatomists to accommodate uncertainty in their accounts of the human body. The rete mirabile is a significant example that shows how anatomy struggled to establish iconographic coherence of this contested anatomical structure and how this contributed to its disappearance from human anatomy before the aestheticized visual language of mid-eighteenth-century anatomy. For early modern anatomists the rete mirabile was an enigmatic structure in the human body exercising physiological key functions. This elusive structure became a matter of considerable debate in the sixteenth century, yet still appeared throughout the seventeenth and into the eighteenth century. Even today the term still features in surgical papers, but the rete mirabile of the twenty-first century is not an anatomical structure anymore but has become a pathological symptom.[212] The 'wonderful net'[213] was usually described as made up from arteries at the base of the skull, but its existence in man, exact appearance and function was heavily contested among early modern anatomists. In tracing the history of this obscure structure, one finds that the uncertainty about the nature of the rete mirabile began to develop in the sixteenth century when its Galenic interpretation as a vital organ, which extracted the animal spirits from the blood, was first doubted by the anatomist and professor of medicine in Bologna, Berengario da Carpi (1460-1530). He claimed that he could not find such a structure during his dissections of human corpses and attributed the production of the animal spirits to the branches of the internal carotid artery in the pia mater.[214] A couple of

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211 An earlier version of this chapter has been published in *Medical History* (Sebastian Pranghofer, '"It could be Seen more Clearly in Unreasonable Animals than in Humans": The Representation of the Rete Mirabile in Early Modern Anatomy', *Medical History*, 53 (2009), 561–586).

212 Pranghofer, 'Representation', 2009, p. 561.

213 Throughout the text the terms 'rete mirabile' and 'wonderful net' will be used synonymously.

214 [Jacopo] Berengario da Carpi, *A Short Introduction to Anatomy = isagogae brevis*, transl. with an introduction and historical notes by L. R. Lind with anatomical notes by R. G. Roofe, Chicago: University of Chicago Press, 1959 (1st ed., Latin, 1522), p. 147; Edwin Clarke, C. D. O'Malley, *The Human Brain and the Spinal Cord: A Historical Study Illustrated by Writings From Antiquity to the Twentieth Century*,

decades after da Carpi had raised his doubts, Andreas Vesalius dismissed the existence of a rete mirabile in human beings in his *Fabrica*. Nevertheless, the rete mirabile in man did not disappear after Vesalius, but remained part of the medico-anatomical discourse.

In the historiography of European anatomy, the rete mirabile has usually been used as an example to illustrate the innovative character of Vesalius' *Fabrica* – the work which has so often been considered to be a turning point in the history of European anatomy.[215] According to this well established narrative the example of the rete mirabile shows how Vesalius managed to go beyond the Galenic dogma.[216] But little work has been done on the post-Vesalian history of the wonderful net. The most comprehensive historical account of the rete mirabile so far, by John M. Forrester, covered accounts of the rete mirabile from antiquity to the twentieth century. He described the different ideas of the wonderful net both in human and comparative anatomy and traced the structure's path into modern zootomy. However, Forrester did little to illustrate the debates among early modern anatomists and their unease with the topic. Also, he neither acknowledged the continuous references to the rete mirabile in human bodies during the eighteenth century nor did he discuss the use of the term in twentieth-century clinical medicine.

The fact that the rete mirabile survived the Vesalian challenge in the sixteenth century reflected its standing as a well-established anatomical object. But the survival of the rete mirabile was only possible through various coexisting assertions about its appearance, nature and function. Both in the Vesalian critique and in subsequent accounts of the rete mirabile in the seventeenth and eighteenth centuries, visual representations were used by authors as part of their argument. This historical inconsistency of scientific knowledge raises the question whether and how such images represented reliable visual information. In order to understand the complex functions and meanings of scientific

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2nd ed., San Francisco: Norman Publishing, 1996, pp. 764-767; French, *Dissection*, 1999, p. 137.

215 For a critical appraisal of this view see Cunningham, *Renaissance*, 1997, pp. 88-142.

216 For the older literature see e.g. O'Malley, *Vesalius*, 1964, pp. 178-179. For a more recent account see Andrew Wear, 'Medicine in Early Modern Europe, 1500-1700', in Lawrence I. Conrad, Michael Neve, Vivian Nutton, Roy Porter, and Andrew Wear (eds), *The Western Medical Tradition: 800 BC to AD 1800*, Cambridge: Cambridge University Press, 1995, pp. 279-280.

images in early modern anatomy, they have to be seen as part of rhetorical and narrative strategies to negotiate truth and not merely the representations of a particular truth.[217] Illustrations of the rete mirabile, together with written accounts of the wonderful net, are analyzed in this chapter with regard to how they established the rete mirabile in human bodies as a matter of fact. In order to understand the persistence of the rete mirabile I trace its changing appearances from the Vesalian critique to its virtual disappearance from human anatomy. I draw on both the specialized literature on the anatomy of the brain from the sixteenth to the end of the eighteenth century as well as on general anatomical handbooks. This selection of sources not only allows the study of the dissemination of ideas. The inclusion of the most relevant handbooks makes it possible to assess what might be regarded as widely accepted or "standardized" knowledge.

The first part of this chapter introduces the traditional Galenic idea of the rete mirabile as well as its corresponding visual representations, and discusses the sixteenth-century challenges to this concept. In the second part, seventeenth-century debates on the rete mirabile, including the Galenists' refusal to accept the new Vesalian anatomy on the one hand and the new physiologies of the rete mirabile on the other hand, are reconstructed. This is followed by a discussion of the developments which led to the disappearance of the rete mirabile from human anatomy in the eighteenth century. The chapter finishes with some suggestions on how to understand the ambiguity, especially of visual representations, of the rete mirabile, and how this reflected strategies to overcome the empirical and conceptual uncertainties surrounding this structure. I will argue that the lack of a coherent iconography of the rete mirabile and conceptual changes in anatomy were crucial when it was easy to drop it from illustrations and finally ignore it completely in accounts of human anatomy.

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[217] On the rhetoric of early modern scientific images see Sachiko Kusukawa, 'The Uses of Pictures in the Formation of Learned Knowledge: the Cases of Leonhard Fuchs and Andreas Vesalius', in Sachiko Kusukawa and Ian MacLean (eds), *Transmitting Knowledge: Words, Images, and Instruments in Early Modern Europe*, Oxford: Oxford University Press, 2006, 73-96. The descriptive-empirical nature of seventeenth-century Dutch art is discussed in Alpers, *Art,* 1983, pp. 99-109. New methods of standardizing visual representations in the eighteenth century are the topic of Stafford*, Body*, 1991.

4.1 The Galenic understanding of the rete mirabile and the Vesalian challenge

In Galen's (131-c200 AD) anatomy and physiology the rete mirabile played a crucial role. It was described as a network of fine vessels, into which the carotid artery branched out at the base of the cranium.[218] For Galen the importance of this delicate structure was obvious: "For wherever Nature wishes material to be completely elaborated, she arranges for it to spend a long time in the instruments concocting it."[219] The function Galen attributed to the rete mirabile was to refine the vital spirit in the blood into the animal spirit, or psychic pneuma, which was seen as a requirement for reasoning and regarded by Galen also as the driving force behind bodily functions and movement.[220] This idea of the rete mirabile as a vital organ remained unchallenged in the Western medical tradition until the sixteenth century.[221] Visual representations of this important organ from this early period are scarce, and the depiction of a human head in *Antropologium de hominis dignitate* (1501) by Magnus Hundt (1449-1519) of the University of Leipzig is probably the only model for pre-Vesalian depictions of the rete mirabile.[222] This rather schematic representation of the human head was still used more than three decades later by Johann Dryander (end of fifteenth century-1560), who was anatomist at the University of Marburg, for his *Anatomiae* (1537).[223] This

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218 Galen, *De usu partium, English: Galen on the Usefulness of the Parts of the Body*, transl. from the Greek with an introduction and commentary by Margaret Tallmadge May, 2 vols, Ithaca: Cornell University Press, 1968, pp. 430-431.

219 Galen, *Usu*, 1968, p. 432.

220 Galen, *Usu*, 1968, p. 432. For a detailed account of Galen's complex concept of pneumatic elaboration and the physiology of the rete mirabile see Julius Rocca, *Galen on the Brain: Anatomical Knowledge and Physiological Speculation in the Second Century AD*, Leiden: Brill, 2003, pp. 208-219. On the pre-Vesalian understanding of the rete in European anatomy see Cunningham, *Renaissance*, 1997, pp. 49-51.

221 Cunningham, *Renaissance*, 1997, pp. 249-253.

222 John M. Forrester, 'The Marvellous Network and the History of Inquiry into Its Function', *Journal of the History of Medicine and Allied Sciences*, 57 (2002), 198-217, p. 204.

223 Magnus Hundt, *Antropologium de hominis dignitate, natura et proprietatibus, de elementis, partibus et membris humani corporis*, Leipzig: Wolfgang Stöckel [printer], 1501, fol. 2v; Johann Dryander, *Anatomiae, hoc est corporis humani dissectionis pars prior, in qua singula quae ad caput spectant recensentur membra, atque singulae partes, singulis suis ad vivum commodissime expressis figuris, delineatur,* Marburg: Eucharius Ceruicorus, 1537, fol. 14r and fol. 28r with the index on fol. 27v. The illustration from Hundt's *Antropologium* is reproduced in Edwin Clarke and Kenneth Dewhurst, *An Illustrated History of Brain Function:*

illustration showed a human head with the different ventricles of the brain and the different senses mapped and indexed (figure 4.1). On both Hundt's and Dryander's illustrations the rete mirabile was represented by a hatching pattern above the nose. Neither of these illustrations represented the wonderful net in a naturalistic way resembling some organic form. Also, neither gave an indication of its precise topographical location or physiological relations according to the traditional Galenic account.

A year after Dryander, Andreas Vesalius published an illustration of the rete mirabile in relation to the vascular system in his *Tabulae anatomicae sex* (1538). On the third plate Vesalius depicted the wonderful net at the top in the centre, in the middle of the head as a conjuncture of blood vessels (figure 4.2).[224] At least until 1540, Vesalius still firmly believed in the existence of a rete mirabile in man, and saw it in the centre of the "noblest" of the three cavities of the body, the skull.[225] By that time, however, he had already adopted a new view of where the animal spirit was produced in place of the rete mirabile and now suggested that the choroid plexus should be regarded as the organ which refined the vital spirit. Vesalius thereby shared Berengario da Carpi's view of the physiology of the cerebral vascular system, but it took him a few more years to conclude that the the rete mirabile simply did not exist in human bodies. Comparative dissections of human and animal cadavers had convinced Vesalius that Galen must have been wrong.[226] In 1543, in the *Fabrica*, Vesalius criticized other physicians for their blind belief in Galen's authority and accounts of the "wonderful plexus reticularis" (i.e. the rete mirabile):[227]

> The netlike plexus in all its glory is a good example of the often quite unreasonable degree of regard paid to Galen (easily the chief of the professors of dissection) by the physicians and anatomists who follow his teachings. [...] It is a favourite topic of discussion by physicians,

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Imaging the Brain From Antiquity to the Present, 2nd ed., San Francisco: Norman Publishing, 1996, figure 32, p. 28.

224 Vesalius, *Tabulae*, 1538.

225 According to Baldasar Heseler's minutes of Vesalius' anatomical demonstrations at Bologna in 1540, Vesalius demonstrated the rete mirabile in the head of a sheep during his fifteenth demonstration and in a human head during his twenty-fifth demonstration. Heseler, *Vesalius*, 1959, pp. 221 and 289. On Vesalius struggling with the rete mirabile during dissections see French, *Dissection*, 1999, pp. 167-168.

226 Mitchell, *Island*, 2007, pp. 303-304.

227 "mirabilis plexus reticularis", Vesalius, *Fabrica,* 1543, p. 642.

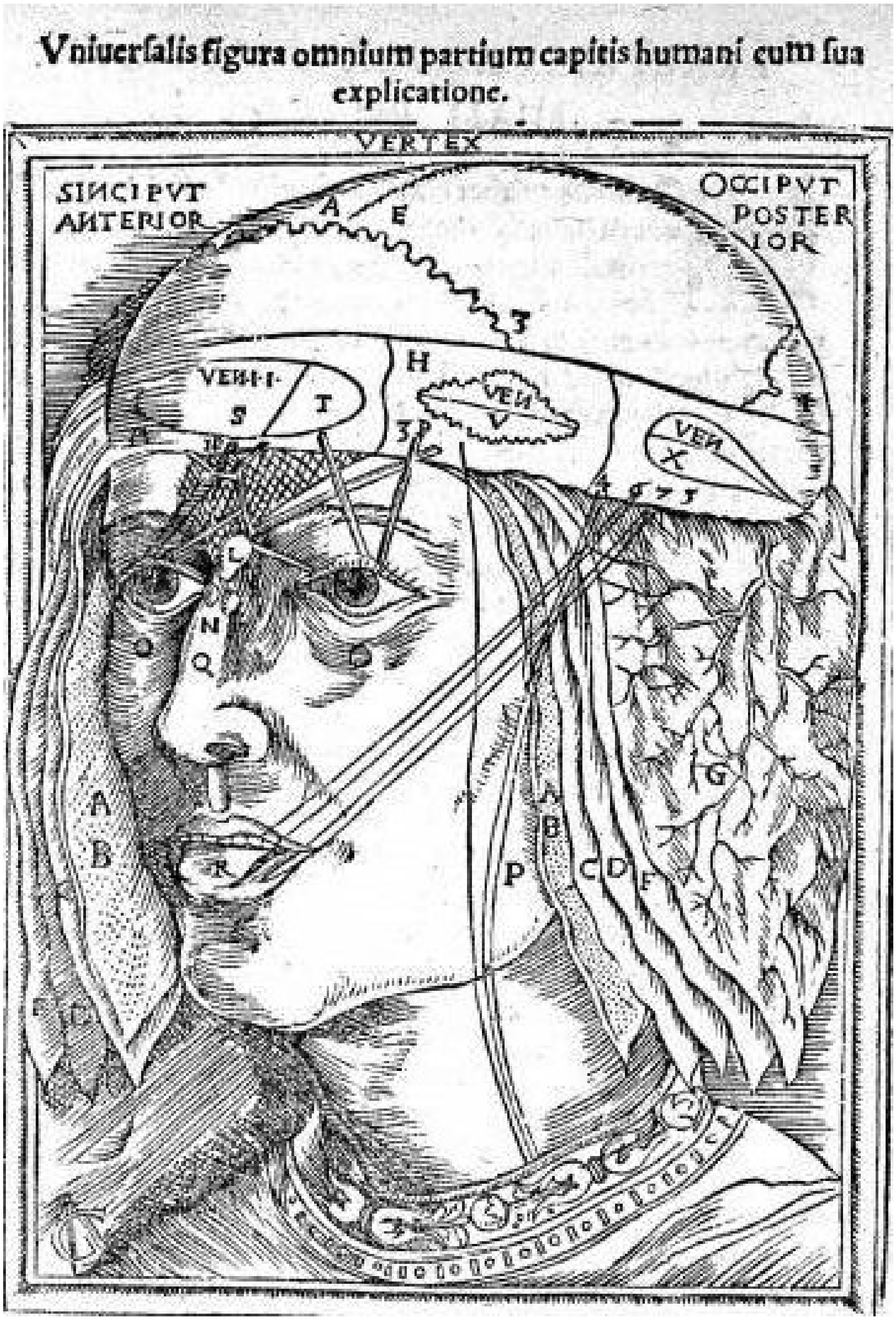
Vniuersalis figura omnium partium capitis humani cum sua explicatione.
VERTEX
SINCIPVT ANTERIOR
OCCIPVT POSTERIOR
VEN
VEN

Figure 4.1

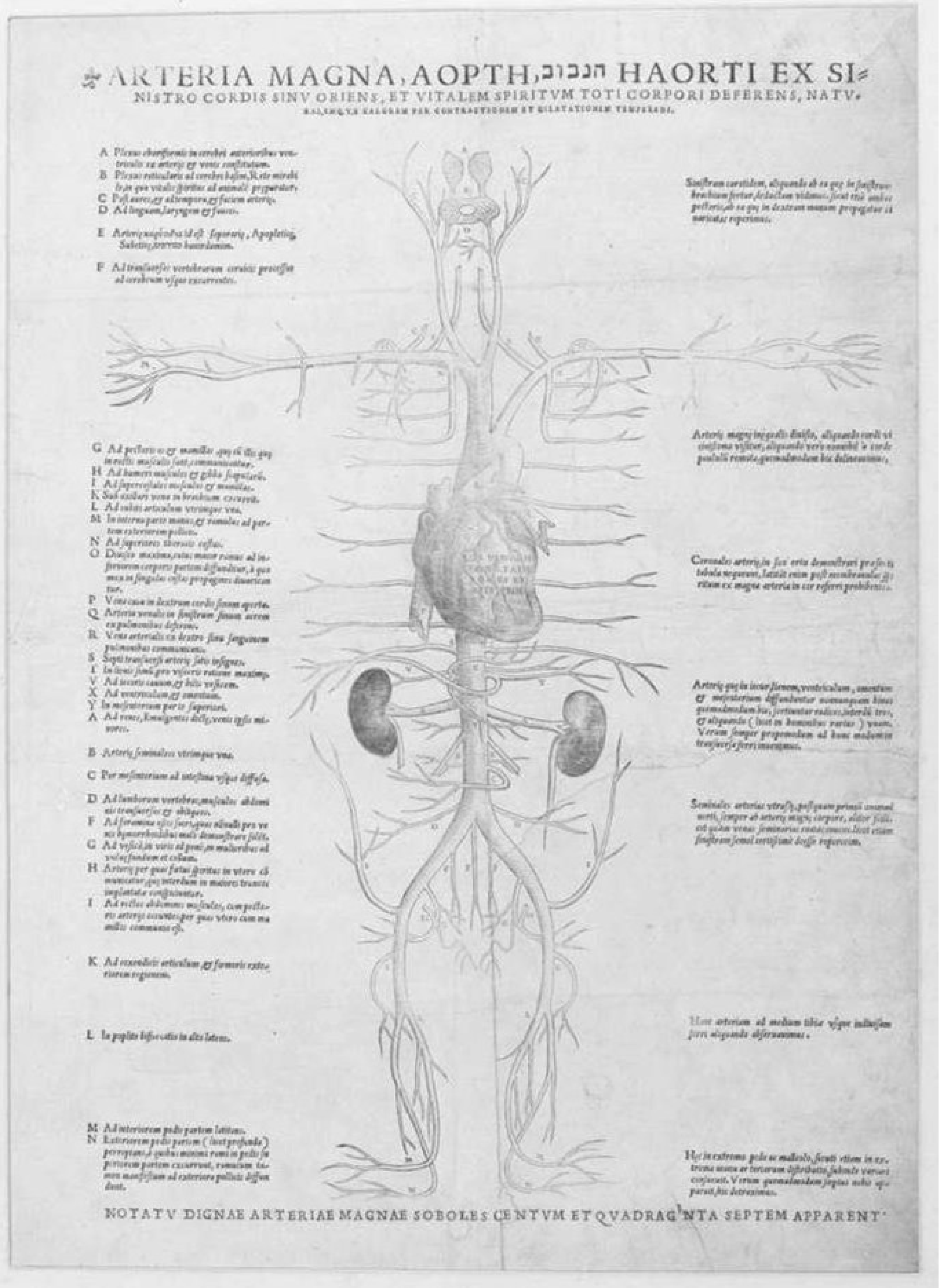
ARTERIA MAGNA, AOPTH, HAORTI EX SINISTRO CORDIS SINV ORIENS, ET VITALEM SPIRITVM TOTI CORPORI DEFERENS, NATV-
NOTATV DIGNAE ARTERIAE MAGNAE SOBOLES CENTVM ET QVADRAGINTA SEPTEM APPARENT

Figure 4.2

> who use Galen's terms to describe it even if they have never seen it (and they certainly never done so in a human body). But passing over the others I cannot set bounds to my astonishment at my own stupidity and excessive trust in the writings of Galen and other anatomists.[228]

In order to prove the Galenic assumptions about the rete mirabile wrong and make up for his omission, Vesalius added his own detailed description of the course of the carotid artery into the head, which was based on his own dissections.[229]

However, Vesalius still added an illustration to *De humani corporis fabrica* which represented a rete mirabile: "In this figure we have shown what the plexus would have to be like in order to conform to Galen's descriptions in *On the Function of the Parts*."[230] He thereby demonstrated that he was well familiar with Galenic anatomy and in the passage where he discussed the rete mirabile he insisted that his "only reason for mentioning these cerebral plexus was so that I should not seem to have left out of this book anything pertaining to the structure of the brain".[231] Yet Vesalius' illustration of the rete mirabile had no resemblance to earlier representations of the organ, except for the hatched structure (figure 4.3). Usually in the *Fabrica* the organs would be illustrated both individually and within their topographical context. The rete mirabile, however, was only shown on its own and not in relation to the brain. By isolating the wonderful net from the rest of the body, without showing it in situ on any other illustration in the *Fabrica*, Vesalius used the image as an argument. He made his point that the Galenic rete mirabile did not exist in human bodies by literally removing it from human anatomy.[232]

However, with Vesalius' denial of the existence of a rete mirabile in human beings the structure did not disappear from the anatomical discourse. Far from it, most anatomical handbooks from the second half of the sixteenth until the early eighteenth century discussed it, and many also included illustrations reaffirming the wonderful net. Some

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228 Andreas Vesalius, O*n the Fabric of the Human Body: A Translation of De Humani Corporis Fabrica Libri Septem*, transl. by William F. Richardson in collaboration with John B. Carman, 5 vols, Novato: Norman Publishing, 1998-2009, vol. 5, 2009, p. 217.

229 Vesalius, *Fabrica*, 1543, pp. 642-643.

230 Vesalius, *Fabric*, vol. 5, 2009, p. 159.

231 Vesalius, *Fabric*, vol. 5, 2009, p. 218.

232 On Vesalius' use of images as part of an argument see Kusukawa, 'Uses', 2006, pp. 87-89.

DECIMASEXTA SEPTIMI LIBRI FIGVRA.

HAC figura nudam depinximus glandem, qua cerebri pituita excipitur, unà cum pelui seu infundibulo pituitam huc deferente, & hic flaccido propendente. A lateribus uerò arteriarum soporalium portiones, quæ reticularem plexum efformare dicuntur, ita hic expressimus, uti nobis inter secandum occurrere. Atq; ut eæ arteriarum portiones uariè se se cautibus offerunt, ita quoq; uariè eas delineauimus.

A Glans, cerebri pituitam excipiens.

B Peluis, seu infundibulum cerebri pituitam super modò dictam glandem deferens.

C,C Arteriarum portio, quæ secundum suorũ in osse caluariæ foraminum ductũ obliquè ferũtur.

D Sinistræ arteriæ ramus in duræ membranæ sinistrum latus excurrens.

E Arteriæ sinistræ portio per proprium foramen ad narium usq; amplitudinem pertingens.

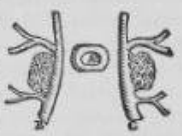
F,F Hac sede diuersam arteriæ seriem delineauimus. ac dextrum quidem F arteriam notat ea serie ductam ut hic non dirimatur: quemadmodum sinistrum F arteriam hanc in duos ramos, qui mox in unum rursus coeunt, insinuat.

G Arteriarum portiones duram cerebri membranam perreptantes, ac partim in cerebri uentriculos, partim in tenuem membranam cerebri basi obductam digesti.

H Propago arteriæ per foramen secundi paris neruorum cerebri caluariam excidens, ac neruum uisorium, ac dein oculum petens.

DECIMASEPTIMA LIBRI SEPTIMI FIGVRA.

HAC figura plexum finximus, cuiusmodi is esse deberet, qui Galeni in
A,B. *libris de Vsu partium descriptionibus conueniret. Significet itaq; hic A*
& B arterias caluariam subeuntes, moxq; in mirabilem illũ plexum diffu-
C,D. *sas. C uerò & D ramos in quos plexus illius propagines colligũtur, quiq;*
illis prorsus arteriarum magnitudine respondent, quas A & B indicauimus. Cæterùm E glandem notat, pituitam cerebri excipientem.



PRAESENTI figura arteriarum sub dura cerebri mẽbrana cõsistentium, ac ad glandis cerebri pituitam admittentis latus reptantium seriem depinximus, quam in ouium ac bouum capitibus obseruamus. Atq; hãc proponere libuit, ne quis nos latère arbitraretur, quæ illorum animalium hic cum homine sit differentia. Significat autem in hac figura A dictam iam sæpius glandem, B & C arteriarum sedem, qua primum in caluariam ingrediuntur.

DECIMAOCTAVA SEPTIMI LIBRI FIGVRA.

PARVA hac figura erectam finximus pelum, seu cyathum, quo cerebri pituita in glandem ipsi subditum distillat. ac dein hic finximus quatuor ductus à glande pituitã per proxima glandi foramina deferẽtes. Indicet igitur A glandem, cui pituita instillatur. B peluim, qua hæc ducitur. C, D, E, F uerò, meatus ad faciliorem pituitæ huc decũbentis egressum paratos. Porrò præter has septimi libri figuras, ad earum potissimum cognitionem spectantes quæ in caluariæ habentur amplitudine, etiam huc facilũt duæ figuræ mox ad finem primi Capitis libri quarti additæ, & septem parium neruorum cerebri delineationem exprimẽtes: quas quum illic prolixè indicauerimus, abs re prorsus esset easdem hic quoq; reponere, et earũ indicẽ ascribere. Præterea figuræ oculi constructionem exprimentes, etiam si ad septimum referantur librum, tamen Capiti decimoquarto duntaxat illas præponam, quod oculorum fabricæ dedicabitur. Atq; id in illis figuris priuatim faciam, quòd nulli alteri quàm dicto iam Capiti famulentur.

CB.

Figure 4.3

authors such as the Spanish anatomist Juan Valverde (born after 1525) promoted the Vesalian denial of the status of the rete mirabile. He adopted many modified illustrations from Vesalius' *De humani corporis fabrica*, but left the illustration of the rete mirabile unchanged.[233] However, influential and well published anatomists like Andreas Laurentius (1558-1608) and Jean Riolan the Younger (1577-1657), who was a fierce critic of Vesalius, did not abandon the Galenic doctrine of the rete mirabile.[234] Riolan gave a detailed description of the topographic anatomy of the rete mirabile, citing authors such as Niccolo Massa (1485–1569) and Sylvius (Jacques Dubois, 1478-1555) and rejected Vesalius' claims that the organ did not exist in human bodies.[235] Laurentius had no doubts that the rete mirabile existed in humans and even included illustrations representing the organ, which were copied after Valverde's plates.[236]

When taking a closer look at illustrated anatomical handbooks it becomes evident that it was not necessarily Vesalius' anatomy which was adopted, but his illustrations which were copied and circulated. While Vesalius' extensive use of illustrations did not find many immediate imitators,[237] seventeenth-century authors did not ignore the new visual standards set out by Vesalius' *Fabrica*. In the publications by Laurentius, for example, the Vesalian representations of the rete mirabile were used as a model for its

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233 Juan Valverde, *Anatome corporis humani*, Venice, Juntarius, 1589 (1st ed., Italian, 1559), Tab. II, Lib. V, Fig. XVII, p. 255.

234 Forrester, 'Network', 2002, p. 208. Laurentius, Bauhin and Riolan held chairs for anatomy at the universities of Montpellier, Basel and Paris, respectively. Andreas Laurentius was also probably the most successful author of anatomical handbooks in the first three decades of the seventeenth century. His *Historia anatomica humani*, Frankfurt: Matthaeus Becker and Theodor de Bry, 1599 saw eleven editions between 1599 and 1628.

235 Jean Riolan, *Anthropographia et osteologia*, Paris: D. Moreau, 1626, pp. 389-390; Jacques Dubois, *In Hippocratis et Galeni physiologiae partem anatomicam isagoge*, Basle: Jacob Derbilley, 1556, pp. 246-247; Nicolo Massa, *Anatomiae liber introductorius, in quo quamplurimae partes, actiones, atque utilitates humani corporis, nunc primum manifestantur: quae a ceteris tam veteribus, quam recentioribus hucusque praetermissa fuerant*, Venice: J. Zilletus, 1559, p. 85.

236 Andreas Laurentius, *Historia anatomica humani corporis et singularium eius partis multis controversiis & observationibus novis illustrata*, Paris: I. Mettayer [printer], 1600 (1st ed. 1599), p. 391. The rete mirabile is illustrated in figure XVII on p. 209.

237 Vivian Nutton, 'Representation and Memory in Renaissance Anatomical Illustration', in Fabrizio Meroi and Claudio Pogliano (eds), *Immagini per conoscere: dal rinascimento alla rivoluzione scientifica*, Florence: L. S. Olschki, 2001, pp. 61-80, here pp. 76-78.

illustration.[238] It appears that the authors of the most successful anatomical handbooks from the late sixteenth century and the first half of the seventeenth century did not seize Vesalius' denial of the human rete mirabile and opposed at least parts of Vesalian anatomy. However, the illustrations in the *Fabrica* did not establish a universal iconographic standard for the visual representation of anatomy.[239] More than the illustrations themselves, Vesalius' ambition to overcome the older, not very detailed and often schematic representations became a new focal point of anatomical illustrations.[240]

Vesalius' illustrations were not the only iconographic model for anatomical illustrations. Some of the frequently copied anatomical illustrations in the seventeenth century, which also followed a naturalistic approach, were done after the plates in Adriaan van der Spiegel's (1578-1625) *De humani corporis fabrica* (1627). They were originally the work of his predecessor on the chair of anatomy at the University of Padua, Julius Casserius (1552-1616), and added by Spiegel's editor.[241] Among the illustrations in Spiegel's anatomical handbook was a new depiction of the rete mirabile, which significantly differed from the Vesalian iconography (figure 4.4).[242] In Spiegel's illustration the wonderful net was not represented in isolation, but in relation to the brain, its nerves and blood vessels. The illustration represented the brain from below after it has been separated from the spinal cord and cleaned from surrounding tissue. The rete mirabile (indexed with the letter "L") branched out from the carotid artery

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238 Laurentius, *Historia*, 1600, p. 209; Caspar Bauhin: *Theatrum anatomicum*, Frankfurt: Matthaeus Becker, 1605, Lib. III, Tab. XI, Fig. XIV, p. 560.

239 On Vesalius' visual paradigm in general see Kusukawa, 'Uses', 2006. On the different and controversially debated modes and concepts for an appropriate visual representation of the anatomical body see Kemp, 'Truth', 1993, and especially with regard to the eighteenth century, see James Elkins, 'Two Conceptions of the Human Form: Bernhard Siegfried Albinus and Andreas Vesalius', *Artibus et Historiae*, 7 (1986), 91-106; Stafford, *Body*, 1991, pp. 108-118; Katja Regenspurger and Patrick Heinstein, 'Justus Christian Loders *Tabulae anatomicae* (1794-1803). Anatomische Illustration zwischen wissenschaftlichem, künstlerischem und merkantilem Anspruch', *Medizinhistorisches Journal*, 38 (2004), 245-284, pp. 256-259.

240 Vesalius' design of his anatomical illustrations also intended to provide naturalistic representations of the human body. They were thought to help those who were not able to attend dissections on a regular basis themselves. Vesalius, *Fabrica*, 1543, fol. 3v-4r.

241 Choulant, *History*, 1921, p. 255.

242 Adriaan van der Spiegel, 'De humani corporis fabrica', in Adriaan van der Spiegel, *Anatomica, operum omnium. Tomus I*, Amsterdam: Johannes Blaeu, 1645 (1st ed. 1627), Lib. X, Tab. X, p. 93.

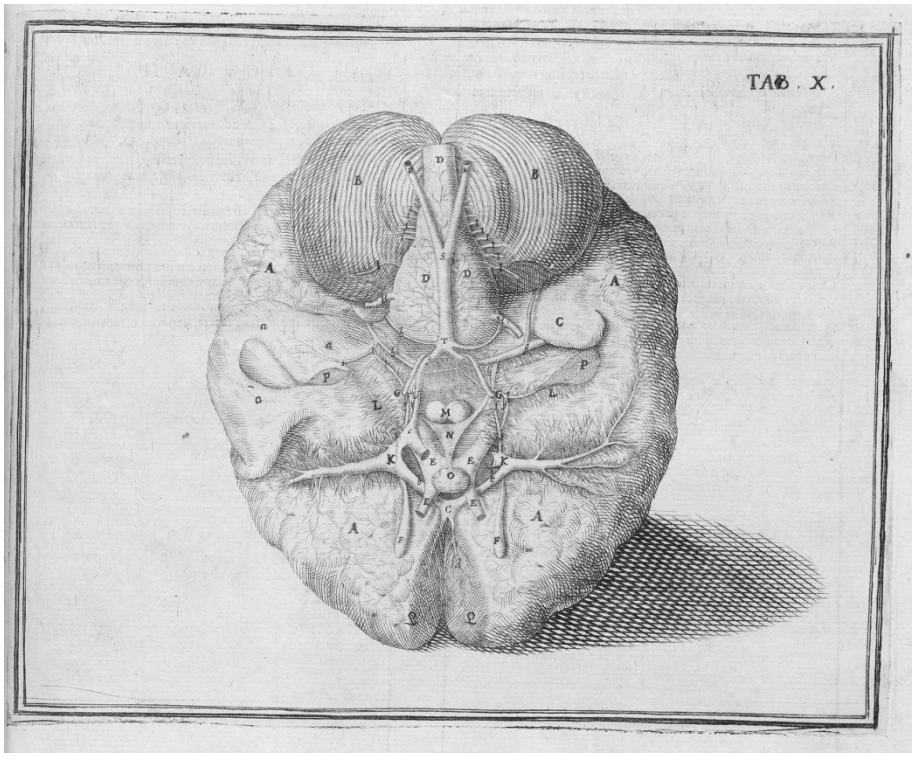

Figure 4.4

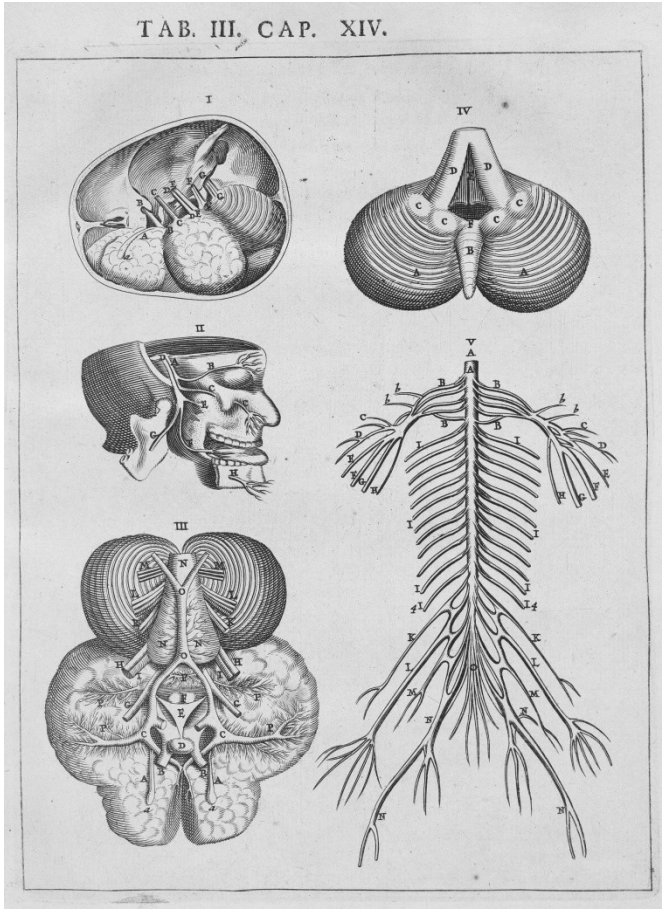

Figure 4.5

(indexed with the letter "K"). The branches representing the rete mirabile were depicted in a naturalistic way and resembled the blood vessels surrounding the brain. There was also no similarity to the hatched structure of the rete mirabile in Vesalian and older illustrations. While Spiegel had no doubt that the rete mirabile existed in humans, he admitted that it was difficult to find and better visible in sheep.[243]

Difficulties to identify the exact situation and appearance of the wonderful net were also reflected in the illustrations to the work of Johan Vesling (1598-1649). Vesling was one of Spiegel's successors to the chair of anatomy at the University of Padua, and his *Syntagma anatomicum* (1641) was the most successful anatomical handbook of the second half of the seventeenth century with sixteen editions in Latin, German, Dutch and English. On page 195 figure III represented the brain from below, in a similar way as in the illustration in Spiegel's *De humani corporis fabrica* (figure 4.5). However, unlike in the illustration in Spiegel's work, the rete mirabile (indexed with the letter "P" on figure 4.5) did not branch off the carotid artery and merged into the plexus choroides (indexed with the letter "P" on figure 4.4), but was simply represented by branches which came off the carotid artery (indexed with the letter "C" on figure 4.5) and then spread over the surface of the brain.[244]

Vesling's written account of the appearance and the function of the rete mirabile was remarkable in two respects. Firstly, he upheld the idea of the existence of a rete mirabile in man, although he admitted, that "it could be seen more clearly in unreasonable animals than in humans".[245] Secondly, Vesling followed the traditional Galenic account of the physiology of the rete mirabile by ascribing to it the same function of extracting the animal spirits from the blood. However, a few pages earlier this function had been

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243 Adriaan van der Spiegel, *De humani corporis fabrica libri decem, tabulis XCIIX aeri incisis [...] nec ante hac visis exornati [...] opus posthumum*, Venice: Deuchinus, 1627, p. 317.

244 Johann Vesling, *Syntagma Anatomicum. Locis plurimis actum, emendatum, novisque iconibus diligenter exornatum*, Padua: Frambotti, 1647 (1st ed. 1641), Tab. III, Cap. XIV, Fig. III.

245 "wiewohl solches [the rete mirabile] in etlichen unvernünftigen Thieren klärer alß in dem Menschen zu sehen." Johann Vesling, *Kunstliche Zerlegung Menschlichen Leibes, Lateinisch geschrieben, und mit vielen schönen Figuren gezieret [...]*, Leiden: Wyngaerden, 1652 (1st ed., Latin, 1641), p. 132.

ascribed to the plexus choroides as well.[246] Thereby Vesling identified an organ that could fulfil the physiological function of the rete mirabile, in case a rete mirabile could not be found. By abandoning the rete mirabile as the sole producer of the animal spirits, he paved the way for new physiological explanations of this structure, but he also made the rejection of its existence in humans possible. Vesling's other important idea was that the different appearance of the rete mirabile in human cadavers and animals could indicate a difference in mental capacities and allow a distinction between man and "unreasonable animals".[247] Both ideas became important themes in the anatomical discussion of the rete mirabile in the seventeenth and eighteenth centuries. These debates were initiated by the new research interest in the anatomy and physiology of the brain from the 1650s which was based on iatromechanistic concepts but also relied on empirical observation.

4.2 New physiologies of the rete mirabile in the seventeenth century

During the second half of the seventeenth century the structure and function of the brain attracted increasing interest from anatomists and resulted in the publication of three groundbreaking works on the anatomy of the brain within just eleven years, between 1658 and 1669: Johann Jakob Wepfer's (1620-1695) *Observationes anatomicae* (1658), Thomas Willis' (1621-1675) *Cerebri anatome* (1664), and *L'anatomie du cerveau* (1669) by Nicolaus Steno (1638-1686). While Wepfer's study was particularly concerned with apoplexy, Willis provided the first comparative handbook on the anatomy and physiology of the brain. Compared with these two comprehensive works, Steno's little treatise appeared to be the least significant, but was an important methodological account and a "programme for brain research",[248] as well as a pointed critique of both the traditional anatomical teaching in Paris and Cartesian theories of the brain.[249] This short methodological treatise clearly set out a new epistemological foundation for empirical, iatromechanistic brain research. Steno advocated an

246 Vesling, *Zerlegung*, 1652, p. 128.
247 Vesling, *Zerlegung*, 1652, p. 132.
248 Nicolaus Steno, *Lecture on the Anatomy of the Brain*, ed. by Gustav Scherz, Copenhagen: A. Busck, 1965 (1st ed., French, 1669), p. VII.
249 G. Stern, 'Introduction: Niels Stensen's Discourse', Nicolaus Steno, *Lecture on the Anatomy of the Brain*, ed. by Gustav Scherz , Copenhagen: A. Busck, 1965, pp. 61-103, here pp. 74-77.

"anatomical method" which was based on the assumption that a more detailed knowledge of the structure of the brain would lead to better understanding of its function.[250] By this method a most accurate dissection of the brain would follow the nerves through the substance of the brain to their origins.[251] Although Steno did not mention the wonderful net in his treatise, his method was designed to solve the major problem caused by doubts of the existence of a rete mirabile in man: the question where the animal spirits were produced. Since these spirits were distributed by the nerves, following the nerves to their origin would have led the anatomist to the source of the animal spirits.

Following such a deductive approach Johann Jakob Wepfer, town physician in Schaffhausen in Switzerland, had carried out his study on apoplexy a few years earlier.[252] His book started with four case histories of patients who had suffered from a fatal cerebral haemorrhage.[253] This was followed by an account of apoplexy which included a review of the medical literature on the topic in the style of traditional Humanist commentaries.[254] Subsequently a more detailed pathological discussion of the

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250 William Bynum argued that the "anatomical method" was the predominant method of anatomical/physiological research until the early nineteenth century and was also used by Thomas Willis. William F. Bynum, 'The Anatomical Method, Natural Theology, and the Function of the Brain', *Isis*, 64 (1972), 444-468, p. 446.

251 Steno, *Lectures*, 1965, pp. 7-9. On Steno's method see also Adolf Faller, 'Die Präparation der weißen Substanz des Gehirns bei Stense, Willis und Vieussens', *Gesnerus*, 39 (1982), 171-193, pp. 176-180.

252 Wepfer's research was methodologically rigorous and based on accurate observation. He adopted a similar approach in his work on toxicology (Andreas-Holger Maehle, *Johann Jakob Wepfer (1620-1695) als Toxikologe*, Aarau: Sauerländer, 1987, p. 127).

253 Regarding the innovative character of Wepfer's work see Clarke/O'Malley, *Brain*, 1996, pp. 769-775. Clarke and O'Malley credited Wepfer with providing the final proof that the rete mirabile was absent in man (p. 769) and also underlined his contributions to the anatomy of the brain by giving the hitherto most accurate account of the cerebral vascular system (p. 771). On Wepfer's anatomy in general see Henry Nigst, *Das anatomische Werk Johann Jakob Wepfers (1620-1695)*, Aarau: H R Sauerländer, 1947.

254 On the use of commentaries in early modern anatomy see Roger K. French, 'Berengario da Carpi and the Use of Commentary in Anatomical Teaching', in Andrew Wear, Roger K. French and Iain M. Lonie (eds), *The Medical Renaissance of the Sixteenth Century*, Cambridge: Cambridge University Press, 1985, pp. 42-74 and more recently, Rafael Mandressi, 'Métamorphose du commentaire: projets éditoriaux et formation du savoir anatomique au XVI^{e} siècle', *Gesnerus*, 62 (2005), 165-185.

cases followed. The starting point for Wepfer's discussion of apoplexy was the idea that it was caused by an obstruction of the cerebral vessels and ventricles.[255] In order to identify the causes and consequences of such obstructions, he gave a fairly detailed account of the anatomy and physiology of the brain, especially of the production and distribution of the animal spirits. Wepfer also touched upon the issue of the rete mirabile, referring to the Galenic definition of the wonderful net: "Where the branches, i.e. of the carotid [artery], come together and intertwine, they form a rete mirabile arteriosum."[256] He described this definition as highly contested among anatomists, and discussed a number of authors who either insisted on or doubted the existence of a rete mirabile in man.[257]

Over the next fourteen pages Wepfer carefully evaluated different accounts of the appearance and physiology of the rete mirabile, before he came to the conclusion that there was no rete mirabile in human beings. However, this meant that the rete mirabile could not receive and refine the vital spirits either.[258] It also left Wepfer with two further problems: why was there a rete mirabile in animals, and where were the animal spirits produced if not in the rete mirabile? He solved the first problem by speculating that since the carotid artery, which rose directly to the dura mater and the brain, was shorter in animals than in man, it was necessary to slow down the influx of the blood, which he thought was the function of the rete mirabile in animals.[259] Wepfer dismissed not only the idea that the vital spirits were refined into animal spirits in the rete mirabile, but also denied that the animal spirits were produced in the ventricles of the brain. Instead he suggested that the animal spirits were produced in the white substance of the brain, which solved his second problem of identifying the location where the vital spirits were transformed.[260]

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255 Johann Jakob Wepfer, *Observationes anatomicae, ex cadaveribus eorum, quos sustulit apoplexia: cum exercitatione de eius loco affecto*, Schaffhausen: Alexander Rieding, 1675 (1st ed. 1658), pp. 20-21.

256 "Ubi rami, scilicet carotidis, coentus & intertexti, Rete mirabile arteriosum constituent." Wepfer, *Observationes*, 1675, p. 26.

257 Wepfer, *Observationes*, 1675, pp. 26-29.

258 Wepfer, *Observationes*, 1675, p. 52.

259 Wepfer, *Observationes*, 1675, pp. 50-52.

260 A. Karenberg, 'Johann Jakob Wepfers Buch über die Apoplexie (1658). Kritische Anmerkungen zu einem Klassiker der Neurologie', *Nervenarzt*, 69 (1998), 93-98, p. 95.

Thomas Willis, professor of natural history at the University of Oxford, took up Wepfer's ideas about the rete mirabile in his *Cerebri anatome* (1664). His account was very similar to Wepfer's, with whose writings Willis was obviously familiar.[261] Willis assumed that in man and horses the carotid artery entered the brain in a single meandering trunk, whereas in other animals it branched out in a rete mirabile under the dura mater to ease the pressure of the blood on the brain.[262]

> If the reason of this kind of Conformation be inquired into, it easily occurs, that in an human Head, where the generous Affections, and the great forces and ardors of the Soul are stirred up, the approach of the blood to the confines of the Brain, ought to be free and expeditious; and it is behoveful for its River not to run into narrow and manifoldly divided Rivulets, which would scarce drive a Mill, but always with a broad and open chanel, such as might bear a Ship under Sail.[263]

This argument gave reasons for the absence of a rete mirabile in human beings and credited them with a superior status over animals. Willis underlined the imperfect nature of the rete mirabile by the other three functions he ascribed to it. According to him the first function of the rete mirabile was to regulate the pressure of the blood flow into the brain. The other function was for Willis to drain superfluous fluids from the watery blood in animals. Finally the wonderful net also offered a backup capacity in case of an obstruction of the arteries, since its complex branches opened different ways for the blood into the brain.[264] Generally, unlike Wepfer, Willis did not dismiss observations of the wonderful net outright in man, but argued that, "it is only in those sort of man, […] being of a slender wit or unmoved disposition".[265] Thereby he once again emphasized the imperfect nature of the rete mirabile.

However, Willis had to admit that horses also lacked a rete mirabile, which he explained with the "noble" nature of this animal. Yet to maintain human superiority, he argued that the brains of horses were still of a weaker constitution than human brains, and to ease the blood pressure, the carotid artery was split in two interconnected branches in

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261 Thomas Willis, *The Anatomy of the Brain and Nerves*, facsimile of the 1681 English edition, ed. by William Feindel, Birmingham AL: Classics of Medicine Library, 1978 (1st ed., Latin, 1664), p. 57.
262 Willis, *Anatomy*, 1978, p. 84.
263 Willis, *Anatomy*, 1978, p. 84.
264 Willis, *Anatomy*, 1978, p. 85.
265 Willis, *Anatomy*, 1978, p. 85.

horses.[266] To illustrate his point Willis added drawings of the rete mirabile to his account (figure 4.6), which represented the carotid artery in man (figure 6, Fig. I), the carotid arteries in a horse (figure 6, Fig. II), and the rete mirabile in a calf (figure 6, Fig. III). Although the caption claimed that the illustration showed the situation of the carotid arteries in man and horses within the skull, they both appeared totally isolated and no hint was given to the relation of these structures to the rest of the body. The representation of the rete mirabile was even more abstract. In the centre, an archway-like shape indexed with the letter C represented the pituitary gland. Alongside the gland were white branches which were indexed on the right with the letter B and represented the "Net-like Infoldings of the Vessels stretched out by that Chanel towards the pituitary Kernel".[267] The said channel was represented by a light vertical line at the right which was indexed with the letter A and identified as the artery.[268] While the representations of the arteries in humans and horses were still naturalistic enough to make them appear as vessels, and they were also accurately indexed, the representation of the rete mirabile was quite abstract and not accurately indexed, which left it without any resemblance to an organic form.

The mechanistic concept of the rete mirabile phrased by Wepfer and Willis quickly made its way into both specialized publications on the anatomy of the brain and anatomical handbooks. But instead of simply adopting the new theories, most authors only picked up certain ideas and combined them with older views. Many refused to dismiss the possibility that the rete mirabile existed in man, such as the French anatomist and Cartesian Raymond de Vieussens (before 1641-1715), who rejected Willis' assertion that the rete mirabile consisted of arteries, veins and nerves and could only be found in animals and just on very rare occasions in humans. Based on experiments using injections of blood-coloured fluid, he claimed that the wonderful net was composed of veins and arteries only and a feature of human anatomy, even though it was very small. Despite his criticism of Willis, Vieussens accepted that the rete mirabile was regulating the blood flow into the brain, but still maintained that it refined

[266] Willis, *Anatomy*, 1978, p. 85.
[267] Willis, *Anatomy*, 1978, p. 86.
[268] Willis, *Anatomy*, 1978, p. 86.

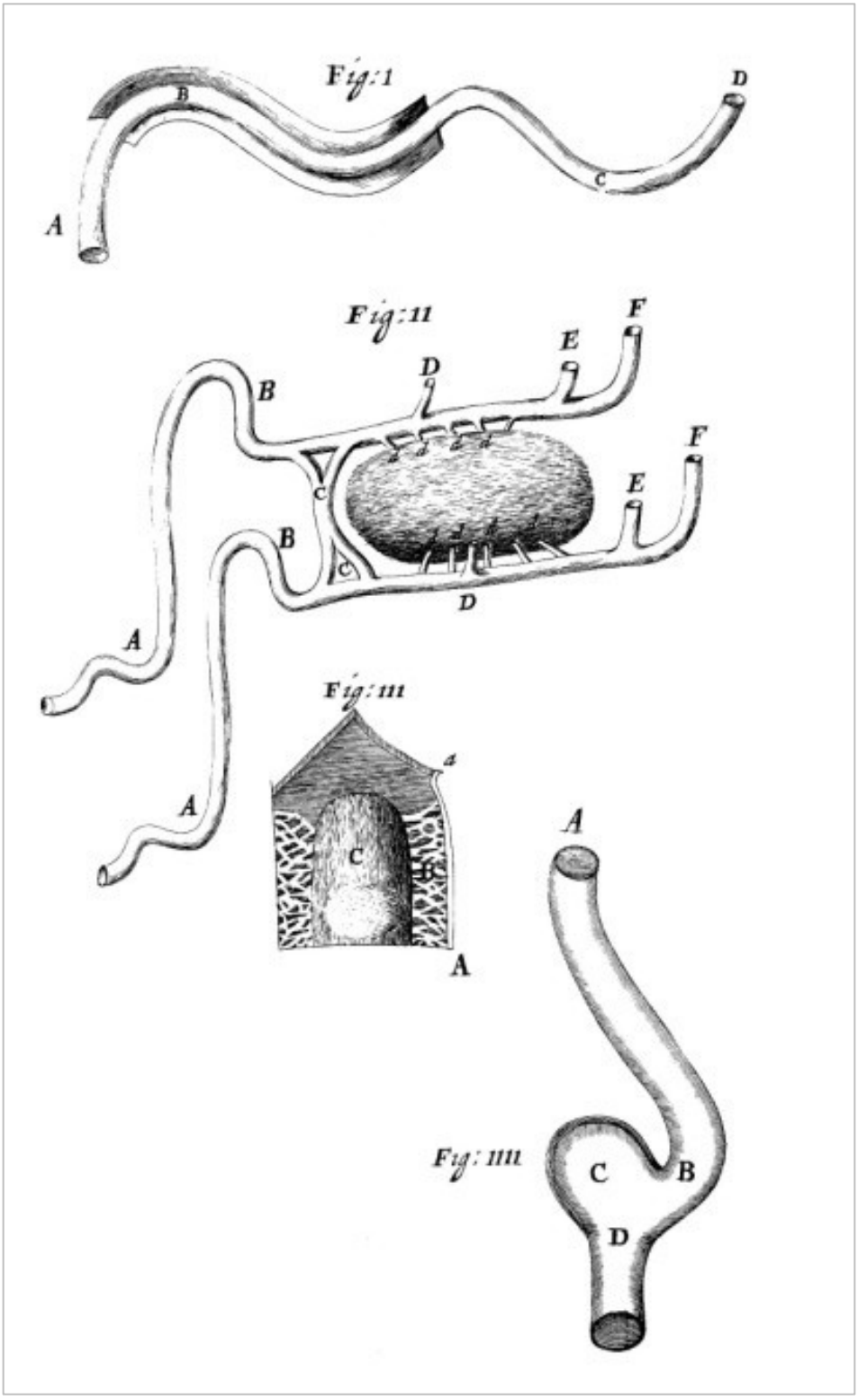

Figure 4.6

the animal spirits before they were referred to the pituitary gland.[269] The English physician Henry Ridley was also happy to accept that the rete mirabile merely regulated the blood flow into the brain, and was thus bigger in animals with a prone position than in man.[270] Nevertheless, he insisted that he had "[…] never found the *Rete* wanting, or with any difficulty discoverable in Men, springing from and lying on the inside of each Carotid Artery"[271].

A certain reluctance to completely give up the rete mirabile in man was also reflected in the most successful anatomical handbooks of the late seventeenth and early eighteenth centuries. The Dutch physician and anatomist Ysbrand van Diemerbroeck (1609-1674) claimed in his *Anatome corporis humani* (1672), which had eleven editions by 1695, that he had found the wonderful net in corpses which he had dissected by his own hand.[272] Regarding the physiological function of the rete mirabile Diemerbroeck agreed with Willis and regarded it as a structure which regulated the speed of the blood flowing into the brain.[273] The Flemish anatomist Philip Verheyen (1648-1711) also described the rete mirabile in his anatomical handbook, which had thirteen editions by 1739.[274] Stephen Blankaart (1650-1702), a Dutch physician, was one of the few authors who unconditionally followed Willis. In his *Nieuw-hervormde anatomie* (1678) he described the rete mirabile at the base of the skull, where the carotid artery entered the head, next

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269 Raymond de Vieussens, *Neurographia universalis: Hoc est, omnium corporis humani nervorum, simul & cerebri, medullaque spinalis descriptio anatomica; eaque integra et accurata, variis iconibus fideliter & ad vivum delineatis, areque incisis illustrata: cum ipsorum actione usu, physico discursu explicatis*, editio nova, Leiden, Johannes Certe, 1685 (1st ed. 1684), pp. 46 and 48. On Vieussens' Cartesian background and experimental research in general see C. E. Kellett, 'The Life and Work of Raymond Vieussens', *Annals of Medical History*, 3rd series, 4 (1942), 31-54.

270 Henry Ridley, *The Anatomy of the Brain: Containing Its Mechanism and Physiology; Together With Some New Discoveries of Ancient and Modern Authors Upon that Subject*, London: Samuel Smith & Benjamin Walford, 1695, p. 64.

271 Ridley, *Anatomy*, 1695, pp. 64-65.

272 "In homine vero exiliis & obscurior est." ("In humans, however, it is thin and obscure.") Ysbrand van Diemerbroeck, *Anatome corporis humani, plurimis novis inventis instructa variisque observationibus, et paradoxis, cùm medicis, tùm physiologicis adornata*, Geneva: Samuel de Tournes, 1679 (1st ed. 1672), p. 529.

273 Diemerbroeck, *Anatome*, 1679, pp. 529-530.

274 Philippus Verheyen, *Anatomie, oder Zerlegung des menschlichen Leibes, worinnen alles so wol die alten als neuen Anatomici erfunden haben, leicht und deutlich beschrieben, und in Kupfer fürgebildet wird*, Königsberg and Leipzig: Christpoh Gottfried Eckart, 1739 (1st ed., Latin, 1693), pp. 502-503.

to the glandula pituitaria. Blankaart claimed that the rete mirabile could only be found in certain animals and not in man and horses and regarded the regulation of blood flow as its function.[275]

Empirical observation of the structure, form and functions of the body was the dominant anatomical method of the seventeenth century. This method required diligent manual dissection and close inspection as well as carefully executed experiments, usually involving injections.[276] Only based on the results of such investigations, the actions of the body and further reasoning would lead to a comprehensive understanding and knowledge of the body which integrated its structure, form and function.[277] This holistic approach caused serious problems when the often inconclusive findings from dissections and injections were confronted with the ancient tradition. In the case of the rete mirabile this led to doubts about the actual appearance, function and nature of this structure, and authors like Wepfer and Willis denied or at least heavily doubted its existence. This made new explanations for the physiology of the rete mirabile necessary, since it was still found in animals. The most widely accepted theory, which was also quickly picked up by authors of anatomical handbooks like Blankaart and Diemerbroeck, was that the wonderful net regulated the speed of the blood flowing into the brain. As a result of this iatromechanist interpretation of the function of the wonderful net, the rete mirabile lost its important function of generating the animal spirits, which were now, for example according to Willis, produced in the cortex.[278] The result was a devaluation of the wonderful net not only by those who denied its existence in man, but also by those who maintained that it could at least occasionally be found in human beings.

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275 Blankaart, *Anatomie*, 1691, pp. 212-214.

276 Blankaart, for example, described an experiment to demonstrate the structure of the rete mirabile in relation to the plexus retiformis by injecting wax or ink. Blankaart, *Anatomie*, 1691, pp. 216-217. A general account of the history of the use of injections in anatomical research can be found in F. J. Cole, 'The History of Anatomical Injections', *Studies in the History and Method of Science*, 2 (1921), 285-343; Adolf Faller, *Die Entwicklung der makroskopisch-anatomischen Präparierkunst von Galen bis zur Neuzeit*, Basle: S. Karger, 1948.

277 Andrew Cunningham, 'The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy Before 1800: II, Old Anatomy – the Sword', *Studies in the History and Philosophy of Biological and Biomedical Sci*ences, 34C (2003), 51-76, pp. 55-56.

278 Willis, *Anatomy*, 1978, p. 92-93.

These uncertainties were reflected by new visual representations of the rete mirabile, which appeared and were frequently copied during the seventeenth century (figures 4.4 and 4.5). They did not clarify the appearance, structure and location of the wonderful net. These illustrations failed to establish a consistent iconography and therefore could not represent the wonderful net as a well established anatomical fact. They created tensions between the textual tradition, which was apparent in Wepfer's long literature review in his book on apoplexy, and the desire for empirical evidence supported by descriptive visual representations of human anatomy. This conflict was not limited to seventeenth-century anatomy, but deeply rooted in early modern (visual) culture. Within an "emblematic world view" every object was representing various complex metaphorical and symbolical meanings.[279] In images, iconographic references could associate the represented object with narratives from the bible or ancient mythology. This approach was rivalled by an understanding of the material world which was based on detailed observation, minute description and exact visual representation.[280] However, the lack of both meaningful explanations and reliable descriptions of the rete mirabile made it difficult to establish a standard for a truthful visual representation of this elusive object.

4.3 The disappearance of the rete mirabile from human anatomy

Despite its ambiguity the rete mirabile continued to feature in anatomical textbooks of the eighteenth century such as *The anatomy of the humane body* (1698) by the Scottish physician James Keill (1673-1719), which had sixteen editions by 1771. He supported

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279 The term "emblematic world view" was coined by William B. Ashworth, who regarded the emblem as the key to Renaissance understanding of the world. The full meaning of an emblem could only be fully comprehended when all three parts, the image as well as the motto and the epigram, were considered. Accordingly a true understanding of an object from the natural world could only be acquired through a comprehensive knowledge of its meanings (William Ashworth, 'Natural History and the Emblematic World View', in David Lindberg and Robert Westman (eds), *Reappraisals of the Scientific Revolution*, Cambridge: Cambridge University Press, 1990, 303-332).

280 Alpers, *Art*, 1983, pp. xxiv-xxv. Hal Cook recently showed how such a new form of objectivity, which was characterized by detailed and exact description of the material world emerged and situated it within the socio-cultural and economic context of the Dutch Golden Age (Cook, *Matters*, 2007).

the idea that the wonderful net regulated the speed of the blood flowing into the brain, but he did not specify whether he was referring to human or animal brains.[281] A more sophisticated account of the wonderful net could be found in the comparative anatomical handbook *Anthropologia nova* (1707) by the English physician James Drake (1667-1707). For Drake the function of the rete mirabile in animals was similar to that of the pituitary gland, which was "to separate the serous matter from the arterial Blood".[282] Regarding the rete mirabile in man he referred to the view of "most anatomists" that it was lacking. Nevertheless Drake went on to quote a long paragraph from Ridley's *Anatomy of the Brain* on the appearance and function of the rete mirabile in animals to balance the pressure of the blood and also confirmed that the wonderful net was not completely absent in man, but just much smaller than in animals.[283] Rather than clarifying the status of the rete mirabile, Drake's account of the structure remained unclear and contradictory. A few chapters later, when he treated the nervous system, Drake developed a quite inventive solution for the problems surrounding the rete mirabile by simply declaring it negligible:

> Surrounding this *Gland* [i. e. the pituitary gland] in the *Sella Turica* is a small *Plexus* of Vessels call'd RETE MIRABILE, which is either not existent in Men, or so very minute that its Existence is fairly doubted. In Brutes it is Conspicuous enough, and by *Willis* is said to consist of *Arteries*, *Veins* and *Nerves*; by *Vieussens* of *Arteries* only, and by others, of *Arteries* and small *Veins*. This is a Controversie not easie to be decided, and scarce worth the trouble.[284]

The controversies about the rete mirabile also puzzled Lorenz Heister (1683-1758). Heister was anatomy professor at the University of Helmstedt and author of the most successful anatomical textbook of the eighteenth century, the *Compendium anatomicum* (1717), which saw more than thirty editions in five languages by 1777.[285] Heister even

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281 James Keill, *The Anatomy of the Humane Body Abridge'd: Or, a Short and Full View of all the Parts of the Body; Together with their Several Uses, Drawn From Their Compositions and Structures*, London: Ralph Smith & William Davies, 1703 (1st ed. 1698), p. 144.

282 James Drake, *Anthropologia nova; Or, a New System of Anatomy: Describing the Animal Oeconomy, and a Short Rationale of Many Distempers Incident to Humane Bodies*, 2 vols, London: Samuel Smith & Benjamin Walford, 1707, vol. 2, p. 394.

283 Drake, *Anthropologia*, 1707, pp. 394-396.

284 Drake, *Anthropologia*, 1707, p. 491.

285 Heister's work, especially his surgical work and his correspondence with colleagues and patients, has recently received increased attention from medical historians such as Marion Ruisinger, *Patientenwege. Die Konsiliarkorrespondenz*

added to the confusion by confirming the existence of this inconspicuous and apparently inconsiderable object by stating that "its use is unknown".[286] In later editions of the *Compendium anatomicum* he reaffirmed the existence of the rete mirabile in man and bristled at its denial by Frederik Ruysch (1638-1731).[287] Although the famous Dutch anatomist "had erstwhile displayed this net with words and etchings, [he] now ranks it among the fairy tales".[288] Heister referred to one of the illustrations in Ruysch's *Epistola anatomica problematica duodecima* (1699) (figure 4.7).[289] The brain of the subject, according to the caption that of a ten-year-old boy, was represented from below, similar to the illustrations in Spiegel (figure 3.4) and Vesling (figure 4.5). The rete mirabile (indexed with the letter T) featured on this illustration left and right of the optical nerve (indexed with letter D). Jan Wandelaar's (1690-1759) delicate etching in Ruysch's *Epistola anatomica* appeared to be the last visual representation of the rete mirabile as part of *human* anatomy. The appearance and location of the wonderful net in this illustration was different from the illustrations in Spiegel and Vesling. It was also

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Lorenz Heisters (1683-1758) in der Trew-Sammlung Erlangen, Stuttgart: Franz Steiner, 2008 (see bibliography for further references). However, the anatomist Lorenz Heister has so far received little attention.

286 Lorenz Heister, *A Compendium of Anatomy: Containing a Short But Perfect View of All Parts of the Humane Bodies*, London: Thomas Combes and James Lacy, 1721 (1st ed., Latin, 1717), p. 211.

287 That Heister revised his account of the rete mirabile (although never denied its existence in human beings) in later editions of his *Compendium anatomicum* was unusual. In the anatomical handbooks of other authors, such as Vesling, Blankaart, Diemerbroeck and Keill, the passages on the wonderful net remained unchanged in the last editions published during their lifetimes (Vesling, *Syntagma*, 1647; Diemerbroeck, *Anatome*, 1674; Blankaart, *Anatomia*, 1695; Keill, *Anatomy*, 1718).

288 "der ehemals dieses Nez mit Worten und Kupferstichen angezeiget hat, izo daselbe unter die mährlein zählet […]" Lorenz Heister, *Compendium anatomicum; das ist: Kurzer Begriff derjenigen Kunst, welche von denen Theilen des menschlichen Körpers, und anderer Thiere [...] handelt; nach der neuesten lat. Aufl. durchsehen, verm. und in vielen Uebers. deutlicher dargest.*, Nuremberg:, Johann P Krauß, 1771 (1st ed., Latin, 1717), p. 315. Ruysch alluded in his later work to the "fables about the rete mirabile in the human head" ("fabulae de reti mirabile in capite humano"). He used them to exemplify the danger of using animal cadavers in anatomy and transfer the results to human bodies. See Frederic Ruysch, 'Adversariorum anatomico-medico-chirurgicorum. Decas secunda. In qua varia notatu digna recensentur', in Frederik Ruysch, *Opera omnia anatomico-physico-chirurgica*, Amsterdam: Janssonius-Waesbergius, 1720, p. 45.

289 Frederik Ruysch, 'Epistola anatomica problematica duodecima, authore Mich. Ernesto Ettmullero, M. D. &c. ad virum clarissimum Fredericium Ruyschium, Med. Doc. Anatomiae & Botanices Professorem, de cerberi corticali substantia, &c.' (1st ed 1699), in Frederik Ruysch, *Opera omnia anatomico-physico-chirurgica*, Amsterdam: Janssonius-Waesbergius, 1721, Tab. 13.

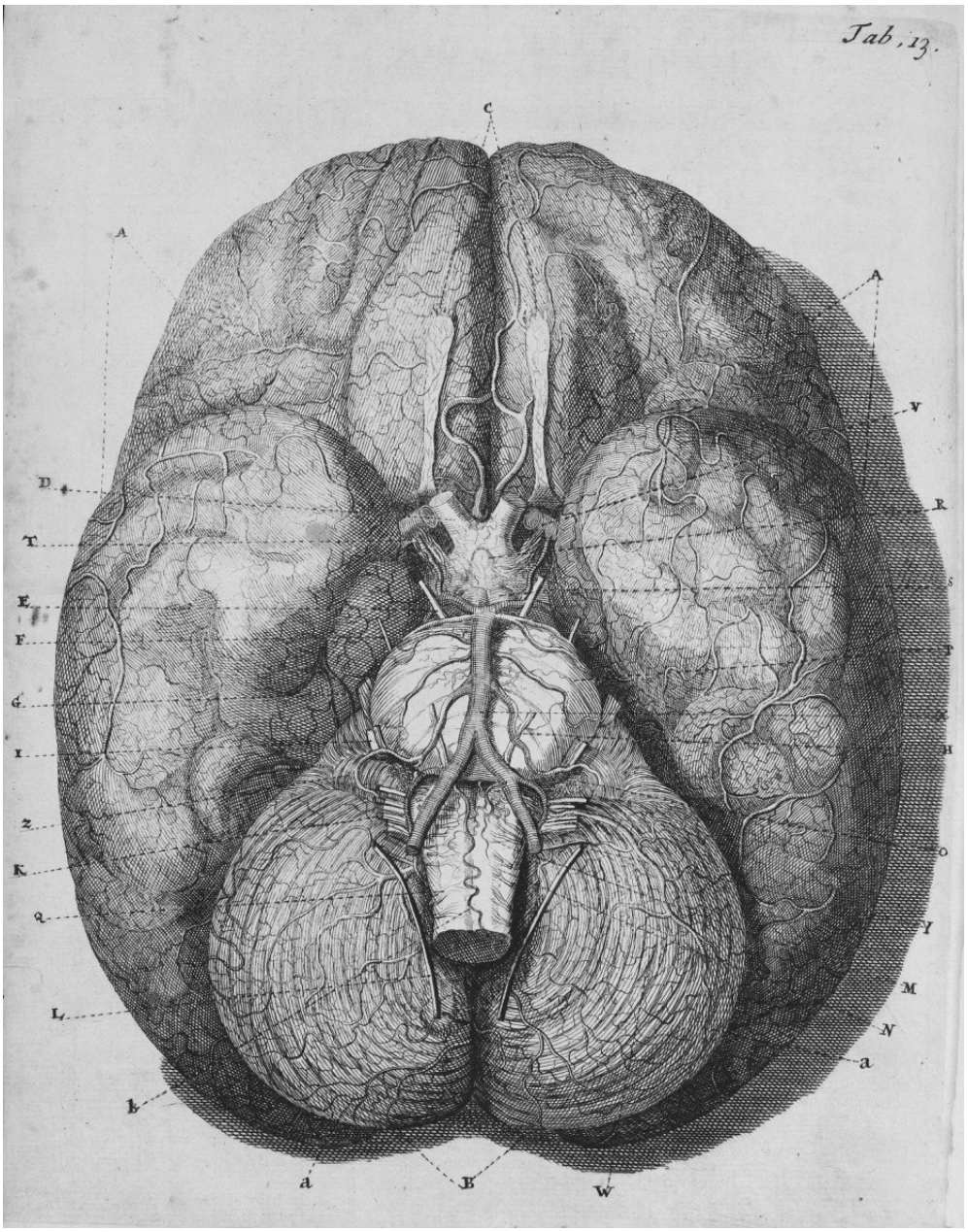

Figure 4.7

less prominent and less noticeable, but shared the manner of a naturalistic representation with the structures of the brain.

Neither Heister's *Compendium anatomicum*, nor the other eighteenth-century anatomical handbooks featured illustrations of the rete mirabile. Nevertheless, the structure itself continued to appear in anatomical publications like *An Essay on Comparative Anatomy* (1744) by the Edinburgh anatomist Alexander Monro the first (1697-1767). Monro insisted on a rete mirabile in human bodies, "notwithstanding several Anatomists have denied its Existence".[290] Although he rejected the Galenic idea of the physiological function of the rete mirabile as "frivolous", Monro did not develop a different concept, but went on to discuss the difficulties which could occur during dissections of this subtle structure.[291] His son Alexander Monro the second (1733-1817), who also became professor of anatomy at the University of Edinburgh, followed the opinion of his father in his *Observations on the Structure and Function of the Nervous System* (1783). In the first chapter, on the circulation of the blood in the head, he gave a brief description of the rete mirabile, explained that it regulated the blood flow into the brain, and stated that it could be discovered more easily in animals, adding an illustration representing the rete mirabile in a calf foetus.[292] The etching showed the structure isolated, and the exact appearance and topographic relations of the rete mirabile remained unclear.[293]

By the end of the eighteenth century, however, the Monros were fairly isolated with their view. Midway through the eighteenth century Albrecht von Haller (1708-1777), who was at the time anatomy professor at the University of Göttingen, published his *Iconum anatomicarum* (1743-1756). Its illustrations, Haller claimed, were as naturalistic as possible representations of his actual observations during dissections. In the seventh part, on the arteries of the brain, the spinal cord and the eyes, Haller also discussed at great length the previous literature on the rete mirabile and came to the conclusion that

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290 Alexander Monro primus, *An Essay on Comparative Anatomy*, London: J Nourse, 1775 (1st ed. 1744), p. 63.

291 Monro, *Essay*, 1775, pp. 63-65.

292 Alexander Monro secundus, *Observations on the Structure and Functions of the Nervous System*, Edinburgh: William Creech and London, Joseph Johnson, 1783, p. 2 and table I.

293 Monro, *Observations*, 1783, caption for table I.

no such structure existed in human bodies. He dismissed the idea that arteries at the base of the brain would form such a structure, and his only comment on the physiological function of the rete mirabile was that the rete mirabile was simply useless in man.[294] The same opinion was held by the surgeon and anatomist John Bell (1763-1820), who wrote in his *Anatomy of the Human Body* (1797) that "in man there is not the smallest vestige of a rete mirabile […]".[295] Bell justified his claim with the argument that because of his upright position, man would not need a structure to regulate the influx of blood to the head.[296]

A similar argument was used by the philosopher Johann Gottfried Herder (1744-1803) in his *Outlines of the Philosophy of Man* (1784-1791). In these reflections on natural philosophy he developed the idea that what ultimately distinguished humans and animals was man's ability to walk upright. This ability was determined by man's anatomy and made him superior to animals. Herder was sure that unlike other animals neither human beings nor horses had a rete mirabile: "Because it's [*sic!* i.e. the horse's] head stands erect, and the carotid artery rises in some measure like that of man, without having occasion for this contrivance to impede the course of the blood, as in brutes that have depending heads. Accordingly it is a nobler, fiery, courageous animal, of much warmth, and sleeping little."[297] Herder's explanation of the absence of the rete mirabile in horses mixed ideas of the upright position as the distinction between humble animal and nobler man with physiological explanations of the rete mirabile which had developed during the seventeenth century.

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294 Albrecht von Haller, 'Iconum Anatomicarum. Quibus alique partes corporis humani delineatae traduntur. Fasciculus VII. Arteriae cerebri, Medullae spinalis, Oculi', 1754, in Albrecht von Haller, *Iconum Anatomicarum Partium Corporis Humani*, Göttingen: Abraham Vandenhoeck, 1743-1756, p. 3.

295 John Bell, *The Anatomy of the Human Body*, 2 vols, Edinburgh and London: Cadell and Davies, 1797, vol. 2, p. 337.

296 Bell, *Anatomy*, 1797, p. 337.

297 Johann Gottfried Herder, *Outlines of a philosophy of the history of man*, London, J Johnson: 1800 (1st ed., German, 1784-1791), p. 80. On the Europe-wide contemporary reception and influence of Herder's *Outlines* see Wolfgang Pross, 'Nachwort: ›Natur‹ und ›Geschichte‹ in Herders Ideen zur Philosophie der Geschichte', in Johann Gottfried Herder, *Werke, Band 3.1: Ideen zur Geschichte der Menschheit*, Munich: Hanser, 2002, pp. 883-1041, here pp. 1021-1041.

Such physiological theories had paved the way for a transformation which turned the rete mirabile into an exclusive property of certain animals, but absent from human anatomy.[298] By the end of the eighteenth century the wonderful net had finally vanished from human anatomy. This was reflected in new handbooks like *Vom Baue des menschlichen Körpers* (1791-1796), published in six parts by the German anatomist Samuel Thomas von Soemmering (1750-1830). Although he opposed a strict distinction of anatomy and physiology,[299] Soemmering nevertheless introduced a rigid taxonomy based on dissection, empirical observation and meticulous description. This meant that the parts and structures of the human body were classified and summarized strictly according to their appearance and correlation. Consequently Soemmering treated angiology and the anatomy of the brain and nerves in two separate volumes.[300] With no link between the anatomy of the vascular system and the anatomy of the brain and nerves, no room was left for the rete mirabile. Soemmering regarded the vascular and the nervous system as two separate systems with distinct structural, physical and physiological features. While the vascular system was preoccupied with nourishing the body and balancing the bodily fluids, the nervous system was transmitting sensory information. Soemmering admitted that the way how nerves worked was unknown.[301] However, he thought of the nerves as fibres and rejected the idea that they were vessels transporting "nervous juice" ("Nervensaft").[302] Therefore an organ, such as the rete mirabile, which would transform a substance from the one vascular system to provide it to another, did not make sense anymore.

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298 The history of the rete mirabile in comparative anatomy is discussed in Forrester, 'Network', 2002. He follows the research on the structure and function of the rete mirabile until the 1980s. By this time a new concept had been established, namely that the function of the rete mirabile in animals was not to regulate the blood flow into the brain, but to regulate the temperature of the blood in the brain (Forrester, 'Network', 2002, pp. 210-216).

299 Samuel Thomas Soemmering, *Vom Baue des menschlichen Körpers*, part 1, *Knochenlehre*, Frankfurt: Varrentrapp und Wenner, 1791, pp. XXIV-XXV.

300 Soemmering described the vascular system in Samuel Thomas Soemmering, *Vom Baue des menschlichen Körpers*, part 3, *Gefäßlehre*, Frankfurt: Varrentrapp und Werner, 1792. The anatomy of the brain, however, was treated in Samuel Thomas Soemmering, *Vom Baue des menschlichen Körpers*, part 5, *Hirn- und Nervenlehre*, Frankfurt: Varrentrapp und Werner, 1791.

301 Soemmering, *Baue*, part 5, 1791, p. 159.

302 Soemmering, *Baue*, part 5, 1791, pp. 106-112 and 163-168..

The rete mirabile in man only resurfaced in clinical medicine in the 1950s and led to some controversy over its terminology. In their paper 'The Myth of the Rete Mirabile in Man' (1972) the American radiologists C. G. de Gutiérez-Mahoney and M. M. Schechter strongly argued against using the term rete mirabile to identify collateral vessels at the base of the brain. They referred to six medical papers from the 1950s and 1960s which used the term in a *clinical* context.[303] Based on a historical overview and a review of twentieth-century literature on the rete mirabile in animals, Gutiérez-Mahoney and Schechter argued that "the use of the term rete mirabile […] should be discontinued if only for the sake of clarity".[304] Modern debates still carried rudiments of the seventeenth- and eighteenth-century debates, when the rete mirabile was described in modern medical literature as a compensatory structure of collateral vessels and linked to cerebral haemorrhage.[305] This assessment resonated with Willis' assumption that in man the rete mirabile could only be found in fools or Herder's belief that the lack of a rete mirabile in man indicated his more perfect constitution.

4.4 Conclusions

The astonishing longevity of the rete mirabile in human anatomy reflected fundamental methodological and epistemological problems of early modern anatomy. Until the second half of the eighteenth century the rete mirabile could be understood as an ambiguous object between anatomical tradition, empirical research and physiological interpretation, which were unified in the "old anatomy" as a "discipline for research on life".[306] However, since the middle of the seventeenth century iatromechanist concepts replaced the teleological Galenic ideas in academic medicine and a more rigid empiricism became the dominant method in anatomical research.[307] Steno's

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303 C. G. de Gutiérez-Mahoney, M. M. Schechter, 'The Myth of the rete mirabile in Man', *Neuroradiology*, 4 (1972), 141-158, pp. 153-155.

304 Gutiérez-Mahoney/Schechter, 'Myth', 1972, p. 157.

305 Gutiérez-Mahoney/Schechter, 'Myth', 1972, p. 157; Takeshi Mikami, Akira Takahashi and Kiyohiro Houkin, 'Cartoid rete mirabile associated with subarachnoid hemorrhage', *Neurologia medico-chirurgica*, 45 (2005), 201-204.

306 Cunningham, 'Pen', 2003, p. 55.

307 Harold J. Cook, 'The New Philosophy and Medicine in Seventeenth-century England', in David Lindberg and Robert Westman (eds), *Reappraisals of the Scientific Revolution*, Cambridge: Cambridge University Press, 1990, pp. 397-436; Roger French and Andrew Wear (eds), *The Medical Revolution of the Seventeenth*

programmatic lecture on the dissection of the brain paradigmatically represented this approach. Although he was aware of the possibility of misperception and manipulation, he gave visual and tactile observations prevalence over theory.[308] This method implied that doubts about the existence of a certain structure like the rete mirabile had far-reaching consequences for its physiology. If the form, structure and appearance of a certain object were doubtful, its physiological function had to be questioned as well and attributed to some other structure. In the case of the wonderful net, this explains why the problems with identifying the structural anatomy of the rete mirabile resulted in a reinterpretation of its physiological function, but did not immediately make it an obsolete object.

Such doubts led to increased uncertainty about the identity of the rete mirabile in human bodies, which was reflected in the avoidance strategies of the authors of anatomical handbooks and textbooks from the second half of the seventeenth and first half of the eighteenth centuries. Instead of taking a firm stance, most of them vacillated and either discussed at great length which authors had denied the rete mirabile and which accepted it (Diemerbroeck), or simply stated that although smaller than in animals it also existed in man, but did not give any account of its function (Verheyen, Heister). Others gave iatromechanist explanations of the rete mirabile as an organ which regulated the speed of the blood flow, but did not specify whether they were referring to human or to animal bodies (Keill). Yet another strategy was to simply end the discussion by declaring that the whole controversy about the rete mirabile was negligible (Drake).

The uncertainty about the rete mirabile was also reflected in and aggravated by its visual representations. In the beginning of the sixteenth century and in Vesalius' *Tabulae anatomicae* the rete mirabile was still part of a visual paradigm, where it could not only be represented in situ but also with a function within a physiological system (figure 4.2). However, the denial of its existence in human bodies in Vesalius' *Fabrica* also visually

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Century, Cambridge: Cambridge University Press, 1989; Karl E. Rothschuh, *Konzepte der Medizin in Vergangenheit und Gegenwart*, Stuttgart: Hippokrates Verlag, 1978, pp. 164-170 on empiricism in seventeenth- and eighteenth-century medicine and pp. 228-240 on iatromechanism in seventeenth-century medicine. On anatomy and the Cartesian "new philosophy" see French, *Dissection*, 1999, pp. 253-273.

308 Steno, *Lectures*, 1965, pp. 144-145.

separated the rete mirabile from the human body (figure 4.3). When the rete mirabile was represented in relation to the human brain during the seventeenth and eighteenth centuries, it appeared in different shapes and places (figures 4.4, 4.5, 4.6 and 4.7). These illustrations failed to become self-evident and standardize the gaze and its object, an ambition seen by Lorraine Daston and Peter Galison in anatomical atlases from the sixteenth to the eighteenth century.[309] The lack of visual coherence of images of the rete mirabile was not only the result of the Vesalian challenge to Galenic anatomy; after all many authors still discussed the wonderful net in their accounts of human anatomy. Since the sixteenth century the artistic virtue of drawing ad vivum (after life) had continuously gained in currency and "images done *ad vivum* bear witness to what they represent, and their mimetic promise came to be negotiated for artistic as well as scientific ends".[310] By the seventeenth century the claim that an image was drawn after life had become a marker of truth and authenticity.[311] However, this visual paradigm did not allow for imaginary representations of natural objects and in the case of the rete mirabile the uncertainty of the anatomical discourse and ambiguity of the results of dissections were reflected in the images of the rete mirabile.

Because illustrations of the rete mirabile did not develop a consistent iconography, the seventeenth- and early eighteenth-century visual representations of this structure carried the uncertainty about its identity forward and did not lead to self-evident and "very normal images".[312] Rather than establishing the rete mirabile as a matter of fact in the anatomical discourse, the iconographic inconsistency and the ambiguous narratives allowed the rete mirabile to survive in human anatomy until a clear disciplinary division into descriptive anatomy and experimental physiology around the turn from the

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309 Lorraine Daston and Peter Galison, 'The Image of Objectivity', *Representations*, 40 (1992), 81-128, pp. 84-95.

310 Claudia Swan, 'Ad vivum, near het leven, from the life: Defining a Mode of Representation', *Word & Image*, 11 (1995), 353-372, p. 354.

311 Swan, 'Life', 1995, pp. 356-357.

312 David Gugerli, Barbara Orland, 'Einleitung', in David Gugerli, Barbara Orland (eds), *Ganz normale Bilder. Historische Beiträge zur visuellen Herstellung von Selbstverständlichkeit*, Zurich: Chronos, 2002, pp. 9-16, here p. 11. Gugerli and Orland defined "very normal images" in modern sciences as images, which had become self-evident and whose meaning was obvious and doubtless within a scientific discourse.

eighteenth to the nineteenth century.[313] The further development of a rigorously empirical method in anatomy led to the gradual separation of anatomy from physiology since the end of the eighteenth century. The "old anatomy" which had integrated topographic description with the bodily functions was replaced by a systematic approach to anatomy which focused on the clear identification and meticulous description of the appearance of the human body. Although Soemmering, for example, did not yet give up the idea of a unity of anatomy and physiology in his *Vom Baue des menschlichen Körpers*, his systematic approach led him to discuss the structure, form and function of the brain separately from both the nerves and the vascular system. Within such a system, a structure such as the rete mirabile, which was formed by blood vessels and provided a substance to the nervous system, which was formed by fibres, did not fit.

[313] Andrew Cunningham, 'The Pen and the Sword: Recovering the Disciplinary Identity of Physiology and Anatomy Before 1800: I, Old Physiology – the Pen', *Studies in the History and Philosophy of Biological and Biomedical Sciences,* 33C (2002), 631-665 and Cunningham, 'Pen', 2003. In German-speaking countries, for example, only from the late eighteenth century journals were published which reflected the development of a disciplinary division, e.g. the *Magazin für die pathologische Anatomie und Physiologie*, Altona (1796), or the more successful *Archiv für die Physiologie*, Halle/Saale (1796-1815). On the institutional establishment of the new disciplines at universities in the German territories, Austria and Switzerland since the early nineteenth century see Hans-Heinz Eulner, *Die Entwicklung der medizinischen Spezialfächer an den Universitäten des deutschen Sprachgebietes*, Stuttgart: Ferdinand Enke, 1970, pp. 31-65. Andrew Cunningham made this disciplinary transformation the focal point of his most recent book on anatomy in the long eighteenth century, where he discussed the development of French experimental physiology in particular. Cunningham, *Anatomist*, 2010, pp. 371-375.

5. From the milky veins to the lymphatic system

While the previous chapter on the rete mirabile showed how the ambiguity of the anatomical discourse was reflected in and contributed to by images, this chapter considers how images helped to constitute the lymphatic system as a "working object"[314] at the end of the eighteenth century. While the rete mirabile as an important part of Galenic concepts of the body had ceased to be an important part of human anatomy and physiology and gradually disappeared, other structures such as the lymphatic system appeared during the seventeenth and eighteenth centuries in human anatomy. Human anatomy was in the early modern period a field of enquiry, in which traditional notions of the body could be challenged and which gave ambitious anatomists plenty of opportunities to make their name through new discoveries. The traditional Galenic view of the body in medicine was not only challenged by critical inquiry, but also rivalled by new mechanistic, chemical and other explanations of the functioning of the body. New physiological explanations of this kind also allowed the introduction of new anatomical structures such as the lymphatic system by making them meaningful.

The development of ideas about the lymphatic system during the seventeenth and eighteenth centuries is a topic which has been marginal in the history of anatomy and physiology. This is remarkable considering the crucial functions attributed to the lymphatics[315] by modern medicine both for the immune system and for maintaining the internal fluid balance, as well as the closely linked controversies about blood circulation

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[314] For Lorraine Daston and Peter Galison a "working object" in the sciences is, in contrast to a "natural object", an ideal or at least typical representative of a particular kind or structure, which allows comparison and generalizations. Daston/Galison, *Objectivity*, 2007, pp. 19-22. In the eighteenth century, the truth-to-nature of scientific images made an otherwise hidden reality visible and showed the "true" nature of the depicted objects. However, this truth was not simply conveyed by the particular object, but the idealized image of it (Daston/Galison, *Objectivity*, 2007, pp. 55-63).

[315] For more clarity I use the term 'lymphatics' in this paper to subsume different terms such as 'lacteal vessels', 'milky veins', 'lymphatic vessels' 'absorbent vessels', etc. These terms were used to label those vessels which were to become the lymphatic system, but were associated with diverging concepts. When I refer to specific notions of the lymphatics I will use the according terms.

and the lymphatics of the seventeenth century.[316] However, unlike the blood circulation, the nervous system or the internal organs, the lymphatic system has received little attention from historians of medicine, although research on the lymphatics was one of the most important areas for many of the leading anatomists from the middle of the seventeenth to the end of the eighteenth century. Apart from articles by Reginald S. A. Lord and Nellie B. Eales,[317] little work has been published on the history of the anatomy of the lymphatic system. There are the MD theses by Matthias Trautmann and Greta Kleinebrink-Kufferath on the history of the lymphatic system, which however remained descriptive and prioritized discovery.[318] Similarly, the few articles on the history of the lymphatic system which have been published in medical journals during the 1990s remained rather short accounts and lacked analytical depth.[319] The only exceptions were papers by M. H. Kaufmann that discussed some remarkable aspects of research on the lymphatics in Edinburgh during the late eighteenth century.[320] A more sophisticated

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316 French made this point in French, *Dissection*, 1999, pp. 248-250. The research and controversies over nutrition, circulation, the lymphatic and the vascular system during in the early modern period are also prominent in Mani's history of hepathology. Nikolaus Mani, *Die historischen Grundlagen der Leberforschung. II. Teil, Die Geschichte der Leberforschung von Galen bis Claude Bernard*, Basel and Stuttgart: Schwabe & Co., 1967.

317 Reginald S. A. Lord, 'The White Veins. Conceptual Difficulties in the History of the Lymphatics', *Medical History*, 12 (1968), 174-84; Nellie B. Eales, 'The History of the Lymphatic System, with Special Reference to the Hunter-Monro Controversy', *Journal of the History of Medicine and Allied Sciences*, 29 (1974), 280-94.

318 Matthias Trautmann, 'Die Entdeckung und Erforschung des Lymphsystems von der Antike bis um 1800', MD thesis, Freie Universität Berlin, 1977; Greta Kleinebrink-Kufferath, 'Die Kontroverse zwischen Thomas Bartholin und William Harvey über die Bedeutung der Chylusgefäße. Text und Übersetzung von "De Lacteis Venis Sententia Cl. V. Guilielmi Harvei expensa a Th. Bartholino"', MD Thesis, Universität Bonn, 1984.

319 G. Fabian, 'Auf dem Weg zur Erforschung des Lymphgefäßsystems', *Lymphologie*, 15 (1991), 33-37; John E. Skandalakis, 'I Wish I Had Been There: Highlights in the History of Lymphatics', *The American Surgeon*, 61 (1995), 799-808; A. J. Miller and A. Palmer, 'The Three Williams – Hunter, Hewson and Cruikshank: Their Unique Contribution to Our Knowledge of the Lymphatics', *Lymphology*, 28 (1995), 31-34; B. Chikly, 'Who Discovered the Lymphatic System?', *Lymphology*, 30 (1997), 186-193.

320 The papers by Kaufman and Best discussed a dry specimen of a whole body of which the lymphatic vessels had been injected with mercury and the plates the Edinburgh anatomy professor Alexander Monro secundus had done after the preparation. Both the body and the print are still kept in the collections of the University of Edinburgh. M. H. Kaufman and J. J. K. Best, 'Monro *Secundus* and 18th century Lymphangiography', *Proceedings of the Royal College of Physicians*

account of the history of the lymphatics in the context of seventeenth-century anatomy and physiology of the liver was given by Nikolaus Mani,[321] and the physiological function of the lymphatics at the turn of the eighteenth to the nineteenth century was discussed by John Pickstone.[322]

Much of this research on the history of the lymphatics has framed it largely as a history of scientific progress. Therefore, the terminological and conceptual difficulties that occurred in research on the lymphatics were not understood as a result of the epistemological limitations and disciplinary boundaries of early modern anatomical research and debate, but as a result of progress not yet reaching far enough. Also, while anatomical drawings, prints and specimens were crucial to the understanding of the difficulties of the terminology and the concepts of the lymphatics, such sources were mostly ignored and only introduced as illustrations in research literature while the emphasis usually remained on the texts.

To understand the problems of both early modern anatomists and modern historians of medicine to label and conceptualize the lymphatics, not only the written accounts of the lymphatic vessels and system provide important material. Most of the texts dealing with the topic were illustrated with prints from drawings after specimens created by injections of the lymphatics. Preparing specimens of such a delicate structure as the lymphatic vessels was a highly regarded skill and contemporaries praised anatomists such as Frederik Ruysch (1638-1731) for their exceptional abilities to produce such

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Edinburgh, 26 (1996), 75-90; M. H. Kaufman, 'Observations on Some of the Plates Used to illustrate the Lymphatics Section of Andrew Fyfe's *Compendium of the Anatomy of the Human Body'*, *Clinical Anatomy*, 12 (1999), 27-34.

321 Mani, *Grundlagen*, 1967, pp. 80-103. On the reception of ancient literature, especially Hippocratic texts in the context of early modern research on the lymphatics see Elizabeth Craik, 'The Reception of the Hippocratic Treatise *On Glands*', in Manfred Horstmanshoff, Helen King and Claus Zittel (eds), *Blood, Sweat and Tears: The Changing Concepts of Physiology from Antiquity into Early Modern Europe*, Leiden: Brill, forthcoming 2011 (=Intersections Yearbook for Early Modern Studies 18). I would like to thank Professor Craik for providing me with a draft version of her paper.

322 John Pickstone, 'The Origins of General Physiology in France with Special Emphasis on the Work of R. J. H. Dutrochet', PhD Thesis, University of London, 1973, Chapter 4, 'Absorption and Imbibition in the 1820s: The Role of Anatomy, Experimental Physiology and Physics', pp. 125-161. My thanks go to Professor Pickstone for providing me with a copy of the chapter.

objects.[323] However, it was difficult and expensive to produce anatomical specimens while their storage required space and adequate facilities. More efficient and cheaper ways to visualize the lymphatics such as drawings and prints therefore had to be used. Although prints were only one of the many different media used to represent anatomy, apart from texts they were most widely circulated. They were relatively cheap to reproduce and easy to distribute. Printed illustrations in anatomical texts made a significant contribution to standardizing knowledge. They reached a wider audience, which was able to discuss views by referring to identical reproductions of the same object and thereby created a collective and comparative understanding of their subject.[324]

Unlike visual representations of the rete mirabile, anatomical illustrations of the lymphatics did not represent early modern uncertainties regarding the nature or even the very existence of their subject. They were rather confirming the existence of the lacteal and lymphatic vessels and in the end the lymphatic system. Illustrations of the lymphatics made an inconspicuous and ephemeral structure visible and thereby contributed to establishing the system of absorbing vessels as an anatomical fact over more than one and a half centuries.[325] They created certainty instead of the visual ambiguity which helped the rete mirabile to survive until the eighteenth century. This, however, raises the question how illustrations of the lymphatics successfully contributed to establishing the lymphatics as an anatomical matter of fact. This chapter therefore does not only look at the lymphatic system as an example for the construction of new knowledge. It also uses the development of the concept of the lymphatic system to exemplify the role of aesthetic theories and visual paradigms in the production of anatomical knowledge. To understand both how the lymphatic system evolved and became a universally accepted fact, and the power of the images in shaping this fact, it will be necessary to use a variety of sources. Apart from the relevant seventeenth and

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323 Andreas-Holger Maehle, '"Ob es auch anatomische Belustigungen gäbe" – Ein Disput über die Ästhetik der Leichenpräparation im 18. Jahrhundert', *Würzburger Medizinhistorische Mitteilungen*, 6 (1988), 89-109, p. 93.

324 Elizabeth Eisenstein pointed out the standardizing effects of the printing press in her classic study *The Printing Press as an Agent of Change: Communications and Cultural Transformations in Early-Modern Europe*, 2 vols, Cambridge: Cambridge University Press, 1979, pp. 80-88.

325 The term "system of absorbing vessels" was commonly used towards the end of the eighteenth century to identify the lymphatic system as a separate anatomical entity.

eighteenth-century treatises on the lymphatics, this chapter also includes anatomical handbooks, and considers early modern aesthetic debates about anatomical illustrations.

First I will make some suggestions for how a history of the lymphatics could be conceptualised. I will then give a brief sketch of the research on the lymphatics from the middle of the seventeenth century until the middle of the eighteenth century. This forms the basis for a reconstruction of the idea of the lymphatics as a system of absorbing vessels as it was established during the second half of the eighteenth century. Finally, using illustrations of the lymphatic system from the 1780s to 1800, the contribution of the visual representation to the formation of the concept of a lymphatic system as a system of absorbing vessels is discussed. I will show how the illustrations in William Cruikshank's *Anatomy of the Absorbing Vessels* (1786) helped to establish the truthfulness of the new concept, while the illustrations in Paolo Mascagni's *Vasorum lymphaticorum* (1787) were part of a systematic, methodical approach to the representation of the lymphatics throughout the human body.[326]

5.1 Milky veins and lymphatic vessels

Before discussing the role of images in establishing the lymphatic system as an anatomical structure in its own right, attributed with a specific physiological function, it is necessary to assess the sometimes confusing terminology and concepts which were used by both early modern anatomists and historians of science and medicine to write about what was to become the system of absorbing vessels. Andrew Cunningham's approach to the history of anatomy as a "history of projects of inquiry"[327] makes it possible to understand the conceptual difficulties of anatomical knowledge in the past. By dismissing the question of the priority of discovery and concentrating on the projects of anatomical inquiry, it becomes clearer what kind of anatomical knowledge could be produced for what purpose under which circumstances. This makes it easier to understand why, for example, the idea of a lymphatic system as a self-contained

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326 William Cruikshank, *The Anatomy of the Absorbing Vessels of the Human Body*, London: G. Nicol [printer], 1786. The second enlarged edition also came with more plates illustrating the lymphatics and is used in the following. Paolo Mascagni, *Vasorum lymphaticorum corporis humani historia et ichnographia*, Siena: P. Carli, 1787.

327 Cunningham, *Renaissance*, 1997, p. x.

anatomical entity was only established towards the end of the eighteenth century, while parts of it like the thoracic duct and the lymphatic vessels in human and animal bodies were already known in the seventeenth century. The lymphatic system provides an opportunity to study how a new anatomical object entered the anatomical discourse and how the uncertainties about this new object were resolved in the anatomical discourse. Early modern anatomists had big conceptual difficulties and terminological problems when they tried to identify parts of what was to become a system of absorbing vessels, called the "lymphatic system". A number of terms circulated to identify parts of the system, such as "vasa lymphatica", a term coined by Thomas Bartholin (1616-1680) for the lymphatic vessels, which succeeded over Olaus Rudbeck's (1630-1702) synonymous term "vasa serosa".[328] Other terms used for such vessels found in the abdomen and thorax were "vasa lactea" or "milky vessels".[329]

The conceptual and terminological problems surrounding the lymphatic system were perpetuated in the historiography of anatomy. Reginald S. A. Lord gave great attention to the development of the topographical anatomy of the lymphatic system in his 1968 paper on 'Conceptual Difficulties in the History of the Lymphatics'. However, he remained fairly vague about the nature and function ascribed to the lymphatic system in the past. The terminological confusion is obvious in Nellie B. Eales' 1974 article on the history of the lymphatic system, where she found it difficult to clearly name her subject: "Although there are vague references to the **lymphatic system** in early times […], the first description of the intestinal **lymph vessels** was given by Gasparo Aselli (1581-1626) […]. He thought that these **lacteal vessels** went to the liver which […] had been regarded as the blood-forming organ of the body."[330] This terminological inconsistency also reflects the difficulties early modern anatomists had when they tried to describe the lymphatics and interpret their physiological function.

Before Aselli's observation of the lacteal vessels while studying the mesenterium of a dog during a vivisection in 1622, descriptions of vessels containing transparent or white

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328 Lord, 'Veins', 1968, p. 177.

329 Stephan Blankaart, *The Physical Dictionary: Wherein the Names of Anatomy, the Names and Causes of Diseases, Chirurgical Instruments, and their Use, are accurately described*, London: John and Benjamin Sprint, 1726 (1st ed., Latin, 1679), p. 350.

330 Eales, 'History', 1974, p. 280. Emphasis by me.

fluids in the human body were sketchy and did not come up with a convincing interpretation of the phenomenon.[331] When Aselli observed white vessels containing valves, which were filled with a white fluid and led from the intestines towards the liver, he interpreted their function as absorbing the digested nutritive substances (chyle) and transporting them to the liver where they would be transformed into blood.[332] The idea that the chyle vessels (lacteal veins) formed a separate structure with a specific function in digestive processes was quickly adopted. While Aselli had only observed the lacteal veins in animals, the Padua anatomist Johann Vesling, for example, soon confirmed their existence in human bodies in the 1630s.[333] Another important step was Jean Pecquet's research, who described the thoracic duct in dogs.[334] He observed this channel in the chest leading from a receptacle for the chyle under the diaphragm to the subclavian vein and linked it to Aselli's mesentery lacteal veins.[335]

These observations were the starting point for a series of investigations into the nature of these vessels and as a result of this research the idea that the lymphatics formed a separate vascular system was gradually established during the second half of the seventeenth century. For the idea of a lymphatic system the research carried out by the Danish anatomist Thomas Bartholin and the Swedish anatomist Olaus Rudbeck (1630-1702) was crucial. Both described in a number of publications during the 1650s the lymphatic vessels in various parts of the body.[336] Their research was based on vivisections during which they managed to identify the lymphatics and used ligations in order to determine their functioning. Rudbeck regarded the lymphatics as vessels which

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331 Lord, 'Veins', 1968, pp. 174-175.

332 Mani, *Grundlagen*, 1967, pp. 85-86. Gaspare Aselli, *De lactibus sive lacteis venis, quarto vasorum mesaraicorum genere*, Milan: Bidellius, 1627.

333 Lord, 'Veins', 1968, p. 176.

334 Jean Pecquet, *Experimenta nova antomica, quibus incognitum hactenus chyli receptaculum, et ab eo per thoracem in ramos usque subclavios vasa lactea deteguntur*, Paris: Sebastian Cramoisy and Gabriele Cramoisy, 1651.

335 Lord, 'Veins', 1968, p. 176.

336 Thomas Bartholin, *De lacteis thoracicis in homine brutisque nupperime observatis, historia anatomica*, Copenhagen: Melchior Martzan [printer], 1652; Thomas Bartholin, V*asa lymphatica, nuper Hafniae in animantibus inventa, et hepatis exsequiae*, Copenhagen: Georg Holst, 1653; Olaus Rudbeck, *Nova exercitatio anatomica, exhibens ductus hepaticos aquosos et vasa glandularum serosa, nunc primum inventa*, Västerås: E. Lauringer, 1653. The simultaneous discovery of the lymphatics by Rudbeck and Bartholin led to a fierce controversy over the priority of discovery. Trautmann, 'Entdeckung', 1977, pp. 33-34.

contained valves and were distinct from the lacteal veins in their origin. He traced their path from the liver and other parts of the body to the receptacle of the chyle.[337] Bartholin also described this new kind of vessels throughout the body, but remained vaguer about their destination and more generally observed that the lympha, the transparent fluid contained in the lymphatic vessels, moved towards the heart.[338] Yet they agreed that the use of the lympha was unknown and only made some remarks which suggested that the lymphatics could play a role in absorbing serous liquids, fat and chyle in the body and might be important for the further refinement of the chyle (Rudbeck) or the blood (Bartholin).[339]

The broader context for this seventeenth-century research on the lymphatics were the debates about absorption, the production of blood and the function of the liver, which were a response to William Harvey's theory of blood circulation.[340] While Aselli's idea of the lacteal veins of the mesentery had not jeopardised the ancient role of the liver as the blood producing organ, Pecquet's observation that the chyle passed from the intestines not through the liver but into the thoracic duct posed a fundamental challenge and the liver was relegated by him to filtering blood and excreting bile.[341] Previously, the liver had been regarded as the blood producing organ, where the digested and liquefied food was transformed into blood.[342] Pecquet, however, had demonstrated that the vessels which took on the chyle from the mesentery bypassed the liver and emptied into the thoracic duct. Therefore there was no evidence that the liver was the organ where the nutritious fluids were transformed into blood. These findings were confirmed by the Dutch anatomist Johannes van Horne, who independently from Pecquet had discovered the thoracic duct in animals and reached similar conclusions.[343]

Rudbeck and Bartholin also denied the existence of lacteal veins in the liver providing chyle and instead minutely described the lymphatic veins of the liver which transported

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337 Aage E. Nielsen, 'A Translation of Olof Rudbeck's *Nova excercitatio anatomica*', *Bulletin of the History of Medicine*, 11 (1942), 304-338, pp. 317 and 329-330;
338 Kleinebrink-Kufferath, 'Kontroverse', 1984, p. 29.
339 Kleinebrink-Kufferath, 'Kontroverse', 1984, pp. 30-31; Nielsen, 'Translation', 1942, pp. 331-332.
340 Mani, *Grundlagen*, 1967, pp. 82-83.
341 Mani, *Grundlagen*, 1967, p. 89.
342 Mani, *Grundlagen*, 1967, p. 80.
343 Mani, *Grundlagen*, 1967, 88-90.

a clear liquid away from the liver to the thoracic duct.[344] In his *Vasa lymphatica*, Bartholin buried the ancient liver, dedicated her an epitaph announcing her demise as the central blood-producing organ. Bartholin's attack on Galenic traditionalists led to a controversy with the traditionalist Paris anatomist Jean Riolan who refused to accept the new notion of the lymphatic vessels proposed by Bartholin.[345] While theories about the function of the liver that regarded it as a purifying and excreting organ quickly became dominant, research on the lymphatics during the last four decades of the seventeenth century focused on a more exact description of the lymphatic vessels and their topography. In the discussions of the exact appearance, structure and function of the lymphatics, the question of the priority of discovery of these vessels was raised again and again. In response to these debates and to claim the fame of having discovered the lymphatics, Bartholin published an edition of both his treatises on the thoracic duct and the lymphatics in one volume.[346] This claim was emphasized by the frontispiece of the book, which showed a portrait of author, flanked by two naked female figures sitting on rocks who were holding a laurel crown above his head (figure 5.1). From the breasts of the women were flowing streams of milk that formed into rivers and fertilised a lush Garden of Eden in the foreground. The frontispiece demonstrated the importance of Bartholin's discovery for the understanding of nutrition and the depiction of the paradise-like landscape suggested that it would also contribute to a better understanding of God's Creation. Meanwhile no doubts were left who deserved the fame of having made these fundamental insights first, when Bartholin's larger than life portrait dominated the whole scene.

In the context of the controversy between Bartholin and Riolan and in response to the Flemish amateur anatomist Louis de Bils, who denied the existence of valves in the lymphatic vessels, the young Dutch anatomist Frederik Ruysch published his

344 Mani, *Grundlagen*, 1967, 93-94.

345 Bartholin, *Vasa*, 1653; Thomas Bartholin, *Defensio vasorum lacteorum et lymphaticorum adversus Joannem Riolanum*, Copenhagen: Georg Holst, 1655; Mani, *Grundlagen*, 1967, pp. 96-98; Nikolaus Mani, 'Jean Riolan II (1580-1657) and Medical Research', *Bulletin of the History of Medicine*, 42 (1968), 121-144, pp. 132-138.

346 Thomas Bartholin, *Opuscula nova anatomica, de lacteis thoracicis et lymphaticis vasis, uno volumine comrtehensa*, Copenhagen: Daniel Pauli, 1670.


VASA LACTEA
et
LYMPHATICA.
Hafniæ Sumtibus DANIELIS PAULLI.

Figure 5.1

Dilucidatio valvularum in vasis lymphaticis in 1665.[347] In this little book he demonstrated the lymphatic valves based on skilful preparations and accompanied his outline of their location, form and function with clear illustrations. While Ruysch's account was more concerned with the microanatomy of the lymphatic veins, the major concern for anatomists became the question of the origin of the lymphatics and where they absorbed the transparent fluid they contained. This interest in the macrostructure of the lymphatics and the influence of Marcello Malpighi, anatomist at Padua, who observed the capillary links between the smallest arteries and veins led to a new theory of arterial lymphatics.[348] Towards the end of the seventeenth century the Leiden anatomist Anton Nuck first suggested that the lymphatic vessels originated from the arteries.[349] Blowing air into arterial vessels and the introduction of mercury injections to research on the lymphatics allowed Nuck to observe and describe the smallest vascular structures of the lymphatic system.[350] Based on Nuck's research the idea of arterial lymphatics became the dominant theory of the early eighteenth century and was promoted, for example, by the French anatomist Raymond de Vieussens in his *Novum vasorum corporis humani systema*.[351] He described different kinds of lymphatic vessels with a variety of abilities. According to Vieussens, certain types formed even muscle tissue, while they could also form glandular drainages, which had the capacity to absorb a variety of different bodily fluids. Vieussens distinguished from those arterial lymphatics the lymphatic vessels originating from the veins, which merely transported the lymph which was used to dilute the chyle.[352]

Opinions on the function of the lymphatics varied widely during the second half of the seventeenth and most of the eighteenth centuries. Besides the question of the origin of the lymphatic vessels, the relation between them and the lacteal vessels was also debated. The generally accepted idea, however, appeared to be that the lymphatics

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347 Frederik Ruysch, *Dilucidatio valvularum in vasis lymphaticis et lacteis*, The Hague: Hermann Gael, 1665. On the dispute with de Bils and how it helped Ruysch to build his reputation see Cunningham, *Anatomist*, 2010, p. 282.

348 Trautmann, 'Entdeckung', 1977, p. 43.

349 Anton Nuck, *Adenographia curiosa et uteri foeminei anatome nova: cum epistola ad amicum, de inventis novis*, Leiden: J. Luchtmans, 1691, pp. 51-54.

350 Trautmann, 'Entdeckung', 1977, pp. 43-44.

351 Raymond de Vieussens, *Novum vasorum corporis humani systema*, Amsterdam: Paul Marret, 1705.

352 Trautmann, 'Entdeckung', 1977, pp. 51-53.

absorbed dispensable liquid from the blood while also transporting the nutritious chyle. Steven Blanckard's medical dictionary defined the "vasa lymphatica" (or "vena lymphatica" and "lymphatic veins" respectively) as vessels which took the lympha, a clear fluid superfluous to the blood, from the glands to the veins and the "receptacle of the chyle", while the "vasa lactea" (or "milky veins") had to "[…] convey the Chyle from the Guts to the little Bag that holds the Chyle, and thence to the *Ductus*, which conveys it along the *Thorax*".[353] However, while Blankaart's medical dictionary was still in print in the second half of the eighteenth century, the idea of the lymphatic vessels as a system of absorbing vessels had taken shape.[354]

5.2 The iconography of the milky veins and the lymphatic vessels

The majority of the important publications from the seventeenth century concerned with the lacteal and the lymphatic vessels were illustrated. These images shared with contemporary representations of the rete mirabile the feature that they also showed an object of which the appearance and nature were unclear and a matter of debate. However, while the rete mirabile fell into oblivion, the lymphatic system became an integral part of human and animal anatomy. Unlike the images of the rete, illustrations showing the lymphatics managed to confirm the existence, appearance and function of the lymphatics and gradually developed a convincing iconography, backed up by anatomical dissections and experiments.

The earliest illustrations showing aspects of what was to become the lymphatic system, Aselli's illustrations of the lacteal vessels of the mesentery (figure 5.2), did not yet differentiate the lacteal veins from other vessels of the abdomen in their appearance. Aselli was uncritical of the Galenic theory of blood production, according to which the veins of the mesentery absorbed the chyle form the digested food in the stomach and transported it to the liver, where it was used to produce blood.[355] Accordingly Aselli's illustration showed how the lacteal vessels (indexed with the letter B) progressed

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353 Blankaart, *Dictionary*, 1726, p. 351. On the "lympha" in general see Blankaart, *Dictionary*, 1726, p. 217.

354 Blankaart's dictionary was a standard medical reference in late seventeenth and eighteenth century Europe. It saw at least 25 editions in Latin, English and German between 1679 and 1788 (Snelders, 'Blankaart', 1988, pp. 163-164 and 171-172).

355 Mani, *Grundlagen*, 1967, pp. 85-86.

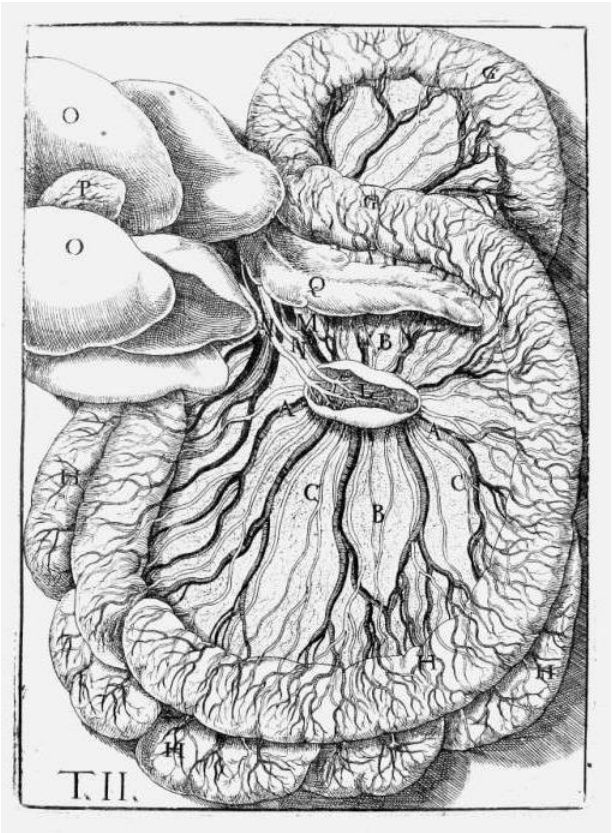

Figure 5.2

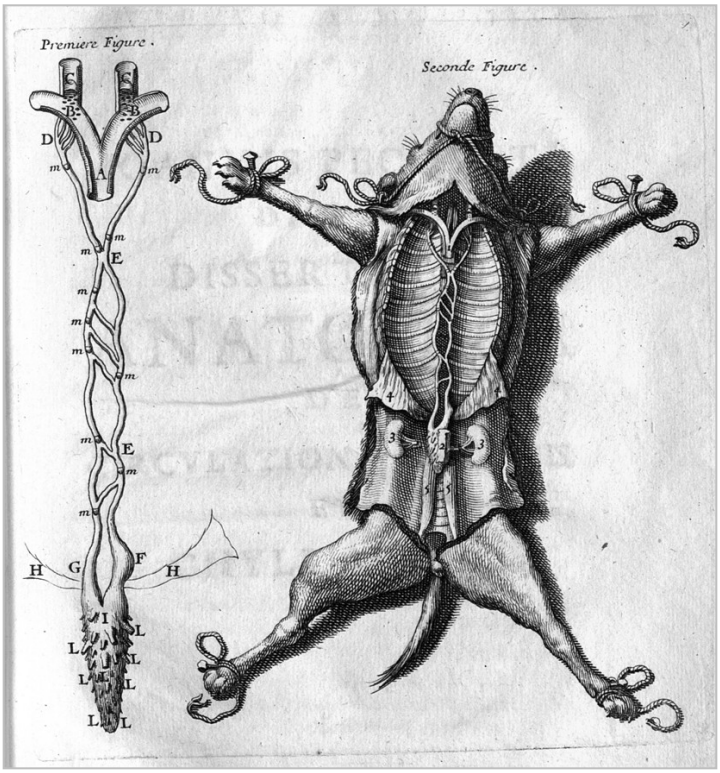

Figure 5.3

through the pancreas (indexed with letters L and N) to the liver (indexed with letter O).[356] Both the lacteal vessels and the blood vessels (indexed with the letter A) were of the same shape and shown alongside each other. The only visible difference between them was their colour. While the lacteal vessels which contained the pale chyle where white, the blood vessels which transported the red blood were darker. The difference in the colour between lacteal vessels and blood vessels, however, merely indicated a different use, but not a separate vascular system.

The first author who used an illustration of the lacteal vessels, which clearly distinguished them from blood vessels, was Jean Pecquet (figure 5.3). In his *Experimenta Nova Anatomica* Pecquet showed the lacteal vessels (indexed with the letter E) as irregular tubes which had little valves (indexed with the letter m) visible from the outside. They differed significantly from the blood vessels forming the vena cava (indexed with letter A) and vena subclavia (indexed with letter B). Unlike the lacteal vessels, the blood vessels were more regular and their fine valves (indexed with letter C) could only be seen when the vessel was opened. For Pecquet the observation of valves in the lacteal vessels was of particular importance with regards to their role in transporting the chyle past the liver which challenged the traditional role of the liver as the blood producing organ.[357] While Pecquet did not argue that the lacteals formed a separate vascular system, his representation of the lacteal vessels established a distinct iconography.

The representation of the lacteal and lymphatic vessels as irregular tubes with little knobs formed by the valves quickly became the distinguishing feature of the lymphatics. Already Rudbeck emphasised the uniqueness of the lymphatics in this manner in his *Vasa glandularum serosa*. His little treatise on the lymphatics came with four figures on two plates. The first plate (figure 5.4, TAB I) showed the intestines of a dog with the lacteal vessels (indexed with letters c and d) and the liver ducts (indexed

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356 Aselli's captions to this illustration were slightly confusing. He identified the object in the centre of the mesenterium as the pancreas while he described the object indexed with the letter Q as a fleshy, glandular and fatty structure, unique in dogs ("pars quaedam carnosa, glandulosa et adiposa, carnibus peculiaris"). Mani pointed out that while what was identified by Aselli as the pancreas was actually a mesentery gland while the object indexed with the letter Q was actually the pancreas (Mani, *Grundlagen*, 1967, p. 596).

357 Mani, *Grundlagen*, 1967, p. 89.

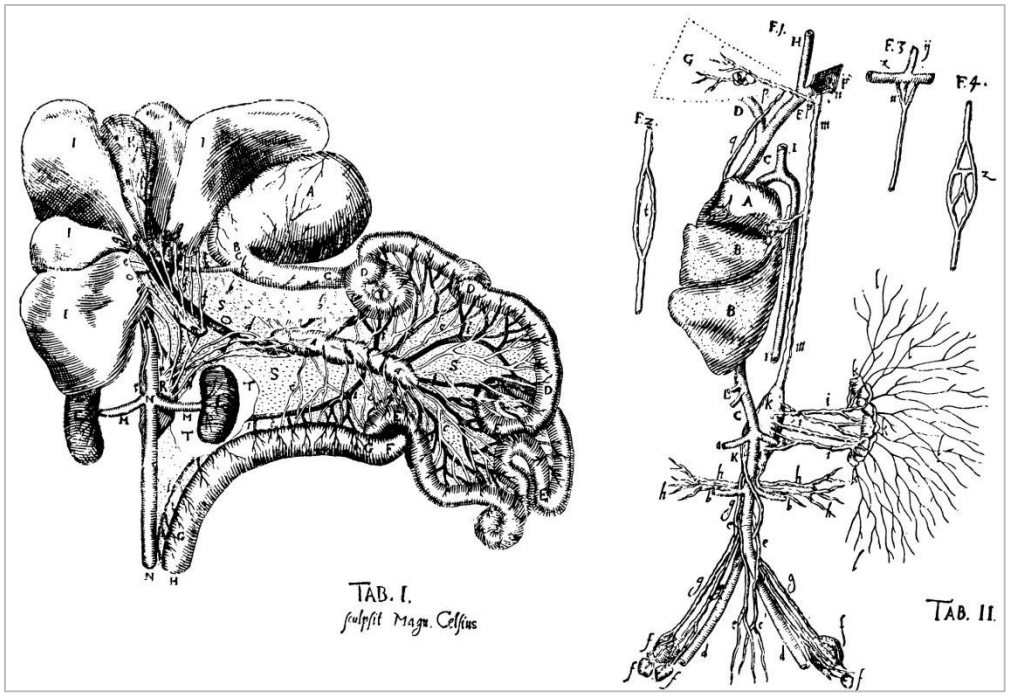
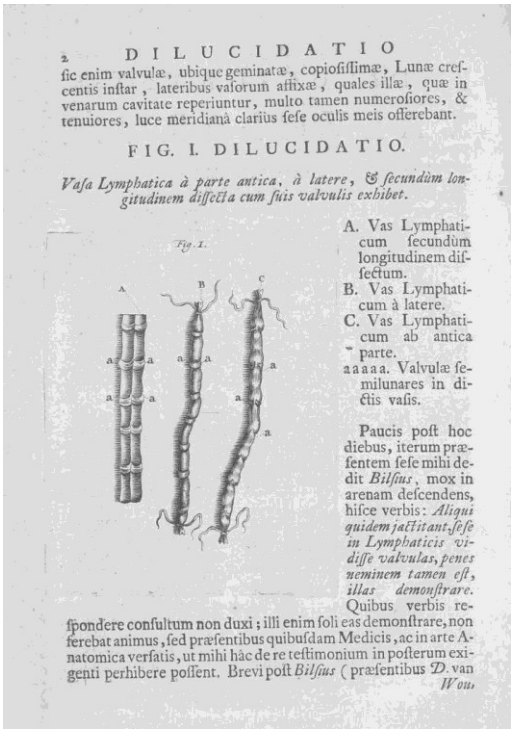


Figure 5.4



2 DILUCIDATIO

ſic enim valvulæ, ubique geminatæ, copioſiſſimæ, Lunæ creſcentis inſtar, lateribus vaſorum affixæ, quales illæ, quæ in venarum cavitate reperiuntur, multo tamen numeroſiores, & tenuiores, luce meridianâ clariùs ſeſe oculis meis offerebant.

FIG. I. DILUCIDATIO.

Vaſa Lymphatica à parte antica, à latere, & ſecundùm longitudinem diſſecta cum ſuis valvulis exhibet.

Fig. I.

A. Vas Lymphaticum ſecundùm longitudinem diſſectum.
B. Vas Lymphaticum à latere.
C. Vas Lymphaticum ab antica parte.
aaaaa. Valvulæ ſemilunares in dictis vaſis.

Paucis poſt hoc diebus, iterum præſentem ſeſe mihi dedit *Bilſius*, mox in arenam deſcendens, hiſce verbis: *Aliqui quidem jactitant ſeſe in Lymphaticis vidiſſe valvulas, penes neminem tamen eſt, illas demonſtrare.* Quibus verbis reſpondere conſultum non duxi; illi enim ſoli eas demonſtrare, non ferebat animus, ſed præſentibus quibuſdam Medicis, ac in arte Anatomica verſatis, ut mihi hâc de re teſtimonium in poſterum exigenti perhibere poſſent. Brevi poſt *Bilſius* (præſentibus D. van Wou-

Figure 5.5

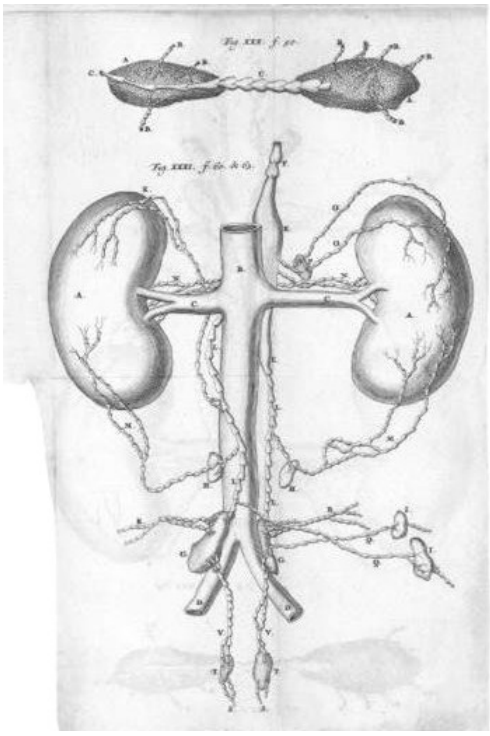


Figure 5.6

with letters e and f), the other figures (figure 5.4, TAB II) represented the lymphatic vessels[358] and the thoracic duct in relation to the heart and the vena cava (figure 5.4, TAB II, F. 1). While the vessels on the first plate did not show any special features, and the lacteal vessels of the mesentery and their distribution resembled Aselli's illustrations, the lymphatic vessels on the second plate, especially in figure 2, showed some distinct features. The lymphatics (TAB II, F., 1, indexed with letters i and m) were identified as a distinct kind of vessels by their corrugated surface in contrast to the plain surface of the blood vessels (TAB II, F., 1, indexed with letters C, D, E, H, J). Unlike previous authors, Rudbeck thereby not only in his text but also visually established the blood vessels and the lymphatics as two separate systems with different appearances and uses by contrasting them. In response to Louis de Bils, Ruysch used dried lymphatic vessels and ligatures to demonstrate how the valves only allowed the fluids to flow in one direction, illustrations of which were included in his *Dilucidatio valvularum in vasis lymphaticis* (figure 5.5). He thereby successfully rejected de Bils's claim that the lymphatic vessels would transport fluid towards both the receptacle of the chyle and the liver.[359]

During the second half of the seventeenth century the overemphasis on the little knobs formed by the valves in visual representations of the lymphatic vessels was on the one hand used to underline the novelty character of the discovery of the lymphatic vessels in more and more parts of the body. Anton Nuck, for example, used in his *Adenographia* a number of plates which showed lymphatic vessels recently discovered by him as extremely irregular tubes with exaggerated valves (figure 5.6, Fig. XXXI). Nuck thereby confirmed the existence of a separate vascular system and was able to substantiate his research on the topography of the lymphatics, for which he was the first to use mercury injections.[360] However, the emphasis on the valves could also be used to make claims about how the lymphatic system worked.

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358 Rudbeck used the term *vasa serosa* for the lymphatic vessels, which did not become part of medical terminology.

359 Trautmann, 'Entdeckung', 1977, pp. 36-38.

360 Rüdiger Schultka, Luminita Göbbel, 'Präparationstechniken und Präparate im 18. und frühen 19. Jahrhundert, dargestellt an Beispielen aus den anatomischen Sammlungen zu Halle (Saale)', in Jürgen Helm and Karin Stukenbrock (eds), *Anatomie. Sektionen einer medizinischen Wissenschaft im 18. Jahrhundert*, Stuttgart: Franz Steiner Verlag, 2003, 49-81, pp. 72-73.

The notion of the lymphatic vessels as a distinct kind of vessel appeared to be well established at the turn of the eighteenth century. The Flemish anatomist Philip Verheyen, for example, dedicated two chapters in his anatomical handbook to the lymphatic vessels. While chapter 5 was a description of the appearance of the lymphatic vessels,[361] chapter 12 discussed the appearance, topography and use of mainly the lacteal vessels and the thoracic duct, although the lymphatic vessels appeared in the chapter title.[362] The notion that the lymphatics were a different kind of vessels was also evident in the illustrations in Verheyen's handbook. On plate II (figure 5.7), which illustrated fibres, membranes, vessels, glands and muscles, he included an illustration of the lymphatic vessels (Fig. 7). This illustration showed the lymphatic vessels (A) with their distinctive feature of irregular knobs indicating the valves. Such knobs were absent in the veins and arteries (Fig. 3), where the valves could only be seen in a longitudinal section of a vein (Fig. 6, A and B).

However, Verheyen was less certain about the relation between the lymphatic vessels and the lacteal vessels. While he did not discuss the lacteals while introducing the different tissues of the body, Verheyen went to great lengths to describe the appearance and use of the lacteal vessels in the chapter on the lymphatics and the thoracic duct. He gave a detailed account of the lacteal vessels absorbing the nutritious fluids from the intestines, their path through the pancreas and into the receptacle of chyle at the base of the thoracic duct from where the nutritious fluids were supplied to the blood. Verheyen regarded the lacteal vessels as similar to the lymphatic vessels and even saw valves in them, but avoided identifying them as part of the same structure, while the thoracic duct was regarded a yet another organ with a specific use.[363]

This notion of the lacteal vessels, the lymphatic vessels and the thoracic duct as separate entities was confirmed by the illustrations which accompanied chapter 12 on plate VIII

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361 Philip Verheyen, *Anatomie, oder Zerlegung des menschlichen Leibes*, Leipzig: Thomas Fritschen, 1708 (1st ed., Latin, 1693), pp. 27-31. Verheyen's anatomical handbook was very popular from the 1690s to the 1730s with twelve editions, two of which were published in German.

362 Verheyen, *Anatomie*, 1708, pp. 117-131.

363 Verheyen, *Anatomie*, 1708, pp. 117, 121-123 and 127.

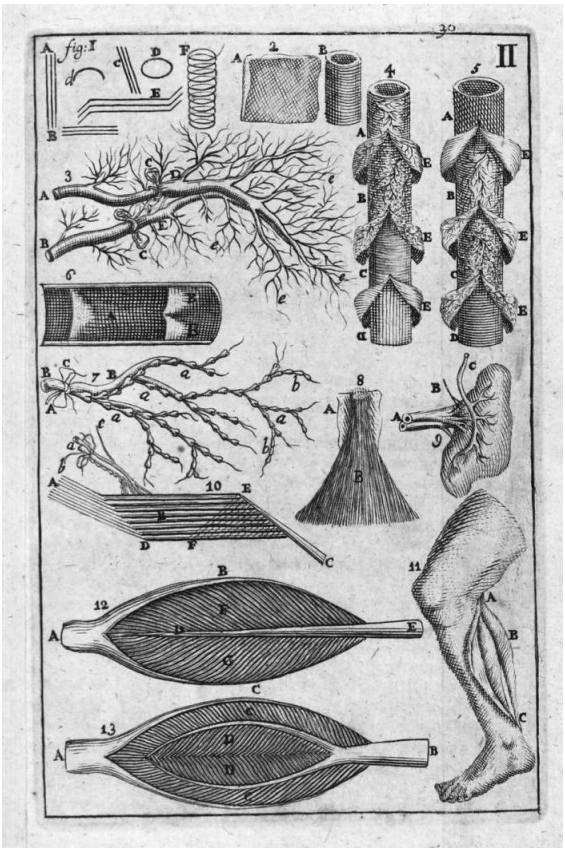

Figure 5.7

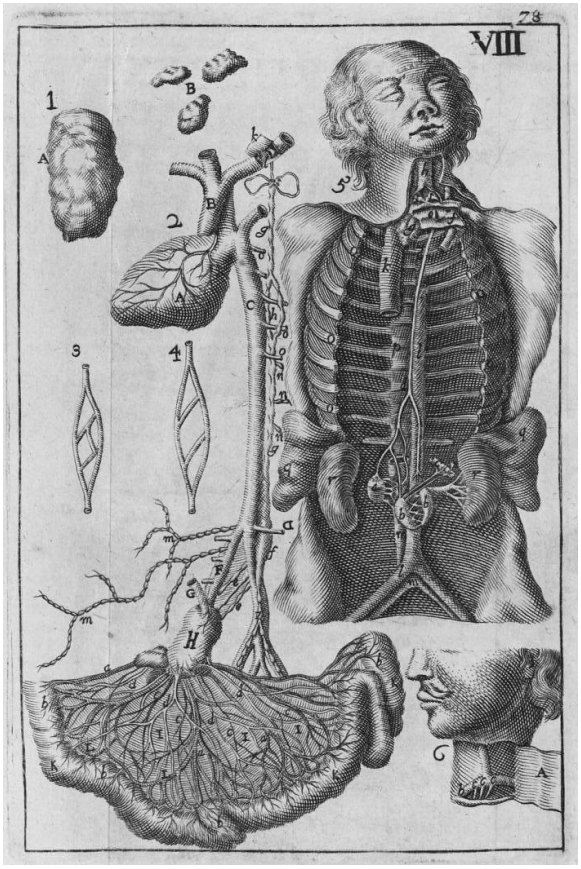

Figure 5.8

(figure 5.8).[364] On this plate the figure 2 represented the mesentery and the path of the chyle in dogs. While the lacteal vessels of the mesentery (d) on this illustration had a smooth surface, the lacteal vessels (e) leading from the pancreas (H) to the receptacle of the chyle (D) had, like the thoracic duct (g), an uneven surface. Meanwhile the lymphatic vessels (m) featured their distinctive knobs which identified them as a separate kind of vessel. The lacteal vessels of the mesentery had been known for a long time and their use explained. This was confirmed by the illustration in which the appearance of the lacteals much resembled the older and frequently copied illustrations by Aselli. The appearance between the other lacteal and the lymphatic vessels as well as the thoracic duct was less clear. The physiological relation between these different vessels was indicated by a certain degree of similarity in their appearance. Vesling had used an illustration which showed the lymphatics of the mesentery, the thoracic duct and other lymphatic vessels as related to each other. However, they featured distinguishing characteristics and were not shown in their topographical context and as a vascular system throughout the whole body. Since there was not yet a coherent concept of the lymphatics forming a separate vascular system, lacteals, lymphatic vessels and the thoracic duct were still treated as separate entities.

Before the second half of the eighteenth century, images representing the lymphatics only showed fragments of the lymphatic system. While they helped to establish this elusive object as an anatomical matter of fact, they also represented the uncertainty about the nature of the lymphatic system and left its discovery throughout the whole body as unfinished business. The distribution of the lymphatic vessels throughout the body remained unclear, the illustrations often showed the lymphatics not in situ, but focused on their appearance and how they operated. Therefore authors such as Rudbeck, Ruysch and Nuck emphasised features such as the lymphatic valves and nodes to distinguish the lymphatic vessels from blood vessels or showed the ligatures which allowed them to demonstrate the direction of movement of the lymph and the chyle in the lymphatic vessels. This established a coherent iconography of the lymphatic vessels, but not of the lymphatic system as a whole. This idea only developed gradually and was not firmly established until the end of the eighteenth century, when the lymphatic

[364] The plate used as an illustration is from the 1710 Latin edition of Verheyen's anatomical handbook. Plate VIII, Fig. 2 is a copy of Plate VI, Fig. 4 from the 1708 German edition.

system as a system of absorbing vessels throughout the whole body had become a generally accepted concept.

5.3 The system of absorbing vessels

Crucial for the development of the idea of the lymphatics as a separate vascular system was the use of mercury injections. Anton Nuck had introduced this technique for the study of the lymphatics and used it for the research on his *Adenographia*, published in 1691.[365] The refinement of this technology during the eighteenth century allowed the production of more and more accurate anatomical specimens showing the appearance, distribution and function of the lymphatics throughout the body.[366] While the introduction of mercury injections and the improvement of this technique was a very important step, it does not explain why it took three generations between Nuck's *Adenographia* and the publications of Cruikshank, Mascagni and others to establish the idea of the lymphatics as a system of absorbing vessels at the end of the eighteenth century.

The discovery of the lymphatic system as a system of absorbing vessels throughout the whole body was claimed in a number of key publications during the second half of the eighteenth century, mainly by Alexander Monro Secundus and anatomists from the circle around William Hunter and John Hunter.[367] Monro and William Hunter began to

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365 Schultka/Göbbel, 'Präparationstechniken', 2003, p. 72

366 Schultka/Göbbel, 'Präparationstechniken', 2003, p. 69.

367 Alexander Monro, *De venis lymphaticis valvulosis et de earum in primis origine*, Berlin: Gottlieb August Lang, 1757; Alexander Monro, *Observations, Anatomical and Physiological, Wherein Dr. Hunter's Claim to Some Discoveries Is Examined*, Edinburgh: Hamilton, Balfour & Neill [printer], 1758; William Hunter, *Medical Commentaries: Part I: Containing a Plain and Direct Answer to Professor Monro, jun., Interspersed With Remarks on the Structure, Functions, and Diseases of Several Parts of the Human Body*, London: printed by A. Hamilton, sold by A. Millar, 1762; William Hewson, *Experimental Inquiries: Part the First: Being a Second Edition of an Inquiry into the Properties of the Blood: With Remarks on some of its Morbid Appearances: And an Appendix, Relating to the Discovery of the Lymphatic System in Birds, Fish, and Animals Called Amphibious*, London: T. Cadell, 1772; John Sheldon, *The History of the Absorbent System, Part the First: Containing the Chylography, or Description of the Lacteal Vessels, with the Different Methods of Discovering, Injecting, and Preparing Them, and the Instruments Used For These Purposes*, London: self-published, 1784; William Cruikshank, *The Anatomy of the Absorbing Vessels of the Human Body*, London: G.

question the doctrine of the lymphatic vessels as extensions of the arteries around the middle of the eighteenth century.[368] Both assumed that the lymphatic vessels formed a separate vascular system which absorbed fluids from the inner surfaces of the body. Monro and William Hunter drew their conclusion from experiments during which they injected blood vessels with mercury, could not observe any transfer of the mercury into the lymphatic vessels, and deducted that the lymphatics could not be regarded as extensions of the arteries. Only when the blood vessels burst and the mercury passed into the surrounding tissue, the lymphatics would absorb it.[369]

The research of Monro and William Hunter into the anatomy and physiology of the lymphatics led to a bitter controversy between the two men about the question of who should have the priority of discovery.[370] After Monro published his little treatise on the lymphatics in 1757 (the research it was based on had been carried out a few years earlier in c1753 to 1755),[371] William Hunter claimed that he had already previous to Monro taught on the lymphatics as absorbent vessels, which were not extensions of the arteries. The rift turned into a public controversy in 1758, when the *Monthly Review* and the *Critical Review* discussed the matter in support of Hunter's claim (there is indeed evidence in lecture notes dating back to 1752 which confirm Hunter's claim).[372] However, the controversy generated renewed interest in the lymphatics and the new theory of lymphatic absorption. Especially authors from the circle around William and John Hunter, such as William Hewson and William Cruikshank, made crucial contributions to establishing the idea of the system of absorbing vessels.

Nicol, 1786; Paolo Mascagni, *Vasorum lymphaticorum corporis humani historia et ichnographia*, Siena: Pazzini Carli, 1787.

368 Trautmann, 'Entdeckung', 1977, pp. 53-54.

369 Eales, 'History', 1974, pp. 282-6.

370 For a brief recent account of the dispute see Cunningham, *Anatomist*, 2010, pp. 287-291. Being a matter of honour and dignity as well as of great importance for establishing or defending social status explains why such disputes over the priority of discovery were often fought quite fiercely among anatomists (Cunningham, *Anatomist*, 2010, p. 280).

371 Trautmann, 'Entdeckung', 1977, pp. 54-56.

372 Eales, 'History', 1974, pp. 285-9. On the controversy between Hunter and Monro see also John Wiltshire, *Samuel Johnson in the Medical World: The Doctor and the Patient*, Cambridge: Cambridge University Press, 1991, pp. 131-135.

William Cruikshank (1745-1800) claimed that in his *Anatomy of the Absorbing Vessels*, he had discussed the lymphatics in a traditional manner: "in compliance with anatomists in general, I have considered the Absorbent System of two parts, and have given the history of the discovery of each part". Yet he declared that he had found that "in fact, the lacteals and lymphatics are branches of one common trunk in the same animal".[373] Cruikshank and others thought that these vessels were absorbing fluid from the (inner) surfaces of the body and would carry fluids such as the chyle or the lymph to the blood-vessels.[374] By the end of the eighteenth century the idea of the lymphatics as a system of absorbing vessels had been accepted as the dominant concept to understand its structure and function. This development was epitomized by the publication and immediate success of William Cruikshank's *Anatomy of the Absorbing Vessels* and Paolo Mascagni's *Vasorum lymphaticorum*. While Mascagni's work was a description of the lymphatics with detailed illustrations of the lymphatic vessels in the whole body, Cruikshank gave a detailed account of the anatomy and physiology of the lymphatic system, with a comprehensive history of the lymphatics.

One reason for the difficulties in establishing the new idea of the lymphatics as a system of absorbing vessels was given by the Leipzig anatomy professor Christian Friedrich Ludwig (1751-1823). He identified terminology as one of the most problematic areas of anatomy in the introduction to his 1789 German translation of William Cruikshank's *Anatomy of the Absorbing Vessels* (first English edition in 1786). Ludwig argued that for a better understanding of anatomy and to identify gaps in research an exact terminology and awareness of previous research were indispensable. Ludwig thought that many anatomical misapprehensions and disputes could be resolved by a historically founded terminology. Therefore a history of anatomy had not only to list the discoveries chronologically, but also to evaluate how far earlier anatomical research went, give an account of disputes over discoveries, reference properly, and describe methods of dissection used by previous anatomists.[375] By emphasizing the need for terminological

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373 William Cruikshank, *The Anatomy of the Absorbing Vessels of the Human Body*, 2nd ed., London: G. Nicol [printer], 1790, p. 37. The second enlarged edition also came with more plates illustrating the lymphatics and is mainly used subsequently.

374 Cruikshank, *Anatomy*, 1790, pp. 9-10 and 99. See also Lord, 'Veins', 1968, pp. 178-180.

375 Christian Friedrich Ludwig, *William Cruikshank's Geschichte und Beschreibung der einsaugenden Gefäße, oder Saugadern des menschlichen Körpers*, Leipzig:

clarification and historical contextualisation, Ludwig justified his edition of Cruikshank's *Anatomy of the Absorbing Vessels* and Paolo Mascagni's (1752-1815) *Vasorum lymphaticorum*, which were accompanied by Ludwig's historical introduction and a comprehensive bibliography on the topic in a third volume. Cruikshank's and Mascagni's books were enthusiastically celebrated by Ludwig as publications which had filled a gap in anatomical research "once and for all, and to a considerable completeness" in an unsurpassable manner.[376]

Ludwig's appreciation of Cruikshank's and Mascagni's work suggests that by the end of the eighteenth century the idea of the lymphatic system as a system of absorbing vessels was generally accepted in anatomy. However, Ludwig's hint at the terminological difficulties and previous disputes alludes to the problems in the development of the idea of the lymphatics as a system of absorbing vessels. This raises two questions: Firstly, what was the exact idea anatomists had in the second half of the eighteenth century of the nature, function and appearance of the lymphatics, and secondly, what were the remaining uncertainties about this concept. Both issues were addressed in Cruikshank's *Anatomy of the Absorbing Vessels*, which gave an account of the development of the idea of the lymphatic system, as well as a detailed description of

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Weidmannische Buchhandlung, 1789, pp. VI-VII. Ludwig also gave a comprehensive overview and bibliography of the development of the idea of a system of absorbing vessels in Christian Friedrich Ludwig, *William Cruikshank's und anderer neuere Beiträge zur Geschichte der einsaugenden Gefäße oder Saugadern des menschlichen Körpers: Mit einigen Anmerkungen und einer Uebersicht der Literatur der Saugaderlehre*, Leipzig: Weidmannische Buchhandlung, 1794. He also edited a translation of Paolo Mascagni's *Vasorum lymphaticorum* (Christian Friedrich Ludwig, *Paul Mascagni's Geschichte und Beschreibung der einsaugenden Gefäße oder Saugadern des menschlichen Körpers*, Leipzig: Weidmannische Buchhandlung, 1789).

376 Ludwig, *Cruikshank*, 1789, p. V. Cruikshank's and Mascagni's work quickly became the most cited literature on the absorbents in anatomical handbooks and textbooks at the turn from the eighteenth to the nineteenth century. See for example Samuel Thomas Soemmering, *Gefäßlehre, oder vom Herzen, von den Arterien, Venen und Saugadern*, 2nd ed., Frankfurt: Varrentrapp und Wenner, 1801 and Andrew Fyfe, *A Compendium of the Anatomy of the Human Body*, 3 vols, Edinburgh: J. Pillans and Sons [printer], sold by A. Guthrie and T. Kay, London, 1800. The importance of Cruikshank's *Anatomy of the Absorbing Vessels* in the contemporary anatomical discourse is also reflected in an early French translation which was published the year after the first edition of Cruikshank's book (William Cruikshank, *Anatomie des vaisseaux absorbans du corps humain*, Paris: Froullé, 1787).

the lymph nodes and the distribution of the lymphatic vessels in the body. Cruikshank's historical account was biased and reduced the contribution of Alexander Monro the second and labelled his work on the lymphatics as plagiarism. More than twenty years after the controversy between Monro and Cruikshank's teacher William Hunter about the priority of discovery of the system of absorbing vessels, Cruikshank made his own contribution to the debate by attributing the discovery to William Hunter and barely referring to Monro's work in his story.[377]

However, it was Cruikshank who gave the first comprehensive account of the lymphatics as a system of absorbing vessels. He brought together research dating back to the middle of the eighteenth century by William Hunter and William Hewson in the Hunterian anatomy school in London, where Cruikshank had been assistant to William Hunter.[378] Hunter, Hewson and Cruikshank showed great interest in the anatomy and physiology of the lymphatics. These vessels were thought to form a system of absorbing vessels independent from the veins and arteries. The function of this system was to gather different substances and supply them to the blood. The idea of a lymphatic system was based on the principle of absorption, according to which living bodies were permeable. However, unlike inanimate matter, which absorbed fluids by chemical attraction or porosity, living organisms absorbed fluids through a system of vessels, the lymphatics and the lacteal vessels and lost this ability immediately after death. Referring to the London physician George Fordyce (1736–1802), Cruikshank claimed that "all parts of a living body [are] impervious but by vessels".[379] Thereby Cruikshank opposed views, held by authors such as Robert Boyle, Bernhard Albinus and Albrecht von Haller, according to which the living animal body was porous as well.[380]

In order to absorb fluids, the absorbing vessels had to be stimulated by the fluids touching their orifices. Because the absorbing vessels were sensible and irritable vessels, this stimulation would trigger their valves to open. Through the contraction of the surrounding muscles the fluids would then be transported through the vessels to

377 Cruikshank, *Anatomy*, 1790, pp ii-iii.
378 On Hunter's activities in London, and also his anatomy school see Bynum/Porter *Hunter*, 1985.
379 Cruikshank, *Anatomy*, 1790, p. 11.
380 Cruikshank, *Anatomy*, 1790, pp. 9-10.

their destination.[381] According to Cruikshank the absorbing vessels could be found throughout the whole body, where they had their origins in the external and internal surfaces. These surfaces could be the skin, but also the intestinal wall, the lungs, the surface of the cavities containing the organs, or the veins. The existence of the absorbing vessels, even if they could not be discovered during dissections, was proven by Cruikshank by applying mercury to the skin, from where it was absorbed and distributed in the body, which was proven by the "brassy taste" which was caused by rubbing mercury onto the skin. He also used injections of mercury or other fluids to observe similar effects. During vivisections Cruikshank showed the functioning of the lymphatics by injecting fluids into the abdomen of dogs, which were quickly absorbed. Mercury injections also allowed him to show that the lacteals and the lymphatics were both part of the same vascular system.[382] When Cruikshank injected mercury into the tubuli lactiferi (lactiferous ducts) of both human corpses and quadrupeds, he observed that the mercury would pass into the lymphatic vessels.[383] The ubiquity of the absorbing vessels was important to Cruikshank's idea of a system of vessels constantly adjusting the balance of fluids in the body.

Generally Cruikshank thought that five substances could be absorbed by the lacteals and the lymphatics. However, he was not clearly differentiating between the origin of a substance and its qualities when he was characterizing it. The substances were chyle, lymph, fluids on the surfaces of the body and the lungs, solids, and medicines. The two most important were for Cruikshank the chyle and lymph. He assumed that chyle was a milky juice which was gathered by the lacteal vessels, i.e. the lymphatics of the mesentery, from the digested food in the intestines. From there it was transported through the lymph glands and the thoracic duct. Finally it was supplied to the blood after it had been refined on its way.[384] The lymph was described as a transparent fluid that was gathered from the "internal surfaces" which formed the cavities containing the internal organs.[385]

> These surfaces are all moist […] arteries, or perhaps certain other vessels arising from them, and known commonly by the name of

[381] Cruikshank, *Anatomy*, 1790, pp. 61-62.
[382] Cruikshank, *Anatomy*, 1790, p. 49
[383] Cruikshank, *Anatomy*, 1790, p. 50.
[384] Cruikshank, *Anatomy*, 1790, pp. 100-102.
[385] Cruikshank, *Anatomy*, 1790, pp. 102-105.

> exhalents, are constantly throwing out a fluid into all the cavities of the body; this fluid keeps the surfaces moist, and makes motion easy, by allowing them to slide readily upon one another. This fluid, however, would accumulate in such a quantity, as to produce dropsy of all those cavities, if the lymphatics were not constantly absorbing it […].[386]

However, Cruikshank suggested that the lymphatics were not only absorbing lymph from the internal surfaces but also from the blood vessels, and occasionally would also be filled with saliva, pancreatic juice, bile and other fluids.[387] Therefore the absorbing vessels appeared as a system with the capacity to refine, transport and balance different fluids in the body.

By the end of the eighteenth century the idea of the absorbent vessels as a vascular system in its own right appeared to be well established. The absorbents were found throughout the whole body and were attributed with the task of nurturing the body and absorbing superfluous substances to prevent diseases. Their irritability enabled them to take in and transport the substances. Based on experiments conducted by Albrecht von Haller, John Hunter, Marcello Malpighi and himself, Cruikshank claimed that if stimulated, the lymphatics and lacteals would contract and thereby absorb and transport fluids.[388] The understanding of the physiology of the absorbing vessels as a drainage system was essentially mechanistic and directed against Galenic concepts. Cruikshank argued: "That these [lymphatic] glands serve to mix animal spirits with the chyle, by means of the nerves, is an idle supposition, since we have no proof of any such

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386 Cruikshank, *Anatomy*, 1790, p. 104.

387 Cruikshank, *Anatomy*, 1790, pp. 105-106.

388 Cruikshank, *Anatomy*, 1790, pp. 61-62. Cruikshank's concept of irritability was based on Haller's ideas and understood irritability as the ability to contract and relax upon stimulation. Since Haller attributed irritability only to muscles, Cruikshank had to explain how a vascular structure could have the same qualities. Therefore he suggested that fibres could be found in the coats of the absorbent vessels, a structural characteristic they shared with the fibrous muscles. However, Cruikshank was aware of the fact that fibres could also be found in other structures such as the nerves. He solved this problem by proving the "muscularity" to the absorbent vessels by experiments and showed how they would contract upon stimulation. Thereby Cruikshank not only provided evidence which supported his assumption about the physiology of the absorbent vessels, but he also used an experiment instead of meticulous dissection, observation and description to assess the anatomical structure. On Haller's concept of irritability generally see Hubert Steinke, *Irritating Experiments: Haller's Concept and the European Controversy on Irritability and Sensibility, 1750-90*, Amsterdam: Rodopi, 2005.

spirits".[389] However, he also suggested that the lymphatic glands were able to change the qualities of the chyle and lymph and might prepare them to be more easily converted to blood. This general obsession with bodily fluids, which is obvious in eighteenth-century research on the absorbing vessels, could also be found in the work of the Dutch physician Herman Boerhaave (1668-1738), who understood the body as a hydraulic system operating on mechanical principles.[390] Yet what appeared as a primarily mechanistic understanding of bodily functions still contained vestiges of humoural ideas of the body, when the use of the lymphatic system was described as balancing the bodily fluids.[391]

However, anatomists were still cautious about making definite claims about certain aspects of the topography and physiology of the system of the absorbing vessels. The question of the origin of the lymphatics and whether they could be found coming from both the veins and arteries was still disputed at the end of the eighteenth century. For example, the question whether the lymphatics not only opened to the external and internal surfaces of the body, but also had their origins in the branches of the arteries, was not resolved. Cruikshank doubted the widely held view that the absorbing vessels were rising from the ends of the arteries, but was not quite sure.[392] More important to Cruikshank was that the absorbing vessels could be found on the inner surfaces of the body, including the inner surface of both veins and arteries.[393] This provided a starting point for developing a general theory of the absorbing capacities of the lymphatics. Ludwig was more cautious: "According to my own observations, which I have made during several zootomical exercises, and also according to my understanding of this system [i.e. the system of absorbing vessels], I want to assume the origins of the

389 Cruikshank, *Anatomy*, 1790, p. 106.

390 On Boerhaave's physiological understanding of the body see Rina Knoeff, *Hermann Boerhaave (1668-1738): Calvinist Chemist and Physician*, Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen, 2002, pp. 163-182. Knoeff distinguished an earlier mechanistic thinking in the work of Boerhaave from a later Boerhaave who was more interested in the non-mechanistic causes of natural phenomena (Knoeff, *Boerhaave*, 2002, pp. 167-168).

391 On the longevity of humoural concepts in medicine see Nelly Tsouyopoulos, *Asklepios und die Philosophen: Paradigmawechsel in der Medizin im 19. Jahrhundert*, ed. by Claudia Wiesemann, Barbara Bröker and Sabine Rogge, Stuttgart: frommann-holzboog, 2008.

392 Cruikshank, *Anatomy*, 1790, pp. 105-106.

393 Cruikshank, *Anatomy*, 1790, pp. 51-53.

lymphatic vessels in the arteries not without some reservation."[394] Ludwig cited authors who denied as well as authors who defended the opinion that the absorbing vessels also originated from the arteries, but was certain that the lymphatics originated from the "red veins" and quoted the Berlin anatomist and court surgeon Johann Friedrich Meckel (1714-1774) as an authority to confirm this assumption.[395]

Generally speaking, the idea of the absorbing vessels as a vascular system throughout the whole body was widely accepted in anatomy by the end of the eighteenth century. The system was thought to comprise the lacteal vessels of the abdomen, the thoracic duct and the lymphatic vessels. Its function was to absorb fluids form the inner and outer surfaces of the body, mainly the nourishing chyle and the superfluous lymph. Therefore, the absorbing vessels helped to balance the fluids in the body, discharged noxious substances and transported medicines into the body. However, some aspects of the absorbing vessels, especially their origins and their exact course throughout the body, were still unclear. This uncertainty was caused by the delicate structure and ephemeral character of the lacteal and lymphatic vessels which was often deplored by anatomists. Even with the most elaborate injections of mercury and under the microscope it was not possible to undoubtedly identify the origins of the absorbing vessels and their finest branches. Hence only by deductive reasoning it was possible to substantiate the claim that the absorbing vessels originated from the surfaces.

5.4 Beauty and truth

The delicacy and volatility of the lymphatics also affected the visual representations of the system of absorbing vessels. Because of decay it was extremely difficult to inject and draw the complete system of the absorbing vessels from one single body. Hence adhering to the ideal of drawing the lymphatics "after life" was almost impossible and compromises were necessary to allow the production of meaningful images of the lymphatic system of the whole body. In order to give an idea of the appearance of the absorbing vessels throughout the whole body drawings of the lymphatics based on

394 "Meinen Beobachtungen, die ich bey mehreren zootomischen Uebungen anstellte, zu Folge, möchte ich den Ursprung der Lymphgefäße aus den Schlagadern nicht ohne einige Einschränkung annehmen." Ludwig, *Cruikshank*, 1789, p. 48.

395 Ludwig, *Cruikshank*, 1789, pp. 47-48.

injections with mercury had usually to be taken from several bodies and combined to show the whole picture.[396] Cruikshank added a plate based on this principle at the end of his *Anatomy of the Absorbing Vessels* (Figure 5.9).[397] Further illustrations were added on two more plates in the first edition. On plate II the three figures represented the lacteal vessels, while the fourth figure illustrated the pores of the skin where Cruikshank suspected the orifices of the lymphatics.[398] The ten figures on the third plate were showing the lymphatic glands, some of them under the microscope.[399] In the second edition of Cruikshank's *Anatomy of the Absorbing Vessels* two more illustrations were added. While plate IV represented the lymphatics of various human and animal subjects, plate V represented an "extraordinary thoracic duct".[400] Cruikshank had found a remarkably large thoracic duct in one of his subjects during a dissection after the publication of the first edition.[401] He obviously thought this discovery so remarkable that he included an illustration of it.

The engraving on the first plate showed a front view of a male human body in a classical contrapposto with a rather anonymous face represented the lymphatic system in human bodies. Abdomen and thorax were opened and partly eviscerated. Outlines of some internal organs were drawn into the thorax and the abdomen in order to give a better impression of their situation and relations of the absorbing vessels.[402] In the index to the plate Cruikshank advised his readers to imagine the body "to be in such a manner transparent as to […] exhibit what parts of the absorbing system I chose".[403] This enabled him to represent the superficial lymphatic vessels throughout the body by thin black and dotted lines. To achieve this Cruikshank apparently first had a life-size outline of a human body drawn, to which the relevant viscera of the thorax and the abdomen and the absorbing vessels were added. When he represented the vessels by dotted lines, this should indicate that they took their course on the posterior side of the

396 Cruikshank, *Anatomy*, 1790, p. vi.
397 The illustrations for Cruikshank's Anatomy of the Absorbing Vessels were drawn and etched by Fred. Birnie and J. Thornthwaite (born circa 1740).
398 Cruikshank, *Anatomy*, 1786, p. 191.
399 Cruikshank, *Anatomy*, 1786, pp. 191-192.
400 Cruikshank, *Anatomy*, 1790, p. [213].
401 Cruikshank, *Anatomy*, 1790, p. 207.
402 Cruikshank, *Anatomy*, 1790, p. viii.
403 Cruikshank, *Anatomy*, 1790, p. [209].

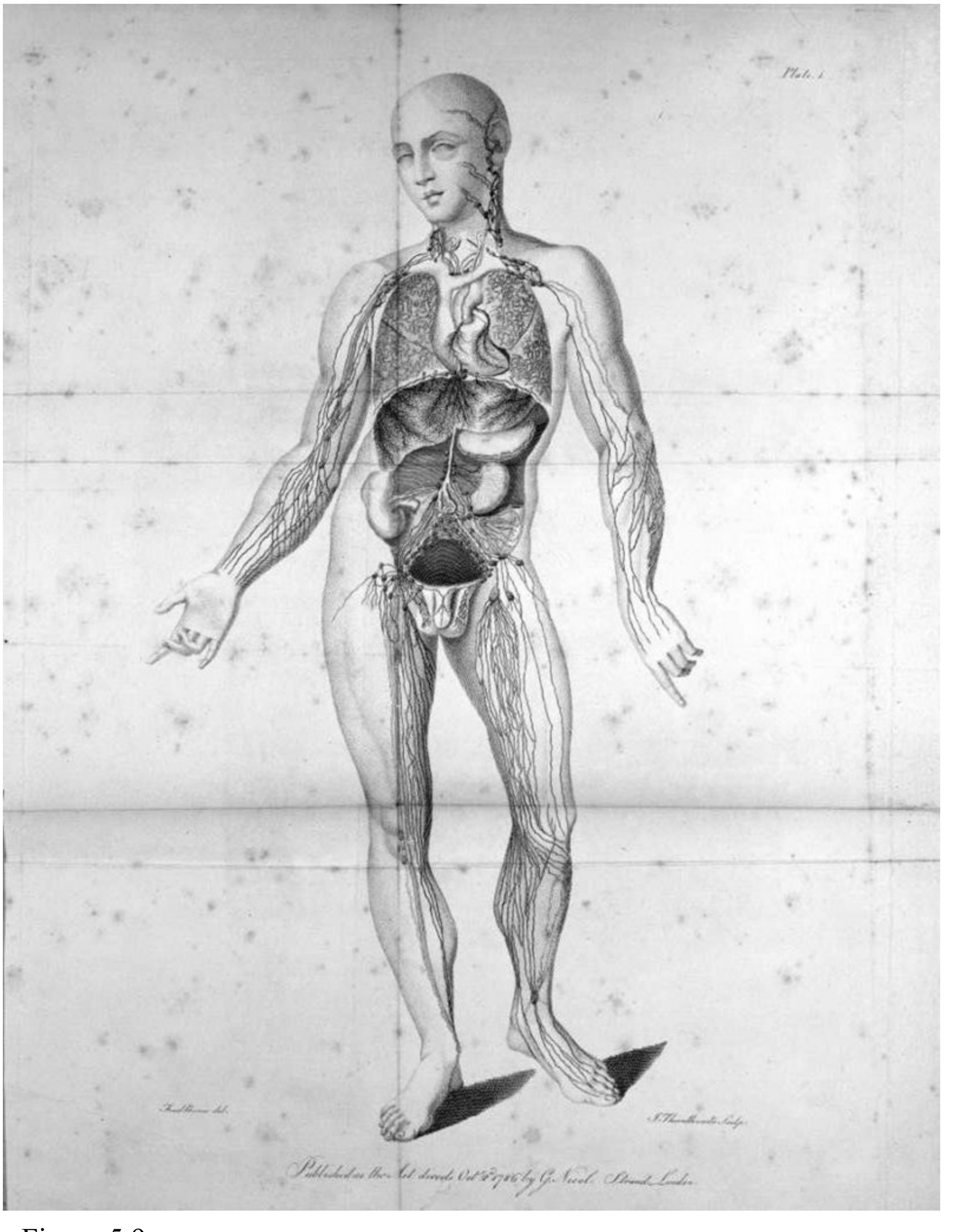

Figure 5.9

limbs. For the preparation of the printed version, the figure was downscaled to its final size, while its proportions were kept.

To justify his decision to draw a figure of the complete system of absorbing vessels in this manner, based on specimens from different subjects, Cruikshank first argued that it would not be possible to make the injections, dissections and drawings on one body because of decay. Secondly, he asserted that there was a problem in injecting the absorbing vessels "equally well in every part of the body".[404] Therefore it was necessary, "in order to exhibit the absorbents of the whole body in one view, to take whatever had been successfully injected in a variety of bodies, and to combine them together".[405] Thereby Cruikshank adopted the method of Bernhard Siegfried Albinus (1697-1770), who used drawings from a variety of specimens for the illustrations in his *Tabulae sceleti et musculorum corporis humani* (1747).[406] Albinus' aspiration had been to depict an ideal human body, the "homo perfectus". He intended to create an account of the human body based on classical proportions and thereby representing ideal beauty, strength and health.[407]

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404 Cruikshank, *Anatomy*, 1790, p. vi.

405 Cruikshank, *Anatomy*, 1790, p. vi.

406 Bernhard Siegfried Albinus, *Tabulae sceleti et musculorum corporis humani,* Leiden, Joannes & Hermann Verbeek, 1747. On the techniques used for the plates in Albinus' work see Irmgard Müller, Daniel Watzke, '"Weil also die beste Abbildung [...] immer nur ein dürftiges Gleichnis bleibt." Zu den Visualisierungsverfahren in der Anatomie des 18. Jahrhunderts', in Rüdiger Schultka, Josef N. Neumann (eds), *Anatomie und anatomische Sammlungen im 18. Jahrhundert. Anläßlich der 250. Wiederkehr des Geburtstages von Philipp Friedrich Theodor Meckel (1755-1803)*, Berlin: LIT Verlag, 2007, pp. 223-249, here pp. 232-236; Tim Huisman, 'Squares and Diopters: The Drawing System of a Famous Anatomical Atlas', *Tractrix*, 4 (1992), 1-11; Punt, *Nature*, 1983.

407 Punt, *Nature*, 1983, p. 17. The rules on proportions first set out by the ancients were extremely influential in the Renaissance, formed an important cornerstone of Western art theory. Teachings on proportions were based on the principle of fixed relations between the different body parts in a human figure of ideal beauty. This ideal beauty became associated with truth. Therefore a body of ideal beauty also represented truth. The question, however, of how exactly to define the perfect beauty and whether there were even different kinds of beauty was a major issue for artists and in art theory throughout the early modern period. On the history of art theory in general see Moshe Barash, *Theories of Art 1: From Plato to Winckelmann*, New York and London, New York University Press, 1985 and Moshe Barash, *Theories of Art 2: From Winckelmann to Baudelaire*, New York and London, Routledge, 1990. The variations on the theory of beauty are a discussed throughout both volumes.

To achieve this aim Albinus chose a skeleton which satisfied his aesthetic sensibilities. He then developed a technique using a grid which allowed his artist-collaborator Jan Wandelaar (1697-1759) to draw the skeleton form a single viewpoint and thereby minimized mistakes caused by taking different angles at different parts of the skeleton.[408] To depict the ideal muscles in relation to the skeleton, however, a variety of specimens from different bodies were used. This meant that Wandelaar had to adapt their proportions according to the proportions of the skeleton using complicated calculations.[409] In a process which took several years, Albinus and Wandelaar managed to create representations of an ideal human skeleton and muscles by erasing individual characteristics and established a standardised human body to which other bodies could be related to as variations.[410]

However, although Cruikshank had followed Albinus' approach to the visual representation of the muscles by combining drawings from a number of specimens for his illustration of the lymphatics of the whole body, he was well aware of the problems and criticism of this technique. Cruikshank acknowledged Haller's criticism of visualizing anatomical structures detached from their bodily context, but defended his choice of a more schematic representation of the absorbent vessels:

> Nevertheless, I say, that though it is certainly true that vessels or nerves thus exhibited do not convey so good an idea as when shewn precisely in their situation, respecting parts more commonly known, yet it may give a very good general idea; and, as I have added the outline of the body and viscera also, it will do more than those figures which Haller complains of.[411]

However, it seems that the production of the illustrations for his *Anatomy of the Absorbing Vessels* did not follow a rigorous methodology as that of Albinus. There is not any evidence of the processes involved in producing them, nor do they show the aesthetic clarity and artistic quality of the work by Albinus and Wandelaar. From this perspective Cruikshank's references to Albinus were rather a programmatic statement. His references to Albinus' work allowed him to make his figure showing the lymphatics

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408 Punt, *Nature*, 1983, pp. 18-21.
409 Punt, *Nature*, 1983, pp. 49-53.
410 Punt, *Nature*, 1983, p. 68.
411 Cruikshank, *Anatomy*, 1790, pp. vii-viii.

throughout the whole body appear as a truthful representation of the lymphatic system and make the idea of the lymphatics as a system of absorbing vessels more convincing.

Even though Cruikshank did not adopt Albinus approach for the production of his illustrations exactly, aspects of Albinus' aesthetic ideas appeared in Cruikshank's figure of the absorbing vessels of the whole body. In particular, it shared the idea of representing an ideal body and not one specific body, something that was underlined by the classical contrapposto of both Albinus' and Cruikshank's figures. In the Western aesthetic tradition a body modestly put in this classical posture still stood for balance, grace and virtue and represented ideal beauty.[412] Albinus had chosen this posture for all the figures which showed an anterior or posterior view of the body in his *Tabulae sceleti et musculorum*. The first figure of the book on myology represented a male écorché standing in almost pristine nature, apart from the rock inscribed with the name of the author and the title of the chapter in the middle ground (figure 5.10).[413]

In his lectures at the distribution of prizes at the Royal Academy of Art in London the painter and president of the Royal Academy, Joshua Reynolds (1723-1792), argued that ideal beauty and symmetry as the goals of the visual arts.[414] Reynolds regarded the achievement of ideal beauty and symmetry not merely as an artistic skill, but identified the ideal beauty with universal truth "formed on the uniform, eternal, and immutable laws of nature".[415] Albinus followed such classical conventions of the representation of a body of ideal beauty and perfect symmetry which was usually also identified with masculinity.[416] With his rigid methodical approach, Albinus intended to produce images of the body conforming to the classical ideal. Therefore these figures – as well as

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412 Joshua Reynolds, *The Works of Joshua Reynolds*, 2nd ed., 3 vols, London, T. Cadell and W. Davies, 1798, vol. 1, p. 260. For detailed accounts of the complex theoretical concept of the contrapposto with a focus on the Italian Renaissance see David Summers, 'Style and Meaning in Renaissance Art', *Art Bulletin*, 59 (1977), 336-361; Joseph Manca, 'Moral Stance in Italian Renaissance Art: Image, Text, and Meaning', *Artibus et Historiae*, 22 (2001), 51-76.

413 Albinus, *Tabulae*, 1747, Tab. I.

414 Reynolds, *Works*, 1798, pp. 64-65. Reynold's lectures were given between 1769 and 1790.

415 Reynolds, *Works*, 1798, p. 240.

416 Anthea Callen, 'Ideal Masculinities: An Anatomy of Power', in Nicholas Mierzoeff (ed.), *The Visual Culture Reader*, London and New York, Routledge, 1988, pp. 401-414, here pp. 404-408.


TAB. I.
BERN. SIEGFR. ALBINI
TABVLAE ANATOMICAE
MVSCVLORVM
HOMINIS

Figure 5.10

Cruikshank's in Ablinus' footsteps – represented this classical ideal of beauty and hence the truth about human nature, both philosophically and anatomically.

Unlike Albinus, Cruikshank did not give his reasons for choosing the particular posture of his figure representing the absorbing vessels of the whole body. Nevertheless, the truthful nature of the contrapposto figure helped Cruikshank's to prove "that the lacteals and lymphatics of the human body are not a trifling appendage of the red veins [i.e. the arteries], but form of themselves a grand system for absorption".[417] However, Cruikshank admitted to some issues with his representation of the system of absorbing vessels in one figure composed from various specimens and regretted that he could not include more drawings for publication.

> Dr. Hunter's trustees once proposed to have engraved and published all the drawings we had on this subject […]; so that the reader, having seen the separate plates, each of which were taken from one body only,[418] and are faithful copies of nature, might better judge the degree of liberty I had taken in combining them into one; but the expense of engraving induced me to lay before the public what Dr. Hunter and I had done in the absorbent system in one view […].[419]

It appears that Cruikshank's interest in the meticulous anatomical description of the system of absorbing vessels conflicted with his desire to make more general claims about the appearance and nature of the absorbents. On the one hand he preferred to include an idealised illustration representing the whole system in his *Anatomy of the Absorbing Vessels* instead of naturalistic illustrations based on particular specimens. On the other hand Cruikshank admitted that his figure did "not convey so good an idea [of the absorbing vessels] as when shewn precisely in their situation".[420] Therefore Cruikshank announced a possible separate publication of the illustrations he and William Hunter had produced based on their specimens if the funding was made available.[421] However, such a publication never materialised, though the gap was filled by Paolo Mascagni's *Vasorum lymphaticorum*, published in 1787.

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417 Cruikshank, *Anatomy*, 1790, p. 207.

418 Apparently, Hunter did not possess a whole body specimen of the lymphatics, but only specimens showing fragments of the lymphatic system which were taken form a number of different corpses. These specimens were the models for the illustrations in Cruikshank, *Anatomy*, 1790.

419 Cruikshank, *Anatomy*, 1790, p. vii.

420 Cruikshank, *Anatomy*, 1790, p. vii.

421 Cruikshank, *Anatomy*, 1790, p. vii.

5.5 Image, text and methodology

Paolo Mascagni was first prosector and later became professor of anatomy at the University of Siena in 1774. He had started researching the lymphatic system in the early 1770s at the suggestion of his teacher and predecessor as professor of anatomy, Pietro Tabarrani (1702-1780). This research was first brought together in two illustrated reports Mascagni submitted to the Academy of Sciences of Paris, which had advertised a prize competition for the best work demonstrating the lymphatic vessels in 1784.[422] Although his submission arrived in Paris only after the deadline, the academy was so impressed by Mascagni's work that he was awarded a special prize and Mascagni published his report in 1784.[423] He continued to research the lymphatic system of the human body and finally published the results in his *Vasorum lymphaticorum corporis humani historia et ichnographia* in 1787.

This large folio gave a detailed account of the lacteal and lymphatic vessels and was also illustrated with 27 elaborate plates with 128 individual illustrations representing the lymphatic system. In the first three tables Mascagni intended to illustrate the more general appearance of the lymphatics to the naked eye and under the microscope (figure 5.11).[424] The other 24 tables represented the lymphatics throughout the whole body in situ.[425] Tables IV to XI represented the lymphatics of the lower limbs, while tables XII to XXI represented the lacteals and lymphatics of the abdomen and the thorax. On tables XXI to XXVII, Mascagni represented the superficial lymphatics of the thorax and the lymphatics of the arms and the head. All plates were indexed with letters and/or numbers referring to details which were then explained in the substantial captions. At the end of his book, Mascagni added a catalogue of his preparations of the lymphatics in the Royal Museum in Florence.[426]

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422 Roberts/Tomlinson, *Fabric*, 1992, pp. 384-385; Choulant, *History*, 1921, p. 315.

423 Paolo Mascagni, *Prodrome d'un ouvrage sur le système des vaisseaux lymphatiques*, Siena: Pazzini, 1784.

424 Mascagni, *Vasorum*, 1787, pp. 65-66 and 71. Figure 5.11 is a reproduction of the first plate in Mascagni's book. As on the other plates the lymphatic vessels feature the typical little knobs which indicated their distinctive valves.

425 Mascagni, *Vasorum*, 1787, p. 75.

426 Mascagni, *Vasorum*, 1787, pp 136-138.

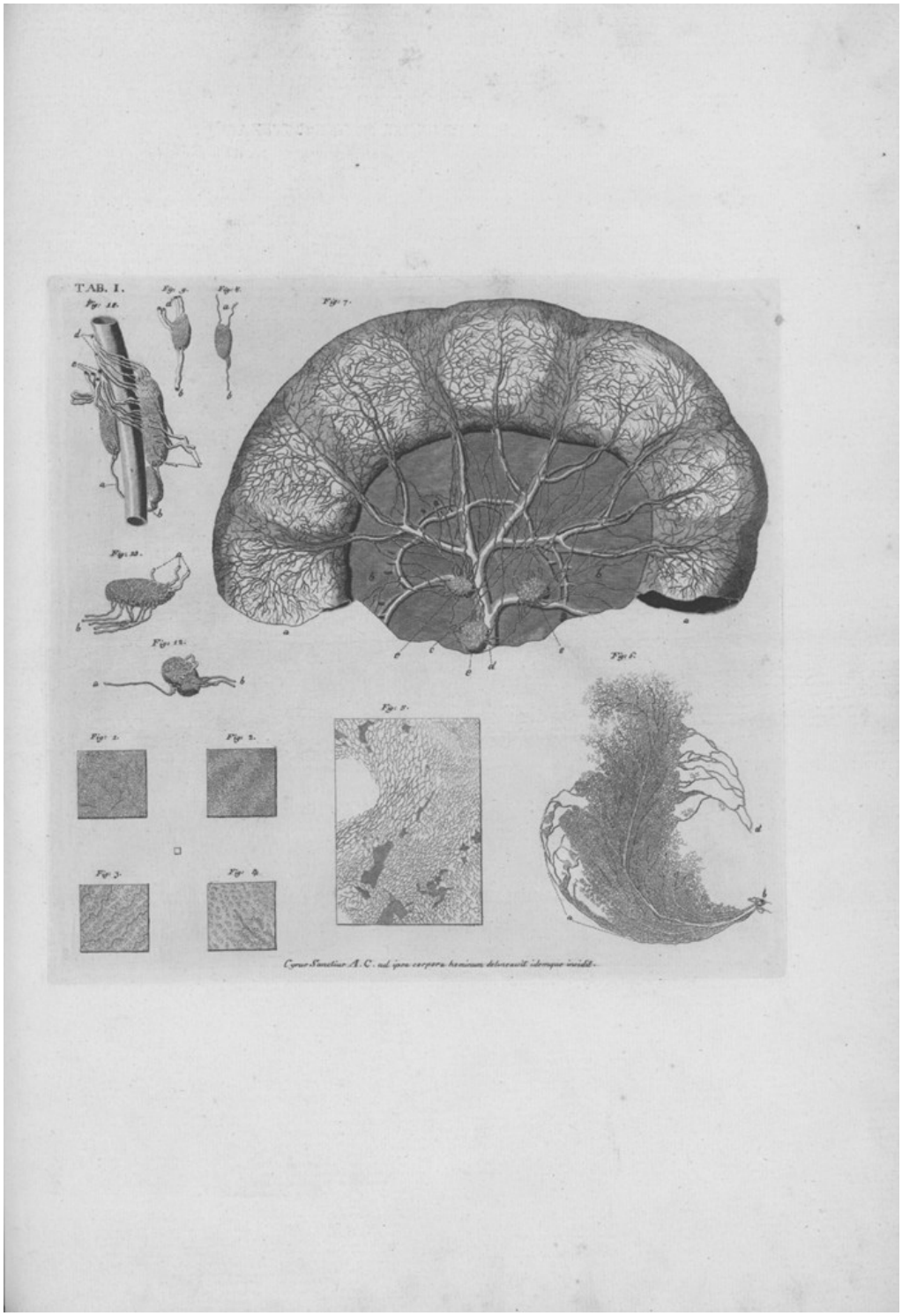
TAB. I.
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.
Fig. 11.
Fig. 12.

Figure 5.11

More complex plates were accompanied on the opposite page by an outline drawing of the depiction of a specimen with the index numbers printed onto the schematic representation such as plate XIX which represented the thoracic duct and lymphatic vessels and glands in the thorax. The left plate was a naturalistic depiction of a disembowelled torso, which was accompanied on the opposite page by an outline drawing of the same object with index numbers printed on it (figures 5.12 and 5.13). At the beginning of the caption, Mascagni identified the object and gave a description of the anatomical dissection that led to the results on display:

> After the abdominal and thoracic cavity had been opened, the abdominal muscles and the ribs cut open, the intestines of both cavities removed together with the cava and the aorta, and the intercostals as well as the right greater psoas muscle taken off, it shows the thoracic duct from its origin to its conjuncture with the blood vessels […][427]

Mascagni further explained which other structures such as the glands could be seen and how the lymphatics and the thoracic duct related to the subclavian vein. This was followed by an index which identified the particular structures indicated by the index numbers on the outline drawing. However, Mascagni's plates not only served as a manual and were designed for terminological clarification. They also came with detailed footnotes, in which they were contextualized with previous writings on and illustrations of the lymphatics in the manner of a critical bibliography. For example the notes on plate XIX were even longer than Mascagni's own description and index. They recounted and commented on much of the literature on the thoracic duct, but also reported pathological observations.[428]

In his plates, Mascagni followed the paths of the lymphatics and lacteals throughout the whole body with illustrations which were drawn from different bodies, both male and female. His illustrations were based on specimens which had been injected with mercury and then dried. Mascagni had started producing such objects from 1777, for which he had initially used the bodies of his patients who had died from dropsy. These

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427 "Abdominis & toraci cavitate aperta, muscoli abdominalibus & costis dissectis, demptis visceri bus utriusque cavitatis, cum cava, & aorta, meleti demum muscoli intercostalibus internis, & muscula psoa dexteri lateris, ostendit ductum thoracicum a sua origine usque ad ejus in venas sanguineas inferrionem […]", Mascagni, *Vasorum*, 1787, p. 102.

428 Mascagni, *Vasorum*, 1787, pp. 102-106.

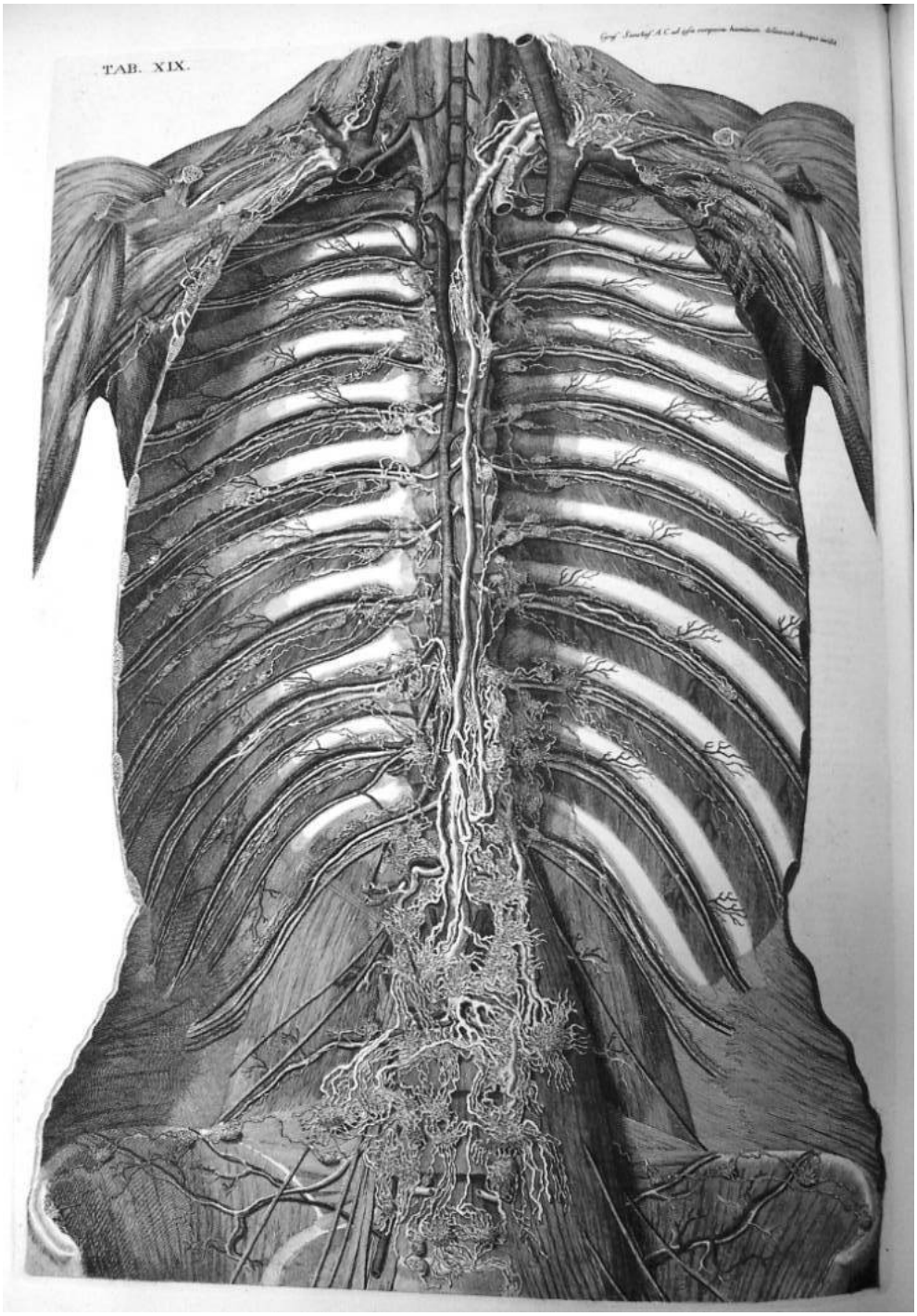

Figure 5.12

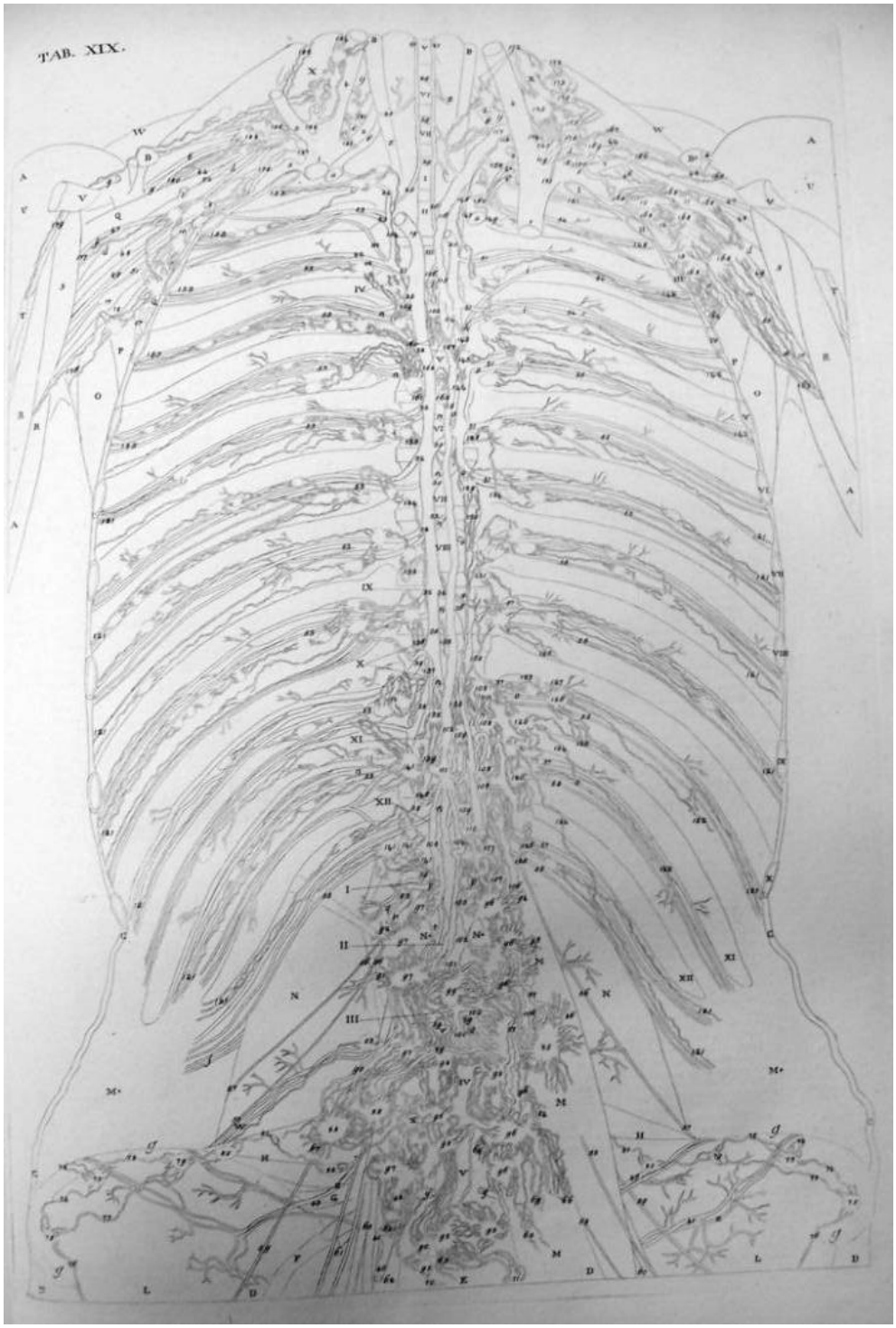

Figure 5.13

dried specimens are still kept today in the *Accademia dei Fisiocritici*, the academy and museum of natural history in Siena. These specimens also formed the basis for the illustrations in Mascagni's *Vasorum lymphaticorum*, when drawings were made of particularly good specimens for engravings.[429]

The prints for Mascagni's book were executed by the Bolognese painter and engraver Ciro Santi, whom Mascagni had induced to move from Bologna to Siena to produce the high quality prints for his work.[430] Santi did not specialize in medical and scientific illustrations and his other works included painted copies of bronze reliefs, printed copies of paintings and architectural prints. However, this work had no obvious influence on the iconography and style of the illustrations of the lymphatics. Therefore it is highly probable that the illustrations in Mascagni's *Vasorum lymphaticorum* primarily followed his systematic approach to produce the best possible visual representation of the lymphatics in situ. Santi's illustrations were highly dependent on Mascagni's expert interpretation of microscopic observations, the results of anatomical dissections and specimens.

Mascagni was also involved in the production of anatomical specimens and wax models of the lymphatic system for the *Museo la Specola* in Florence.[431] In 1782 he had travelled to Florence to show some of his drawings to the director of the museum, Felice Fontana (1730-1805). Mascagni's drawings must have been impressive enough and he was commissioned to produce a series of dry and wet specimens that showed the

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429 Roberts/Tomlinson, *Fabric*, 1992, p. 384; Thomas Schnalke, 'Der expandierte Mensch – Zur Konstruktion von Körperbildern in anatomischen Sammlungen des 18. Jahrhunderts', in Thomas Schanlke, Florian Steger (eds), *Medizin, Geschichte und Geschlecht: Körperhistorische Rekonstruktionen von Identitäten und Differenzen*, Stuttgart: Franz Steiner Verlag, 2005, pp. 63-82, here pp. 79-80; Fabio Bisogni, 'Scienza e iconografia: la funnzione delle incisioni nel Vasorum Lymphaticorum di Paolo Mascagni', Francesca Vannozzi (ed.), *La scienza illuminata: Paolo Masagni nel suo tempo (1755-1815)*, Siena: Nuova immagine, 1996 pp. 111-133, here pp. 111-112. On the history of the *Accademia dei Fisiocritici* generally see Mario Lisi, *I Fisiocritici di Siena: Storia di una Accademia scientifica*, Siena: Accademia dei Fisiocritici, 2004.

430 Choulant, *History*, 1921, p. 315; Premuda, *Storia*, 1957, p. 189.

431 Schnalke, 'Mensch', 2005, pp 80-81; Anna Maerker, '"Turpentine hides everything": autonomy and organization in anatomical model production for the state in late eighteenth-century Florence', *History of Science*, 45 (2007), 257-286, pp. 273-275.

complete lymphatic system throughout the whole body for *La Specola*.[432] In 1785, Mascagni went to Florence again to oversee the production of the wax models of the lymphatics in the workshop set up by Fontana at La Specola.[433] They were six whole-body models showing the lymphatic system – one of them was sent to Vienna – as well as a number of smaller specimens of the lymphatics in particular parts of the body.[434]

The iconography and style of these wax models significantly differed from the illustrations in Mascagni's *Vasorum lymphaticorum*. While the prints showed the lymphatics in minute detail in situ in particular parts of the body, the whole-body wax models might focus on certain areas such as the mesentery, but never fragment the body. The wax models of the lymphatics in both *La Specola* and the *Josephinum* in Vienna also conformed to contemporary aesthetic conventions.[435] They were draped in distinct poses reminiscent of classical archetypes. While female models were associated with images of Venus (figures 5.14 and 5.15),[436] male models were rooted in the tradition of écorchés (figures 5.16 and 5.18). Such figures were commonly used in anatomy teaching for artists and even became conventional attributes for artists (figure 5.17). The German/Dutch painter Godfrey Kneller, for example, used an open book showing a naked female figure in classical pose supported by a scull and a male écorché as central attributes to indicate his profession.[437]

Thomas Schnalke has suggested that in one of the male wax models showing the superficial lymphatic vessels (figure 5.18), another iconographic tradition was represented. This model used a lying figure, which rested its weight on the left arm, raising the head. Schnalke argued that it cited Michelangelo's recumbent Adam on his

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[432] Ludwig, Mascagni, 1789, p. 4.

[433] On the production of wax models in Fontana's workshop see also Anna Maerker, 'Handwerker, Wissenschaftler und die Produktion anatomischer Modelle in Florenz, 1775-1790', *Zeitsprünge*, 9 (2005), 101-116.

[434] Ludwig, *Mascagni*, 1789, p. 5.

[435] For an overview of the wax models in *La Specola* and the *Josephinum* see Anon., *Encyclopaedia Anatomica: A Complete Collection of Anatomical Waxes*, Cologne and London: Taschen, 2006; Manfred Skopec, Helmut Gröger (eds), *Anatomie als Kunst: anatomische Wachsmodelle des 18. Jahrhunderts im Josephinum in Wien*, Vienna: Brandstätter, 2002.

[436] Jordanova, *Visions*, 1989, p. 44.

[437] On the use of écorchés in anatomy teaching for artists see Kemp/Wallace, *Bodies*, 2000, pp. 75-84.

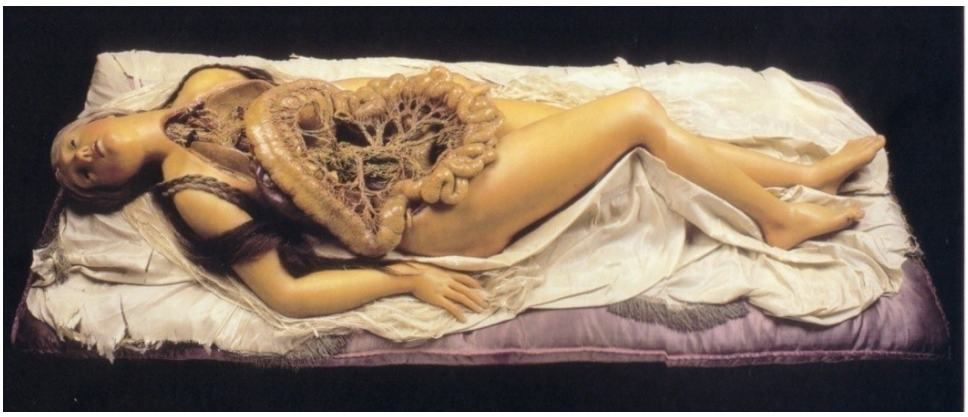

Figure 5.14

Figure 5.15

Figure 5.16

Figure 5.17

Figure 5.18

fresco of the creation of man in the Sistine Chapel in the Vatican.[438] This could be regarded as a resonance of earlier physicotheology, which regarded natural history as a way to prove the existence of God. By researching the natural world, physicotheologists hoped to acquire a deeper understanding of the Creation and ultimately God.[439] However, this wax model lacked certain distinctive features such as the hand reaching out to God and the eyes looking in the direction of the Creator. Martin Kemp meanwhile has associated wax models from *La Specola* with heroic poses of dying warriors and ancient gods.[440] The posture of the wax model, with the weight resting on one arm and appearing to be in a struggle to either get up or avoid collapsing, also reminds of the famous Roman statue of the Dying Gaul. Models based on this ancient statue where frequently used in artistic anatomy.[441] The Royal Academy, for example, had a plaster cast taken from a body dissected by William Hunter in 1775 set in the pose of the Dying Gaul.[442] However, figures such as the wax models in *La Specola* often did not exactly conform to the iconography of particular ancient models, but clearly conformed to artistic conventions. More important than the iconographic meaning associated with certain poses was now the truthful character of figures which alluded to classical ideals of beauty.

It is not clear whether it was Fontana, Mascagni or the artists in the workshop in *La Specola*, who were responsible for the aesthetic choices. However, like Cruikshank's lymphatics man, the wax models of the lymphatics also emphasized the truthfulness of the claims they made about the lymphatics as a distinct system throughout the body. They also represented whole body specimens and showed the lymphatics throughout the whole body. Furthermore, the models in *La Specola* were designed to make it easier for their intended audience to engage with the natural history of the human body. *La*

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438 Schnalke, 'Mensch', 2005, p. 80. For an easily accessible reproduction of the fresco see Vatican Museum, *Collections Online: Sistine Chapel*, 2003, URL: http://mv.vatican.va/3_EN/pages/CSN/CSN_Main.html (last accessed 08/11/2010).

439 Maehle, 'Anatomy' 1989.

440 Kemp/Wallace, *Bodies*, 2000, pp. 85-87.

441 Kemp/Wallace, *Bodies*, 2000, pp. 58-61.

442 Since the Royal Academy is not prepared to waive copyright fees for PhD theses and insists on a ten-years time limit applying to the version of this thesis in the online repository of Durham University a reproduction of this image has not been included. For a good-quality image of the cast see Kemp/Wallace, *Bodies*, 2000, p. 87.

Specola was not an exclusive collection for a learned audience. As a project of the late Enlightenment it was aimed at educating lay people, also of the lower classes.[443] By using familiar aesthetic conventions the wax models of the lymphatic system could make the exposure to a dead body easier for a lay audience and therefore human anatomy more accessible, but did not follow a coherent iconographic programme.

The plates in Mascagni's *Vasorum lymphaticorum*, however, were aimed at a very different audience. His methodological and systematic approach to a representation of the lymphatic system appealed instead to a learned readership, which was able to appreciate such an effort. In the introduction of a third volume with an appendix and a critical bibliography of the history of the lymphatics, which followed the translations of Cruikshank's *Anatomy of the Absorbing Vessels* and Mascagni's *Vasorum Lymphaticorum*, Christian Friedrich Ludwig harshly criticized previous anatomical illustrations for their inaccuracy and lack of clarity as well as the frequent inconsistency of image and text and demanded a more reflected approach:

> where several different items are to be pictured simultaneously, it is necessary to pay ever more attention and to show ever more diligence. For example how much shall one see of the muscles, arteries, veins, glands and so on, if the nerves are to be shown. Here the anatomist, if it is he not himself, has to guide the artist very conscientiously. Such a network must neither be put on an inane album, a bare white sheet, nor be lost in unclear shadows. And if complete cavities are to be shown, the peculiarity and character of the bones, the various intestines and each other part have to be preserved.[444]

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443 Anna Maerker, 'Uses and Publics of the Anatomical Collections of La Specola, Florence, and the Josephinum, Vienna, around 1800', in Marco Beretta (ed.), *From Private to Public: Natural Collections and Museums*, Sagamore Beach: Watson, 2005, pp. 81-96, here pp. 82-87.

444 "wo mehrere und veschiedene Gegenstände zugleich abzubilden sind, da ist nothwendig auch vervielfachte Aufmerksamkeit und Sorgfalt nöthig. So z. B. wie viel soll man von den Muskeln, Schlagadern, Blutadern, Drüsen, u. s. f. sehen, wenn Nerven vorgestellt werden sollen. Hier muß der Zergliederer, wofern er es nicht selobst ist, den Künstler ganz vorzüglich leiten. Es darf weder ein solches Nerven- oder Gefäßgeflechte auf ein Inane album, auf das bloße weiße Blatt, hingestellt werden, noch auch in undeutlichen Schatten sich verlieren. Und wenn nun ganze Höhlen vorgestellt werden sollen, muß den Knochen, den verschiedenen Eingeweide und jedem andern Theile sein Eigenthümliches, sein Charakter erhalten werden." Ludwig, *Beiträge*, 1794, p. vi.

However, Ludwig admitted that this was difficult and an illustration which matched the ideal was maybe an impossible achievement.[445] But Mascagni's illustrations of the lymphatics conformed with this call for a reductionist method and focused on the representation of the particular object (i.e. the lymphatics), while they still gave enough of its topographical context to give the bigger picture. Mascagni's illustrations thus achieved the necessary clarity without inadequate simplification and Ludwig celebrated them as "masterpieces […] prepared with much truth".[446] Mascagni's prints were not only based on skilled and elaborate dissections and meticulous naturalistic visual representations of the appearance of the lymphatic vessels in the human body. They were also accurately indexed, supplied with detailed footnotes and embedded in a descriptive narrative and therefore formed a systematic methodical approach to the representation of the lymphatic system.

5.6 Monro, Fyfe and the 'Edinburgh body'

The explanatory power of the theory of the lymphatics as a system of absorbing vessels and the usefulness of the illustrations in Cruikshank's and Mascagni's books was reflected in their use by other authors such as the anatomist Andrew Fyfe (1752–1824). Fyfe was dissector under Alexander Monro Secundus, and a skilled artist and curator of the anatomical figures Monro had donated to the university in 1800. The same year he published an anatomical handbook for students in three volumes with a large number of illustrations, many of which were attributed to Monro. Fyfe's chapter on the "absorbent system" was based on Cruikshank's and Monro's account of the lymphatic system.[447] The third volume of Fyfe's *Compendium* came with 25 plates representing the lymphatics, which were mainly copied from Hewson, Sheldon, Cruikshank, Mascagni and Haase's illustrations in their works on the lymphatic system as well as a life size print of a body showing the lymphatic vessels in the whole body by Alexander Monro the second (figure 5.19).[448]

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445 Ludwig, *Beiträge*, 1794, p. vii.

446 "Meisterstücke [...] mit vieler Wahrheit […] gefertigt." Ludwig, *Beiträge*, 1794, p. 145.

447 Fyfe, *Compendium*, 1800, vol. 3, pp. 3-37.

448 Kaufman, 'Observations', 1999, p. 28, note 7. Kaufman cites "Haase" and "Kuhn" as sources for Fyfe's illustrations (refering to Johann Gottlob Haase (1739-1801); Haase was anatomy professor in Leipzig), *De vasis cutis et intestinorum*

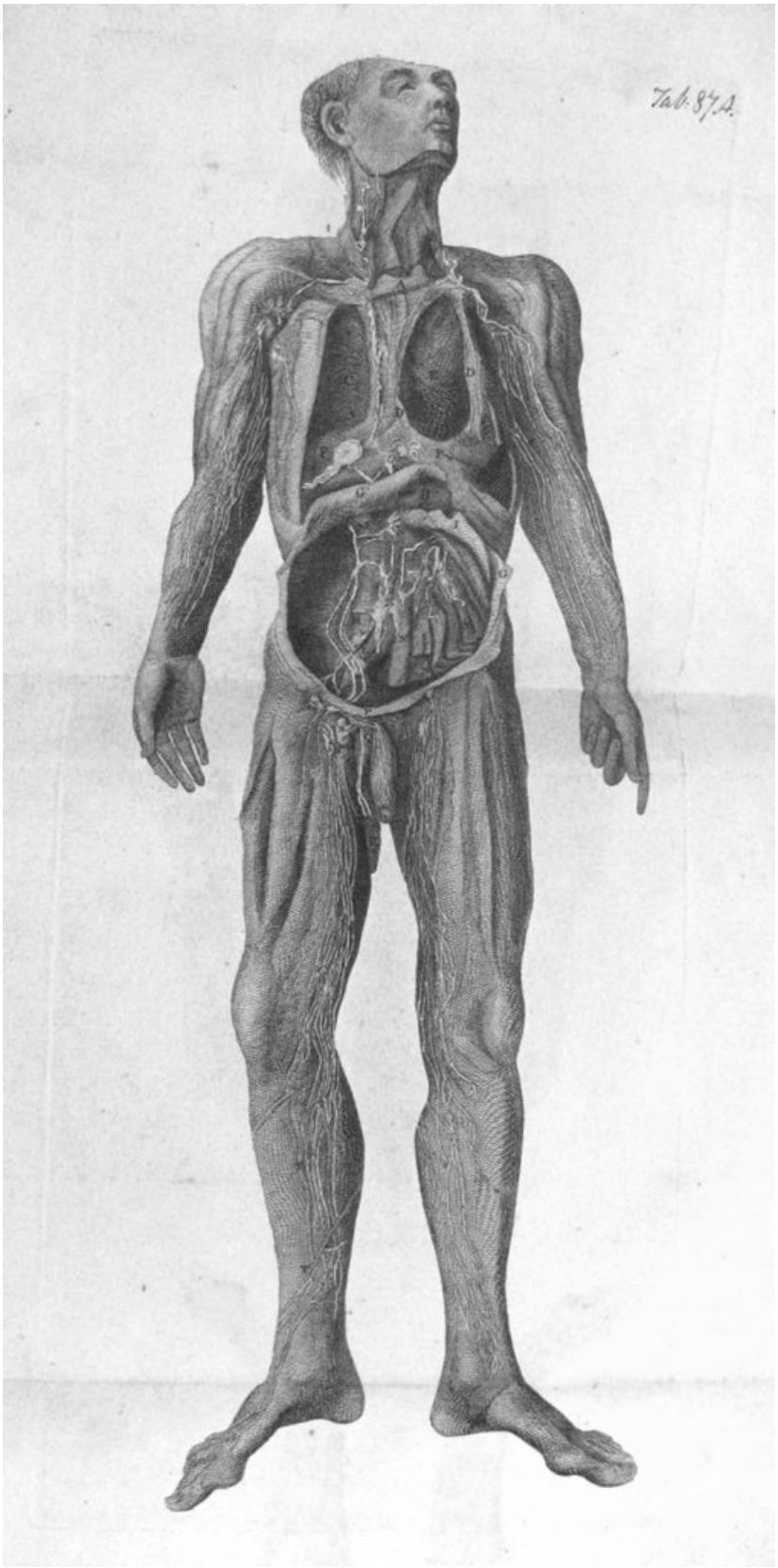

Figure 5.19

By using Cruikshank, Mascagni and Haase's illustrations for his *Compendium*, Fyfe drew on the most comprehensive publications on and best illustration of the lymphatics available to him. The reviews of their works in the *Allgemeine Literatur-Zeitung* were symptomatic.[449] One reviewer remarked on Haase's illustrations that they "brought the artist much honour and show that German diligence and accuracy can well mate with British elegance".[450] However, Cruikshank was credited with being the first author who gave a comprehensive account of the lymphatic system in the review of Ludwig's translation of the *Anatomy of the Absorbent Vessels*, [451] and the reviewer marvelled at the first illustration of the lymphatics of the whole body as a masterpiece.[452] Shortly after, Mascagni's *Vasorum lymphaticorum* received similarly positive review.[453] While the reviewer was less convinced with Mascagni's physiological explanations and preferred Cruikshank's,[454] he was full of praise for the anatomical description and the illustrations: "The images are drawn and engraved beautifully and arranged highly instructively throughout, and the drawings of the muscles, intestines, blood vessels, are according to nature."[455] While the illustrations Fyfe took from Mascagni and Haase would create an image of the lymphatic system from its different elements, only Cruikshank's illustration gave an immediate idea of the whole system (figure 5.20).

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absorbentibus plexibusque lymphaticis pelvis humanae anotationes anatomicae cum iconibus, Leipzig, Johann Friedrich Junius, 1786 and presumably Carl Gottlob Kühn (1754-1840), *Johann Adam Kulmus anatomische Tabellen für Lehrlinge der Anatomie*, Leipzig: Fritsch, 1789). In Fyfe's *Compendium* handwritten notes reattributed some plates originally attributed to "Kuhn" and one plate originally attributed to Mascagni to Haase.

449 The *Allgemeine Literatur-Zeitung* was the review journal with the highest circulation and great influence on intellectual life in the German territories and beyond at the turn from the eighteenth to the nineteenth century. On the *Allgemeine Literatur-Zeitung* in general see Mark Napierala, *Archive der Kritik. Die Allgemeine Literatur-Zeitung und das Athenaeum*, Heidelberg: Universitatsverlag Winter, 2007.

450 "machten dem Künstler sehr viel Ehre, und zeigen, dass deutscher Fleiss und Genauigkeit sich sehr wohl mit brittischer Eleganz paaren kann". *Allgemeine Literatur-Zeitung*, (1787), vol. 1, col. 458-62, col. 462.

451 *Allgemeine Literatur-Zeitung*, (1790), vol. 1, col. 217-220, col. 217.

452 *Allgemeine Literatur-Zeitung*, (1790), vol. 1, col. 219.

453 *Allgemeine Literatur-Zeitung*, (1790), vol. 3, col. 33-40.

454 *Allgemeine Literatur-Zeitung*, (1790), vol. 3, col. 33-40, col. 33.

455 "Die Abbildungen sind durchgehends schön gezeichnet und gestochen, überaus instructiv eingerichtet, und die Zeichnungen der Muskeln, Eingeweide, Blutgefässe, – sind der Natur gemäss." *Allgemeine Literatur-Zeitung*, (1790), vol. 3, col. 33-40, col. 40.

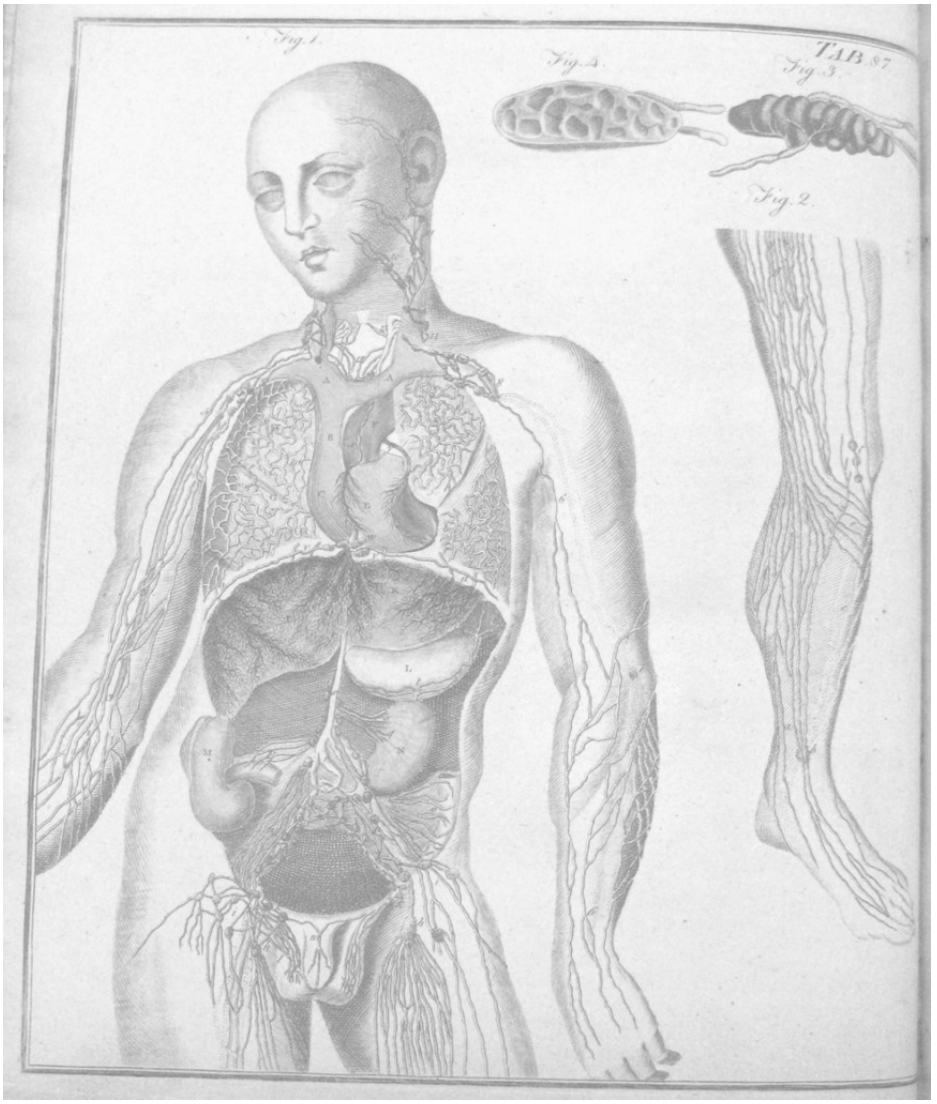

Figure 5.20

However, Fyfe not only used this illustration to represent the idea of the lymphatics as a system throughout the whole body.

While Fyfe had cropped the figure copied from Cruikshank at the thighs and one of the lower legs in a separate figure,[456] the figure showing the lymphatics in the whole body after a print based on a specimen by Monro remained intact. Fyfe also added a plate which showed the lymphatic vessels on a male body with the abdomen opened. This illustration was based on a life-size print which was based on a dry specimen, where the lymphatic vessels had been injected with mercury and the blood vessels with wax.[457] The original specimen and the large print are still kept at the Department of Anatomy at the University of Edinburgh, where they had been prepared by Alexander Monro the second around 1788.[458] This image was a version of Monro's life-size print that had been scaled down but was still fairly large. Unlike the illustration done after Cruikshank it was not cropped and in order to fit the page had to be folded into the bound volume. These efforts suggest that Fyfe attributed this illustration with a particular importance and regarded it as superior to Cruikshank's lymphatics man. Unlike the figure showing the lymphatics throughout the whole body from Cruikshank's *Anatomy of the Absorbing Vessels*, the figure drawn after Monro's lymphatics man is not represented in a particularly classical pose. Thereby the naturalistic nature of the image is underlined, which was confirmed by Fyfe's comment in the caption, which emphasised that, while more vessels had originally been injected than could be seen in the illustration, "none having been painted excepting what could be distinctly seen, after the Preparation had been kept a considerable time in the dried state, and of course many Lymphatics so shrivelled, as not to admit accurate delineation."[459]

Although Fyfe made no direct comparison between Cruikshank's and Monro's lymphatics man, both figures appeared close to each other on subsequent plates, which implies a relationship between them. On the one hand, both illustrations confirmed the view of the lymphatics as a system of absorbing vessels throughout the body. On the other hand they shared a similar background in the research on the lymphatics in

456 Fyfe, *Compendium*, 1800, vol. 3, Tab 87, Fig. 1 and Fig. 2.
457 Fyfe, *Compendium*, 1800, p. 31.
458 Kaufman/Best, 'Monro', 1996, pp. 75-76.
459 Fyfe, *Compendium*, 1800, vol. 3, p. 32.

Edinburgh and London, which had generated the controversy between Monro and William Hunter and his pupils about the priority of discovery of the lymphatic system. In this debate Cruikshank had taken the side of his teacher William Hunter and supported his claim to priority in the *Anatomy of the Absorbing Vessels*, while he marginalised Monro's contribution.[460] Meanwhile Cruikshank also had claimed that it was impossible to produce an anatomical preparation of the lymphatic vessels in one body. Against this background Monro was able to demonstrate his superior knowledge and skills as an anatomist by producing such a specimen, which Cruikshank had regarded as impractical. Fyfe included illustrations of the lymphatics throughout the whole body by both authors but acknowledged the particular relevance of Monro's work. This is evident in the additional inclusion of twelve prints showing the lymphatic vessels based on Monro's preparations, the majority of illustrations by a single author in the chapter on the system of absorbing vessels.

By using the illustrations prepared by Monro, Fyfe not only made a pragmatic choice and used the material easily accessible to him. His use of Monro's figures can also be interpreted as a comment on Cruikshank's and Hunter's work on the lymphatics. The presumed superiority of Monro's figure over Cruikshank's lymphatics man is not only indicated by the larger scale of the former. While Cruikshank's figure was cropped, the plate showing Monro's specimen of the lymphatics of the whole body had to be folded into Fyfe's *Compendium*. This emphasised that Monro had achieved something Cruikshank had claimed to be virtually impossible by preparing the lymphatic vessels in a whole body specimen.[461] While Cruikshank had to assemble his lymphatics man from a variety of specimens, Monro's figure did not need iconographic references to establish the truthfulness of the lymphatics as a system throughout the whole body. After all Monro's figure was drawn from a single corpse, in which he had dissected and injected the lymphatic vessels himself.

5.7 Conclusions

There were a number of reasons why the lymphatics were of such great importance to early modern anatomists. During the second half of the seventeenth century work on the

[460] Cruikshank, *Anatomy*, 1790, pp. ii-iii.
[461] Cruikshank, *Anatomy*, 1790, p. vi.

lymphatics was complementary to the idea of blood circulation. The demonstration of the passages of the newly discovered lymphatic vessels and experiments on their mechanism provided substantial evidence which supported the assumption that blood was constantly circulating through the body and not produced in the liver and to be consumed in different organs and parts of the body. When it was shown that the chyle was not transported to the liver, the claim that the liver was the blood producing organ became unsustainable. Furthermore, preparations of the lymphatics required great skills and the use of the cutting edge technology of injections.[462] Anatomists were thus able to demonstrate their outstanding skills by preparing specimens of this delicate structure and constantly improved techniques to trace the passage of the lymphatics throughout the body by, for example, introducing mercury injections. Finally, while the topography of other structures such as the skeleton, the muscles, the veins and arteries and the nervous system was well established by the middle of the seventeenth century, the appearance of the lymphatics throughout the body was not fully known until the end of the eighteenth century. Therefore research on the lymphatic system was an area of macroscopic anatomy where it was still possible for anatomists to claim the fame of genuine discoveries.

During much of the earlier history of the lymphatics from Aselli's work on the lacteal vessels to the controversy between Hunter and Monro, ideas about the appearance, structure and function of the lymphatics remained inconclusive. The concept of the lymphatics forming a separate vascular system, first put forward by Bartholin and Rudbeck, became only slowly generally accepted. The inconclusive results of dissections and the unclear terminology made it difficult to establish a coherent notion of the structure. This was only possible when the idea of the lymphatics as a system of absorbing vessels provided a conclusive explanation of the physiology of the lymphatics. That the absorbing vessels were responsible for maintaining the fluid balance in the body might have carried traces of older Galenic ideas, but allowed observers to interpret the structure in mechanistic terms as a hydraulic system and integral part of the body.

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[462] On the role of injections in early modern anatomy see Cunningham, *Anatomist*, 2010, pp. 235-246, and on the particular importance of mercury injections for research on the lymphatics from Nuck to Mascagni Cunningham, *Anatomist*, 2010, pp. 241-244.

At the turn of the nineteenth century the idea of the lymphatics as a separate vascular system had become common knowledge in anatomy. The two crucial publications were, also in the view of contemporaries, the books by William Cruikshank on *The System of Absorbing Vessels* and Paolo Mascagni on *Vasorum lymphaticorum*. In both publications, the illustrations were an integral part of the work. In their illustrations both Mascagni and Cruikshank represented the idea of the lymphatics as a separate anatomical structure and system of vessels throughout the whole body. While Mascagni gave both in the text and his illustrations an account of the lymphatic vessels throughout the whole body, he did not include an illustration outlining the system in a whole body figure like Cruikshank. Their illustrations manifested the relatively new idea of the lymphatics forming a separate vascular system of absorbing vessels. The plausibility of the new concept of the lymphatics was confirmed by contemporary reviewers and authors such as Ludwig and Fyfe.

In contrast to the pictures representing the system of absorbing vessels throughout the body, the seventeenth- and early eighteenth-century illustrations were very different. They only showed parts of the lymphatic system and often displayed the lymphatic vessels not in situ but isolated or in relation to specific organs and structures only. The fragmented nature of these illustrations represented the lack of a coherent concept of the lymphatics as a system throughout the body. However, they still established a distinct iconography of the lymphatic vessels with their irregular knobs, which distinguished them from other vessels with their smooth surface. This iconography was introduced by Ruysch who needed to emphasise the role of the lymphatic valves to argue against de Bils' claims about the function of the lymphatic vessels. This iconography confirmed that the lymphatic vessels were a specific kind of vessels in their own right and could still be found in the later illustrations of the lymphatics throughout the whole body by Cruikshank and Mascagni.

To understand the success of anatomical illustrations of the lymphatics, it is worth considering several factors. The seventeenth century saw a rise of empiricism during the "scientific revolution" as well as technological advancements such as the refinement of

injection techniques and the introduction of the microscope. [463] These developments allowed anatomists in the second half of the seventeenth century to base their research on close observation and minute description even more and to focus more on delicate structures. This laid the foundations for the credibility of the discovery of new anatomical objects, especially such elusive structures as the lymphatic vessels. Secondly, the fascination with close observation and detailed accounts of nature coincided with the dominance of an artistic convention that privileged the "art of describing" in seventeenth-century Dutch visual culture. Most of the art produced in mass scale in the Netherlands during this period favoured the accurate and naturalistic depiction of shapes, light and surfaces over the true representation of ideal forms and proportions.[464] Against this background, minute visual accounts such as Ruysch's or Nuck's illustrations of the lymphatic vessels which showed their appearance and structure in great detail could generate credibility.

However, certainty about the appearance and nature of the lymphatics as a distinct anatomical entity and system was only established with the help of illustrations such as Cruikshank's and Mascagni's at the end of the eighteenth century. The visual language of these illustrations could not just rely on a naturalistic and purely descriptive manner in showing the vessels themselves. It was also necessary to give an accurate idea of the appearance of the lymphatic vessels in situ throughout the body, which was accomplished especially in Mascagni's almost encyclopaedic illustrations which recorded in great detail the distribution of the lymphatics throughout the whole body. Meanwhile the aesthetic conventions of neoclassical art theory helped to establish the credibility of illustrations representing the lymphatics as a system of absorbing vessels such as Cruikshank's lymphatics man. Neoclassical art theory habitually stressed the truthful representation of the ideal beauty as the highest achievement of the artist. This beauty could only be found in nature, but not in the simplistic imitation of nature, but in

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463 On the "scientific revolution" generally see Steven Shapin, *The scientific revolution*, Chicago: University of Chicago Press, 1996. The influence of the microscope on natural history is described in Edward Grant Ruestow, *The Microscope in the Dutch Republic: The Shaping of Discovery*, Cambridge: Cambridge University Press, 1996. The shift of interest in anatomy towards more delicate structures in relation to the development to injection techniques is discussed in Francis J. Cole, 'The History of Anatomical Injections', *Studies in the History and Method of Science*, 2 (1921), 285-343.

464 Alpers, *Art*, 1983.

an art that was able to understand the principles of nature. To illustrate this idea of beauty, frequent references were made to canonical classical conventions which were often found in ancient Graeco-Roman sculpture. By following such conventions in pictures such as Cruikshank's lymphatics man or the wax models in La Specola and the Josephinum, these anatomical illustrations and models became more accessible for their audiences and gained in credibility.

The importance of the illustrations showing the lymphatics as a system throughout the whole body was generally acknowledged by contemporaries. The use of images representing the lymphatics in Fyfe's *Compendium* was symptomatic of this, but also hinted at why the topic was of such great importance. Fyfe not only used pictures of both fragments of the lymphatic system as well as of the lymphatics throughout the whole body by Mascagni and Cruikshank. In adding a number of illustrations based on specimens and prints produced by Alexander Monro secundus, he also commented on the dispute about the priority of the discovery of the system of absorbing vessels and took the side of Monro. The apparently strong feelings about who would be allowed to claim the priority of discovery about forty years after the original controversy reflected the importance of the lymphatics in late eighteenth-century anatomy. Controversies in the early modern republic of letters not only highlighted the importance of gaining academic fame by being associated with discoveries. Such arguments only arose around topics of great significance, confirming that the lymphatics were of a particular relevance in eighteenth-century anatomy. Mastering this topic of cutting edge research in Enlightenment anatomy allowed men such as Hunter, Monro, Cruikshank or Mascagni to establish their professional reputation and thereby gain both in social status and financially through international acclaim from other scholars, by obtaining promotions as well as by attracting students.

6. Personhood before birth? – Early modern images of the unborn[465]

When does life begin? How are the embryo, foetus and the female body created as an object of knowledge? And what is the identity of the foetal and the female body? These are questions that, in one form or another, have been asked in Western cultures for centuries and are still key to contemporary debates about abortion, reproductive technologies and embryonic stem-cell research. Medico-scientific discourses of embryology, anatomy and obstetrics have always played a crucial role in questions of this kind. Within these discourses visual representations of the foetal and the female body have helped determine ideas of life, generation and identity. The two previous chapters on the rete mirabile and the lymphatics showed how during the early modern period anatomical objects could become obsolete or new anatomical structures emerged and the crucial role visual representations played in such processes. In this chapter, however, I am less interested in how anatomical objects become obsolete or were created, but rather in changing theoretical concepts of their object of investigation. When early modern scholars tried to determine the identity of the unborn, they had to deal with a different kind of uncertainty. The unborn had always had an undeniable presence in the pregnant female body, but ideas about the nature and the history of the development of the unborn changed fundamentally from the sixteenth to the eighteenth century. The focus of this chapter will thus be on the question of how changes in the notion of the nature of the unborn and the history of its development were reflected in the visual representation of the embryo and the foetus. These images were however often more than mere illustrations of reproductive processes. Issues of generation not

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[465] I am using the term "unborn" in this chapter despite its problematic implications. My intention is not to indicate that what was experienced by women during pregnancy or imagined as the contents of the pregnant uterus by others was at any given moment during pregnancy regarded as identical with a newborn child. I simply use the term to subsume the different terms, such as "seed", "animalcule", "fruit", "embryo", "foetus" or "child", which were used in my sources to identify what was to become a child. Only when it is necessary to distinguish between the different concepts of generation or developmental stages associated with these terms do I use them with their historical meaning. For a discussion of the unborn and the tensions between the female somatic experience of pregnancy and male discourses about the nature of the unborn see Barbara Duden, ' Zwischen ›wahrem Wissen‹ und Prophetie: Konzeptionen des Ungeborenen', Barbara Duden (ed.), *Geschichte des Ungeborenen: Zur Erfahrungs- und Wissenschaftsgeschichte der Schwangerschaft, 17.-20. Jahrhundert*, Göttingen: Vandenhoeck und Ruprecht, 2002, pp. 11-48, here pp. 11-18.

only mattered for the identity of the unborn as a biological entity but also raised questions about both the metaphysical and moral status of the unborn which are still contested today.

Beyond the gendered knowledge about human reproduction, early modern images of the unborn made claims about the identity and the human body and human nature in relation to Christian cosmology, natural philosophy but also in relation to Enlightenment ideas of individuality and subjectivity.[466] This chapter looks at how authors of midwifery handbooks, obstetrical atlases, anatomical handbooks and atlases as well as embryological treatises created a predominantly male discourse which was able to claim the exclusive knowledge about mechanisms and meanings of human generation. While this chapter draws on the already rich research literature on the visual representation of the unborn as well as early modern embryology, it also goes beyond it. Previous studies were often either focused on a particular country or genre, such as McTavish book on early modern French midwifery texts, or made often too generalizing claims about the identity of the unborn, for example Karen Newman in *Foetal Position*. My aim, however, is to evaluate images of the unborn across different genres. This will allow me to draw a more comprehensive picture of early modern ideas of the unborn. I will also analyse visual representations of the unborn, how they mediated a variety of ambiguous and contested views of the embryo and the foetus, frequently within the same picture, and thereby create a more differentiated understanding of early modern understandings of the unborn.

In *Fetal Positions*, Karen Newman has shown that contemporary images of the unborn are part of a long visual tradition, from late medieval obstetrical illustrations, Renaissance anatomy, eighteenth century obstetrical atlases and anatomical wax models to modern obstetrics. This book was the first comprehensive account of the Western visual tradition of representations of the unborn. Newman argued that common to all these images was that they tended to isolate the foetus from the female body or reduced the female body to its reproductive capacity and inscribed the foetus with individual

[466] Karen Newman, *Fetal Positions: Individualism, Science, Visuality*, Stanford: Stanford University Press, 1996; Eve Keller, 'Embryonic Individuals: The Rhetoric of Seventeenth-Century Embryology and the Construction of Early-Modern Identity', *Eighteenth-Century Studies*, 33 (2000), 321-348, p. 333.

identity.[467] Newman assumed that since the Enlightenment modern subjectivity was the model for the identity of the foetus, as did Eve Keller, when she claimed that "competing theories of embryogenesis and the conflicting formulations of the embryo itself take part in the conceptual struggles accompanying the emergence of the early-modern individual".[468] Keller also assumed pre-natal individual identity and assigned embryology a crucial role in establishing such an identity for the embryo and the foetus. Keller argued that embryology, especially in its variant as animalculist preformation, provided a mechanist explanation for generation while protecting subjectivity against the threat mechanism itself posed to this concept of identity.[469] However, both Newman and Keller remained rather vague about the characteristics of the identity of the embryo and the foetus before the Enlightenment. They tended to underestimate the often ambiguous identity of the unborn as a liminal being within the Christian narrative of Salvation. However, questions about the beginning of human life had strong theological implications, since a clear answer was crucial in order to know from what point the salvation of the immortal soul of the unborn was at stake.

Such interpretations of early modern views of the unborn as an autonomous individual were often contrasted with interpretations of the early modern male views of the female reproductive body as passive or dangerous. The history of human reproduction and generation has often been written as a story of male subjectification, with the female reduced to her reproductive capacities. One example of such narratives is Lara Thompson's *The Wandering Womb*. Thompson tended to simplify the ambiguity and complexity of early modern male discourses about the female body. She rightly identified the Christian creation myth as fundamental to the modelling of gender roles and ideas of generation in the West. However, when Thompson used Dürer's 1504 woodcut of the Fall of Man to argue that in the Western Christian tradition the female body was rendered as inherently sinful, seductive and dangerous,[470] she ignored the

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467 Newman, *Positions*, 1996. For a critical revision of this thesis see also McTavish, *Childbirth*, 2005, pp. 173-178.

468 Keller, 'Individuals', 2000, p. 333.

469 Those who had adopted animalculist preformationist views thought that that the individual being was already existent in the male semen before conception. For a more detailed discussion of early modern theories of generation see section 6.3 in this chapter.

470 Lara Thompson *The Wandering Womb: A Cultural History of Outrageous Beliefs About Women*, Amherst: Prometheus Books, 1999, pp. 16-17.

possibility of a shared responsibility of both Adam and Eve for the original sin, which is implied in the print. Instead, Thompson reduced Eve to the physically and mentally inferior seducer and denied the female power as well as the possibility of mutual attraction of men and women and the erotic aspects of this relationship, which is implied in many early modern images representing the Fall of Man.[471]

Although anatomy and embryology were male domains in the early modern period, the ascriptions made to the foetal and the female body in these areas did not remain unchallenged. Male discourses of the foetal and the female body had to consider cultural meanings of the body and concepts of gender. They were also not isolated from predominantly female areas of practices like childbirth and domestic care, and were confronted with genuine female somatic experiences of pregnancy, labour and childbirth. Furthermore, in the area of midwifery, male practitioners were in increasing competition with well established female professionals, when more and more male accoucheurs tried to establish themselves on the medical marketplace from the second half of the seventeenth century.[472] Yet these areas were intertwined with male discourses, and male interventions, for example by male-midwifes, could be regarded as an invasion of female domains. Thus eighteenth-century obstetrical atlases in particular have to be understood as part of a male strategy to gain hegemony over hitherto female dominated areas and experiences.[473] However, Lianne McTavish has recently shown in her work on early modern French midwifery treatises how this process was not a one-sided patriarchal subjection of a previously female domain, but "that men's entry into the lying-in chamber was a complex negotiation involving their adaption to the

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471 Bark, *Suche*, 1994, pp. 25-45.

472 The literature on early modern midwifery is vast, ever growing and too extensive to discuss it comprehensively within this chapter. Recently Helen King, for example, published *Midwifery, Obstetrics and the Rise of Gynaecology: The Uses of a Sixteenth-Century Compendium*, Aldershot: Ashgate, 2007 and Adrian Wilson discussed the competitive challenges for midwifes on the early medical marketplace in 'Midwifery in the 'Medical Marketplace'', in Mark Jenner, Patrick Wallis (eds), *Medicine and the Market in Early Modern England*, London: Palgrave Macmillan, 2007, pp. 153-174. A good overview of the practice of midwifery in early modern Europe is still Hilary Marland (ed.), *The Art of Midwifery: Early Modern Midwives in Europe*, London: Routledge, 1993.

473 Ludmilla Jordanova, 'Gender, Generation and Science: William Hunter's Obstetrical Atlas', in William F. Bynum and Roy Porter (eds), *William Hunter and the Eighteenth-Century Medical World*, Cambridge: Cambridge University Press, 1985, pp. 385-412.

demands of women".[474] In such a context, gendered inscriptions on the foetal and the female body were complex and contentious as results of power relations in which women were both agents and subjects to male superiority.[475]

The illustrations of anatomical handbooks, obstetrical atlases and embryological works were evidence of the pursuit for the hegemony of male knowledge about generation, and illustrations of the foetal body attributed it with a distinct identity. This identity was framed by early modern natural philosophy, ideas about subjectivity and Christian understanding of human nature. Yet these ideas were not stable and changed fundamentally from the sixteenth to the eighteenth century. While illustrations in midwifery books and obstetrical atlases showed the changing relationship between the female and the foetal body, early modern natural philosophers discussed in embryological treatises various concepts of generation, ranging from Aristotelian epigenesis via preformationist theories to early ontogenetic ideas. In anatomical handbooks and atlases the moralising iconography associated with the unborn made wide ranging claims about its status within Christian salvation history. In early modern anatomy and embryology the foetal body became a scientific object in its own right and was gradually disjoined from the female body.

A clear distinction between the three areas of midwifery, embryology and anatomy is not always possible. Authors often contributed to all three discourses and images moved from one context to the other.[476] Nevertheless, the three areas each had their own visual traditions, and I will argue that these distinct traditions were the result of specific iconographic conventions related to the functional context of the illustrations. In the first section of this chapter I will look into the iconographic tradition and function of illustrations in midwifery manuals, before I discuss the relation between ideas and

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474 McTavish, *Childbirth*, 2005, p. 217. A discussion of current research on midwifery with a bias to work on Britain and Germany can be found in Samuel S. Thomas, 'Early Modern Midwifery: Splitting the Profession, Connecting the History', *Journal of Social History*, 43 (2009), pp. 115-138.

475 For a more detailed account of the complex story of the gendered body and early modern generation see Mary Fissell, 'Gender and Generation: Representing Reproduction in Early Modern England', *Gender & History*, 7 (1995), 433-456.

476 Andrew Cunningham has argued that generation (i.e. early modern embryology) and man-midwifery should actually be regarded as "sub-disciplines" of anatomy. Cunningham, *Anatomist*, 2010, pp. 165-185.

images of generation in the second part of the chapter. In the third section the focus is on how the Christian tradition and morality shaped ideas and images of the unborn. I will then show how the secularized images of embryos and foetuses rendered the unborn as a biological entity from the second half of the eighteenth century. The last section of the chapter sums up the ways that the identity of the unborn was imagined and changed during the early modern period and shows that images of the unborn not only shaped the changing relations between the female and the foetal body, but also reflected and contributed to establishing modern subjectivity. Furthermore they also reflected the shift from a metaphysical understanding of the body to a secularised understanding of the body as a natural object during the second half of the eighteenth century.

6.1 Practical knowledge and images of the unborn

The most coherent iconography of the unborn in the West was established from the middle ages in illustrated midwifery manuals such as the various versions of Muscio's *Gynaecia*, a gynaecological text from late antiquity that borrowed heavily from the Greek physician Soranus of Ephesus (first/second century AD). This text circulated widely in medieval Europe and was often illustrated with images representing the situation of the foetus in the womb (figure 6.1).[477] These images were introduced into print by Eucharius Rösslin's (c1470-1526) *Der swangern Frauwn und Hebammen Rosegarten*, first published in Strasbourg in 1513 (figure 6.2).[478] This book became one of the first medical bestsellers and was translated, reedited and republished in several European languages up to the seventeenth century and had great influence on other midwifery texts such as Walter Hermann Ryff's *Frawen Rosengarten* and *Albertus*

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477 Christine Bonnet-Cadilhac, 'Les representations du foetus in utero', *Medicina nei secoli*, N. s. 7 (1995), 339-50.

478 Eucharius Rößlin, *Der Swangern Frauwen vnd Hebamen Rosegarten*, Strassbourg: Martin Flach, 1513. On the sources for Rösslin's midwifery book and its later editions see Monica H. Green, 'The Sources of Eucharius Rösslin's 'Rosegarden for Pregnant Women and Midwives (1513)', *Medical History*, 53 (2009), 167-192; Thomas Reynalde, *The Birth of Mankind: Otherwise Named, the Woman's Book Newly Set forth, Corrected, and Augmented*, ed. by Elaine Hobby, Farnham and Burlington: Ashgate, 2009.

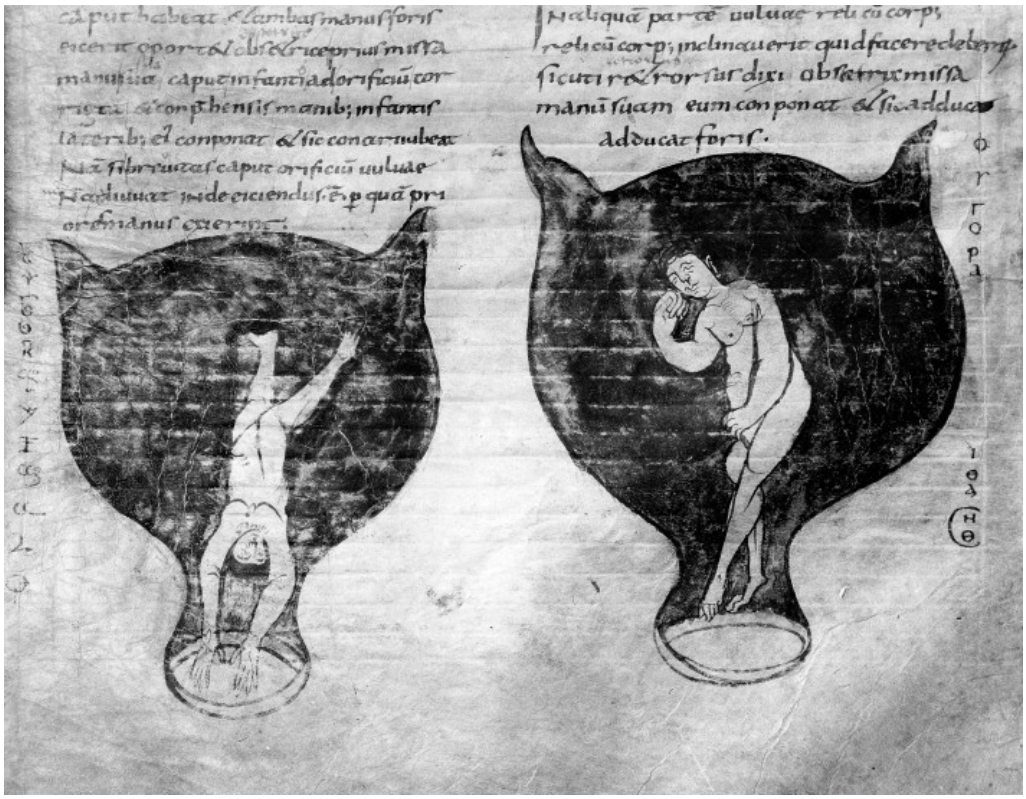

Figure 6.1

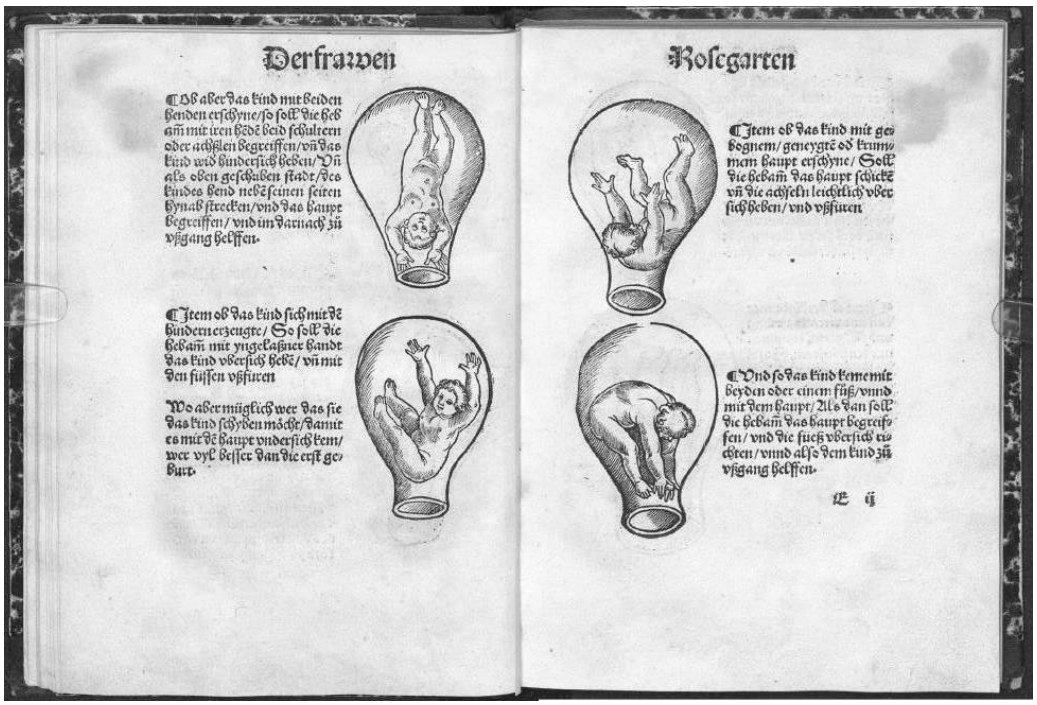

Figure 6.2

Magnus as well as Jacob Ruf's *Trostbüchlein*, further best-sellers of the sixteenth and seventeenth centuries.[479]

The illustrations in these books depicted the unborn in various poses within the womb. The images were intended to help midwives understand the different positions of the foetus in utero just before birth and the potential complications during birth, resulting from the abnormal positions of the foetus. Such illustrations often showed the unborn within either an abstract womb, almost reminiscent of a topped urine glass, as they were common in medieval medical manuscripts, early prints and on urine charts. Urine glasses were a common attribute of physicians and were used to distinguish them from other medical practitioners on drawings, paintings and prints. However, if the representation of the unborn inside a shape that reminded one of a topped urine glass could be interpreted as a symbol of the authority of the learned physician over the unborn is doubtful.[480] Other obstetrical illustrations represented the unborn within the womb and provided more anatomical context when they showed the different layers of the womb opening like a flower (figures 6.6 and 6.8B). The womb reminiscent of an

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479 Walter Hermann Ryff, *Frawen Rosengarten. Von vielfältigen sorglichen Zufällen und Gebrechen der Mütter und Kinder, So inen vor, inn unnd nach der Geburt begegnet mögenn. Dabei auch aller Bericht der Pflege unnd Wartung, Frawen, Jungfrawen, und Kindern dienlich und von nöten*, Frankfurt: Christian Egenolff, 1545; Walter Hermann Ryff, *Ein Neüwer Albertus Magnus. Von Weibern, und geburten der Kinder, sampt ihrer Arzneyen. Auch von Tugenden etlicher Fürnemer Kreatür. Unnd von Krafft der Edlen Gestein. Von Art und Natur etlicher Thier. Mit sampt einem bewerten Regiment für die Pestilenz*, Frankfurt: Weygandt Han and Georg Raben, 1562. Especially on Ryff's *Albertus Magnus*, which was less detailed than his *Frawen Rosengarten* and more like a pamphlet, and for further reading on Ryff see Kathleen Crowther-Heyck, 'Wonderful Secrets of Nature: Natural Knowledge and Religious Piety in Reformation Germany', *Isis*, 94 (2003), 253–273. Jacob Ruf, *Ein schön lustig Trostbüchlein von den empfengknussen und geburten der menschen*, Zurich: Christof Froschauer, 1554. The Latin edition was published the same year as Jacob Ruf, *De conceptu et generatione hominis, et iis quae circa hec potissimum consyderantur*, Zurich: Christof Froschauer, 1554. The edition used here is the critical edition in Jakob Ruf, *Leben, Werk und Studien* Hildegard E. Keller (ed.), 5 vols, Zurich: Verlag Neue Züricher Zeitung, 2009, vol. 4, pp. 265-699. On the publication history and reception of Ruf's *Trostbüchlein* see Hildegard E. Keller, 'Züricher Geburtshilfewissen in Europa: Die Rezeptionsgeschichte des *Trostbüchleins*', in Jakob Ruf, *Leben, Werk und Studien*, Hildegard E. Keller (ed.), 5 vols, Zurich: Verlag Neue Züricher Zeitung, 2009, vol. 5, 232-263.

480 On the iconography of uroscopy with a particular focus on early modern Dutch genre paintings see Michael Stolberg, *Die Harnschau. Eine Kultur- und Alltagsgeschichte*, Cologne: Böhlau, 2009, pp. 137-166.

opening flower referred to a discourse in which agricultural metaphors were very common to describe human reproduction.[481]

The images showing the unborn in different poses in the womb were part of a long established canon of illustrations of the unborn before birth and remained part of the iconographic repertoire of midwifery books throughout the seventeenth and into the eighteenth century.[482] In frequent reprints the series of images representing the child before birth in various poses in the womb remained in circulation well into the eighteenth century, for example in Jane Sharp's *The Midwives' Book* and Mauriceau's *Des maladies des femmes grosses et accouchées*.[483] But they not only appeared in reprints of older midwifery handbooks. They were also reprinted in surgical handbooks, such as Lorenz Heister's *Chirurgie*, one of the most successful chirurgical handbooks of the eighteenth century.[484] Heister used this series of illustrations in the chapter on operations necessary during complicated births.

Illustrations of the positions of the unborn inside the uterus were often supplemented by images showing the unborn in situ. From the sixteenth century, some illustrations from an anatomical context were added to this canon, such as Vesalius' images of the chorion, amnion and the embryo attached to the placenta by the umbilical cord (figure 6.3), as well as female torsos or whole-body figures representing the anatomy of the pregnant uterus, some of them showing the unborn crouching inside the womb (figure 6.4). These full body figures had their origins in the medieval anatomical manuscript tradition and circulated widely in midwifery manuals and anatomical texts, as well as anatomical fugitive sheets during the sixteenth and seventeenth centuries.[485] These images usually represented a sitting female figure with the legs opened. On the

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481 Kathleen Crowther-Heyck, '"Be Fruitful and Multiply": Genesis and Generation in Reformation Germany', *Renaissance Quarterly*, 55 (2002), 904-935.

482 Newman also observes that these "visual codes for representing obstetrical knowledge were remarkably constant", Newman, *Positions*, 1996, p. 26.

483 Jane Sharp, *The Midwives Book: Or the Whole Art of Midwifery Discovered. Directing Childbearing Women How to Behave Themselves*, London: S. Miller, 1671; Francois Mauriceau, *Des maladies des femmes grosses et accouchees*, Paris: J. Hénault, 1668.

484 Lorenz Heister, *Chirurgie, in welcher alles, was zur Wund-Artzney gehöret, nach der neuesten und besten Art, gründlich abgehandelt* [...], Nuremberg: Hoffmann, 1719. The illustrations are reproduced in Newman, *Positions*, 1996, p. 37.

485 On their iconographic tradition see Carlino, *Bodies*, 1999, pp. 74-88.

Figure 6.3

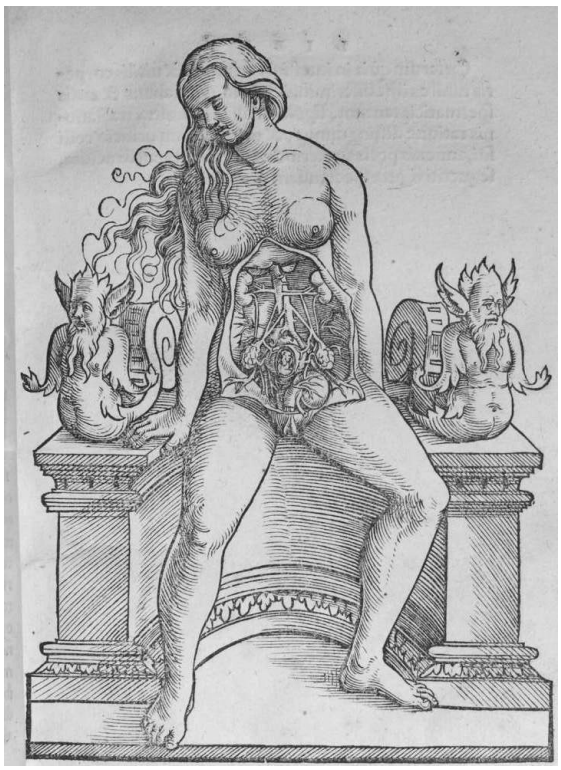

Figure 6.4

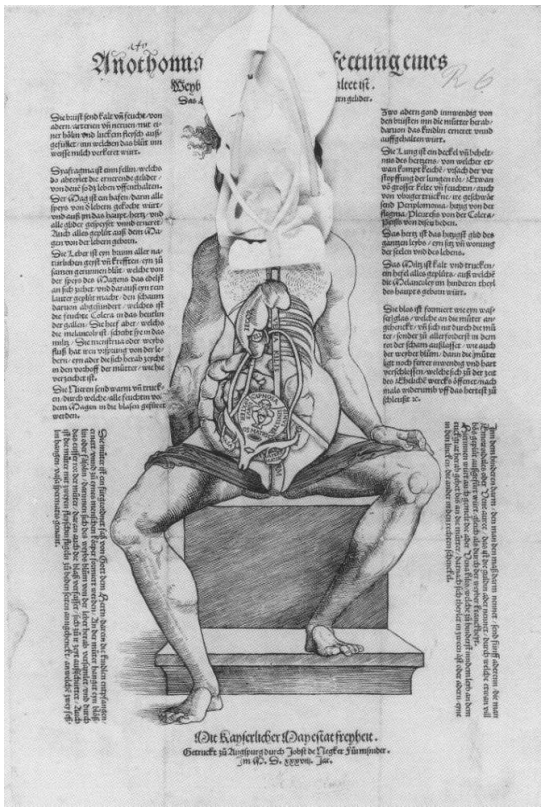

Figure 6.5

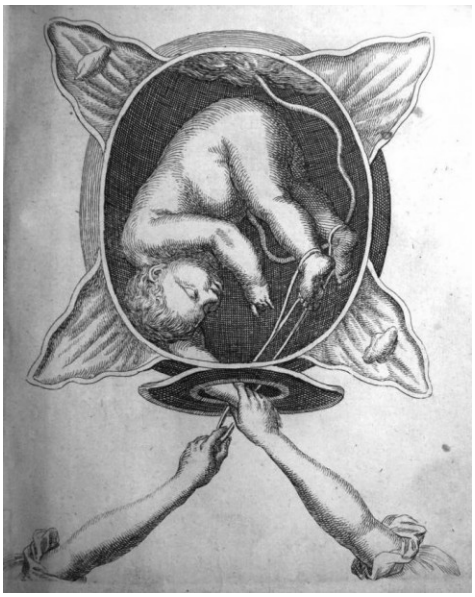

Figure 6.6

anatomical fugitive sheets, readers would be able to lift the abdominal wall to gaze into the body where they would see the internal organs and frequently the unborn inside the womb (figure 6.5). The practice of introducing anatomical images into midwifery books continued into the seventeenth century. In the *The Compleat Midwife's Practice,* an anonymously published but highly successful English midwifery book of the seventeenth century, for example, the first image after the title page is taken from an anatomical context, a copy of a figure in Spiegel's *De formato foetu* (figure 6.18d). [486]

Illustrations in the tradition of Muscius were primarily concerned with the different positions the foetus might obtain before birth and the appearance of multiple births in the womb. Over almost a millennium they were not changed substantially and only modified. Anatomical detail was apparently of a lesser concern and illustrated midwifery manuals gained their value primarily from their practical usefulness. The importance of the mediation of practical knowledge in illustrations in midwifery books becomes particularly evident with Justina Siegemund's (1636-1705) *Hoff-Wehe-Mutter* (1690).[487] Siegemund was midwife at the court of Brandenburg and wrote her book as a dialogue between an experienced midwife and her pupil.[488] The illustrations in the book

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[486] Adriaan van der Spiegel, *De formato foetu: liber singularis*, Padua: Io. Bap de Martinis and Liuius Pasquatus, 1626; Anon., *The Compleat midwifes practice, in the most weighty and high concernments of the birth of man*, London: Nathaniel Brooke, 1656.

[487] Justina Siegemund, *Die Chur-Brandenburgische Hoff-Wehe-Mutter, das ist: Ein höchst-nöthiger Unterricht von schweren und unrecht-stehenden Geburten, in einem Gespräch vorgestellet, wie nehmlich durch Göttlichen Beystand eine wohl-unterrichtete und geübte Wehe-Mutter, mit Verstand und geschickter Hand, dergleichen verhüten, oder wanns noth ist, das Kind wenden könne, durch viele Jahre Ubung, selbst erfahren und wahr befunden, nun aber Gott zu Ehren und dem rechten Nutz, auch, auf Gnädigst- und inständiges Verlangen, Durchlauchtigst- und vieler Standes-Personen nebst Vorrede, Kupfer-Bildern, und nöthigem Register auf eigene Unkosten zum Druck befördert*, Cölln an der Spree: Ulrich Liebperten [printer], 1690. An English translation has recently been edited by Lynn Tatlock: Justina Siegemund, *The Court Midwife*, Chicago: University of Chicago Press, 2005. For French midwifery manuals see McTavish, *Childbirth*, 2005, pp. 173-215. McTavish argued that the images in midwifery books "combined iconic and indexical signs to make arguments about the haptic knowledge and gendered medical identity of the practitioner" (McTavish, *Childbirth*, 2005, p. 206).

[488] On Siegemund's biography, the genesis of the book and its importance as a female contribution to the early modern discourse on midwifery see Waltraud Pulz, *«Nicht alles nach der Gelahrten Sinn geschrieben» - Das Hebammenanleitungsbuch von Justina Siegemund: zur Rekonstruktion geburtshilflichen Überlieferungswissens frühneuzeitlicher Hebammen und seiner Bedeutung bei der Herausbildung der*

included a series of twelve images showing the various positions of the child during birth (figure 6.6). While these illustrations were modelled on older images, which also showed the unborn in a rather abstract uterus with no or only little anatomical detail, they were remarkable in how they emphasized the practical aspects of showing the foetal positions. Beyond being merely illustrative, they gave explicit practical advice by showing how the midwife could grab and move the child during difficult births. Simultaneously the way the child had to be held and the particular moves by the midwife that would ensure a successful birth were also explained in the accompanying text.

The interior of the female body often remained obscure in such illustrations, yet the unborn appeared as an active individual moving about the womb. This notion of a child trapped inside the uterus conformed with early modern notions of childbirth. Usually the unborn was described as actively pushing itself out of the womb, as if it was captured and contained inside the pregnant female body, about to liberate itself from its prison during birth.[489] This view was reflected in the illustrations of midwifery books with the foetus moving independently within a uterus, which was detached from the female body. On the one hand this omission of the female body can be understood as the representation of a notion of the unborn as an autonomous agent and the mother's body its passive host. On the other hand, the illustrations in midwifery books were situated in a moment of transition when the different poses of the unborn in the womb were usually described as representations of the different positions of the child *at birth*. These illustrations were therefore imaginary representations of the unborn and were characterized by a certain degree of uncertainty about the appearance of the unborn, which could ultimately only be confirmed after the newborn child had left the womb.

In the eighteenth century a new mode for the representation of the unborn was introduced with obstetrical atlases, in which the foetus was usually depicted in situ in the female body. Unlike the animated foetuses in the Muscio-tradition these foetuses

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modernen Geburtshilfe, Munich: Münchner Vereinigung für Volkskunde, 1994 and Lynn Tatlock, 'Speculum Feminarum: Gendered Perspectives on Obstetrics and Gynecology', *Signs*, 17 (1992), 725-760.

489 See Ruf, *Werke*, 2009, vol. 4, pp. 406-408; Newman, *Positions*, 1996, pp. 33, 126 and n. 45 for further references.

appeared passive and motionless.[490] Yet the illustrations of these works were full of anatomical detail and high quality; unlike the midwifery books, which were produced as handbooks and textbooks for surgeons and midwifes. The obstetrical atlas *Anatomia uteri humani gravidi* (1774) by the London anatomist and male accoucheur William Hunter, for example, was a representative folio volume with elaborate prints.[491] More than teaching the reader practical obstetrical knowledge, it was designed to represent the skills and competence of William Hunter as learned anatomist and leading male accoucheur and part of a movement that took childbirth out of the hands of women and turned it into a male domain.[492]

The relatively stable iconography of early modern midwifery changed from the middle of the eighteenth century with the appearance of obstetrical works such as William Smellie's *A Sett of Anatomical Tables* (1754), Charles Nicholas Jenty's *Demonstratio uteri praegnantis mulieris* (1761) and Hunter's *Anatomia,* which was the most remarkable of these books.[493] The illustrations in these atlases showed great anatomical detail and were based on dissections of pregnant female bodies, and were characterized by a high degree of naturalism (figure 6.7).[494] Focusing on the pregnant female body, Hunter was not especially interested in the anatomy of the unborn itself and commented "that part has been executed by others" without clarifying which authors he was

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490 Roberta McGrath has argued that Hunter's images represented an active foetus and a passive female body (Roberta McGrath, *Seeing her Sex: Medical Archives and the Female Body*, Manchester: Manchester University Press, 2002, p. 67). However, I would argue that these prints do not make any suggestions that the unborn was moving independently. Neither the positions of the fetuses nor any other visual narrative suggested that the unborn should be regarded as an active agent. In section 6.5 of this chapter I will suggest a different interpretation of how Hunter's plates could be interpreted with regard to the identity of the foetal and the female bodies.

491 Hunter, *Anatomia*, 1774.

492 McGrath, *Sex*, 2002, pp. 65-66.

493 William Smellie, *A Sett of Anatomical Tables, with Explanations, and an Abridgement of the Practice of Midwifery, With a view to Illustrate a Treatise on that Subject, and Collection of Cases*, London, 1754; Charles Nicholas Jenty, *Demonstratio uteri praegnantis mulieris*, Nuremberg: Felssecker [for] heirs of Seligmann, 1761; For a discussion of these atlases see Jordanova, 'Gender', 1985, 386-387, who focuses on Hunter's plates and McGrath, *Sex*, 2002, pp. 63-92. For a more detailed discussion of Hunter's obstetrical atlas see section 6.5 of this chapter.

494 On Hunter's naturalistic paradigm see Jordanova, 'Gender', 1985, pp. 393-394.

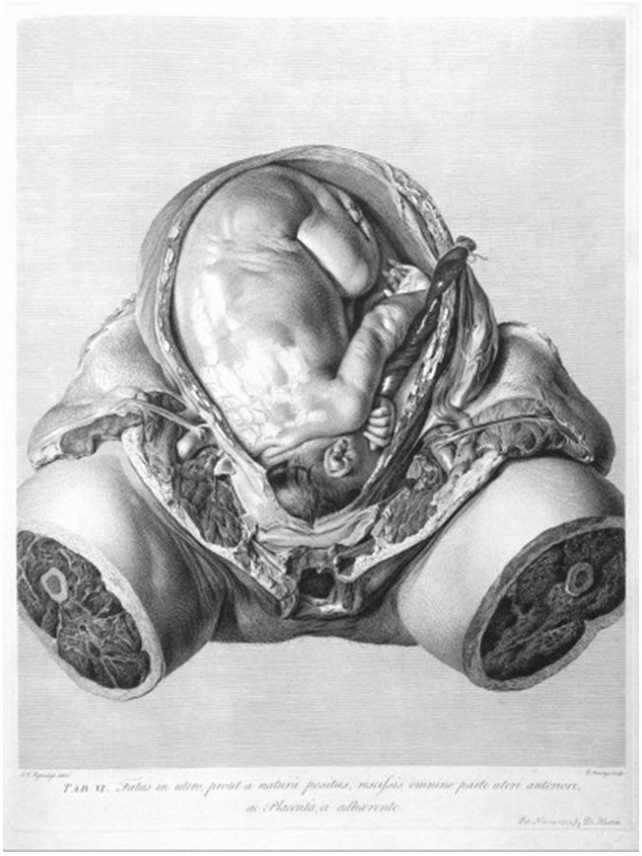

Figure 6.7

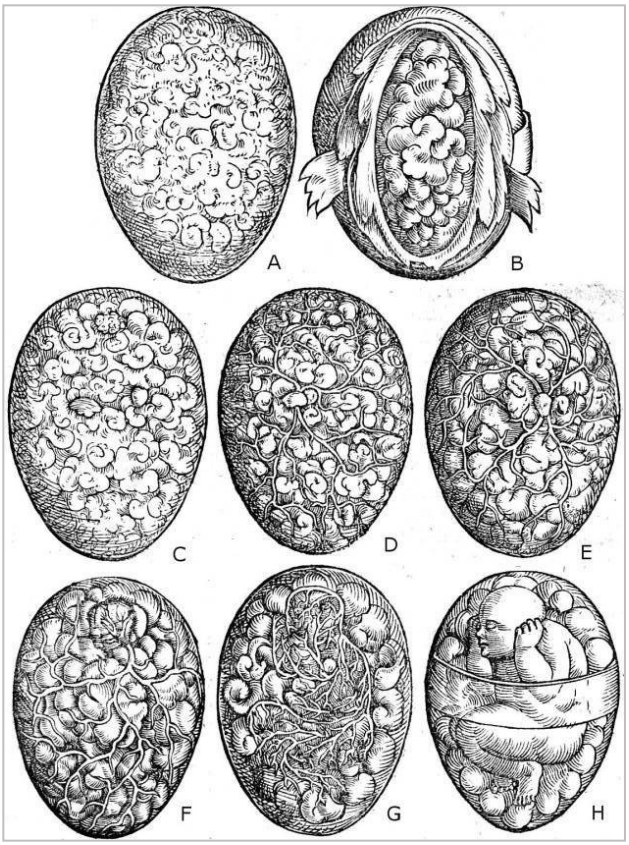

Figure 6.8

referring to.[495] Like the authors of the older illustrations from midwifery manuals, Hunter was also less concerned with the representation of foetal development. Although he noted the age of the different foetuses depicted on the plates, the images were not designed to mediate a particular theory of generation. From a pragmatic point of view they were not necessary for anatomical and obstetrical practice and ignoring such issues allowed Hunter to avoid the muddy waters of debates about concepts of generation.

6.2 Images and ideas of generation

Authors of midwifery books, anatomical and physiological treatises with an interest in natural philosophy and matters of generation had also produced images of reproductive processes since the sixteenth century, forming a visual tradition of changing views on generation. The most significant innovation with regard to the visual representation of generation during the sixteenth century were Ruf's images illustrating the formation of the foetus (figure 6.8). His idea of human generation was firmly rooted in a Galenic concept of epigenesis, according to which the fully formed child was the result of a continuous morphological transformation.[496] To the first book of his *Trostbüchlein* on conception and the formation of the foetus he added a series of illustrations representing the development of the unborn from the moment when male and female semen mixed in the womb to the fully developed child. In the text Ruf described the formation of the foetus as a sequence of transformations during which the semen was gradually formed into the basic components of the body under the influence of the four humours. According to this theory, for example, dryness and heat would form the heart and veins, while coldness and dryness would form the brain and nerves.[497]

Ruf's book was primarily written as a midwifery handbook intended to form the basis of the training and examination of midwives in Zurich.[498] The inclusion of images of the process of human generation in a book on generation and child birth was not strictly

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495 Hunter, *Anatomia*, 1774, fol. 4r.

496 On Galenic concepts of generation see Michael Boylan, 'Galen's conception theory', *Journal of the History of Biology*, 19 (1986), 47-77.

497 Ruf, *Werke*, 2009, vol. 4, pp. 356-58.

498 Hildegard E. Keller, Clemens Müller and Hubert Steinke, 'Trostbüchlein. De conceptu et generatione hominis', in Ruf, Werke, 2009, vol. 4, pp. 266-315, here pp. 266-269.

necessary from a pragmatic point of view, but can be explained by the intended audience. In the preface to the reader of the Latin edition, published a year after the German edition, Ruf made it clear that he had intended to write a more substantial book than just a practical guide to midwifery:

> It is not the intention of this project to reduce such a big field to a few regulations or to treat only a small part of such rich material, but to explore the miracle of the whole human nature as a whole and to start with the first principles of this matter.[499]

Therefore, Ruf argued, the book, especially in its Latin edition, should be of particular interest for learned readers.[500] For such an audience a work that also reflected on the principles and natural history of human generation would have been more appealing than merely a practical textbook for midwifery.

The illustrations represented these developments in the gradual differentiation of the undifferentiated mix of male and female semen in the womb (figure 6.8A) into a fully formed "child" ("Kind") after forty-five days (figure 6.8H). Over the course of the first month after conception, the stages illustrated in the images were the formation of the liver, heart and brain (figure 6.8C), the veins (figure 6.8D), after which the heart was fully formed (figure 6.8E). Subsequently the brain would develop more fully and be covered by a skin, which would harden into the cranium (figure 6.8F); and finally, after about eighteen days, the more fully formed "fruit" ("Frucht") entered the womb (figure 6.8G). This account very much reflected a Galenic understanding of embryonic development, according to which the male and female semen mixed and were gradually formed into a foetus while undergoing a sequence of morphological changes within the first six weeks after conception.[501]

Ruf's account of the process of human generation suggested changes in the nature of the unborn after conception. During the first two weeks he would merely refer to it as

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499 "Es ist nicht die Absicht des vorliegenden Unternehmens, ein so umfängliches Wissensgebiet auf einige wenige Vorschriften zu reduzieren oder aus dem so reichen Stoff nur ein einziges kleines Teilstück zu behandeln, sondern für die Betrachtung des Wunderwerks der ganzen menschlichen Natur der Sache selbst auf den Grund zu gehen und bei den allerersten Grundlagen dieser Materie zu beginnen." Ruf, *Werke*, 2009, vol. 4, p. 319.

500 Ruf, *Werke*, 2009, vol. 4, p. 321.

501 Boylan, 'Galen', 1986, pp. 76-77.

semen and only when the outlines of a human form appeared Ruf would call it a "fruit" (figure 6.8G). The next substantial transformation would manifest itself after about six weeks when the unborn was fully formed and should now be called a "child".[502] While Ruf used the illustrations of his Galenic account of human generation to emphasise his point by duplicating his descriptions, especially the last two images of the sequence also made clear that the human nature was identical with the human form. Meanwhile the final image in the sequence, showing the fully formed child (figure 6.8H), also depicted the unborn as an independent individual and result of an autonomous development from the moment of conception.

The images of human generation in Ruf's *Trostbüchlein* were purely imaginative and not based on autopsies. The lack of an empirical basis for these illustrations and the absence of any practical use might explain why they did not establish an iconographic tradition for the visual representation of generation. The development of seventeenth-century embryology, however, was mainly based on observations on chicken eggs, which were also the basis for images of developmental sequences in the works of authors such as the Padua anatomist Hieronymus Fabricius ab Aquapendente (1533-1619) or Marcello Malpighi.[503] Their illustrations were naturalistic visual accounts of their observations and represented the empirical basis for their reflections on the mechanisms of generation, a claim which could not be made for Ruf's illustrations of embryonic development.

Yet often the boundaries between naturalistic illustrations and images of ideas about reproductive processes were blurred. In the second book of his *Opusculum physiologum* (1599), the French surgeon Severin Pineau (1550?-1619) discussed questions of generation and proposed a theory of generation, according to which the foetus was formed during a period of twelve days. After conception, when the male semen came

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502 Ruf, *Werke*, 2009, vol. 4, p. 372.

503 Hieronymus Fabricius ab Aquapendente, *De formatione ovi et pulli*, Venice: Padua, Aloisius Bencius, 1621. Subsequenlty I will use Adelmann's edition and translation of Aquapendente's embryological works: Howard B. Adelmann, *The Embryological Treatises of Hieronymus Fabricius of Aquapendente*, 2 vols, Ithaca: Cornell University Press, 1967. Marcello Malpighi, *De formatione pulli in ovo*, London: Martyn, 1673. Subsequenlty I will use Adelmann's edition and translation of Malpighi's embryological works: Howard B. Adelmann, *Marcello Malpighi and the evolution of embryology*, 5 vols, Ithaca: Cornell University Press, 1966.

together with the female semen in the uterus, they were mixed and fermented during the first seven days. From the seventh to the twelfth day, however, this mixture was gradually turned into a fully formed foetus. This foetus could be as big as an ant or as small as a wheat grain. By this time also all parts of the body were fully formed. To support these claims Pineau referred to Hippocrates (*Libello de natura pueri*) and rejected Aristotle's opinion that the foetus only reached such size and perfection after 40 days.[504]

In the following chapter, Pineau introduced some images to illustrate his reflections on generation. Among them was an image which he claimed was showing his observations of a stillborn twelve-days-old foetus (figure 6.9).[505] The woodcut showed the foetus as a small human form in front of an oval shaped amorphous object, which was identified as the placenta, to which the foetus was linked by the umbilical cord. According to Pineau, the foetus was represented in its true size and replicated on the bottom left and bottom right of the illustration, but without any further explanation or indexing. Karen Newman regarded this illustration as a representation of the foetus as a tiny homunculus lost in the space of the uterus, with the umbilical cord as its Ariadne thread. While Newman did not further elaborate on the metaphor of the Ariadne thread – for which there is no reference in Pineau's book – she also ignored Pineau's description and interpreted the illustration as a typical early modern image of the unborn, relatively independent from the mother's body and claimed: "Not until the eighteenth century do images appear that suggest the size and significance of the uterus and placenta or fetal development on the woman's body."[506]

With these claims Newman ignored the early modern anatomical illustrations which represented a highly complex relationship between the female and the foetal body, although she discussed these images later on herself.[507] With regard to Pineau's illustration in particular she ignored the ambivalence of this image. While Pineau claimed a certain degree of naturalism by showing the foetus in its true size, he only

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504 Severin Pineau, *Opusculum physiologum, anatomicum*, Frankfurt: Zacharias Pathen, 1599, pp. 75-77.

505 Pineau, *Opusculum*, 1599, p. 80.

506 Newman, *Positions*, 1996, p. 33.

507 Newman, *Positions*, 1996, p. 82. For my own interpretation of these images see section 6.4 in this chapter.

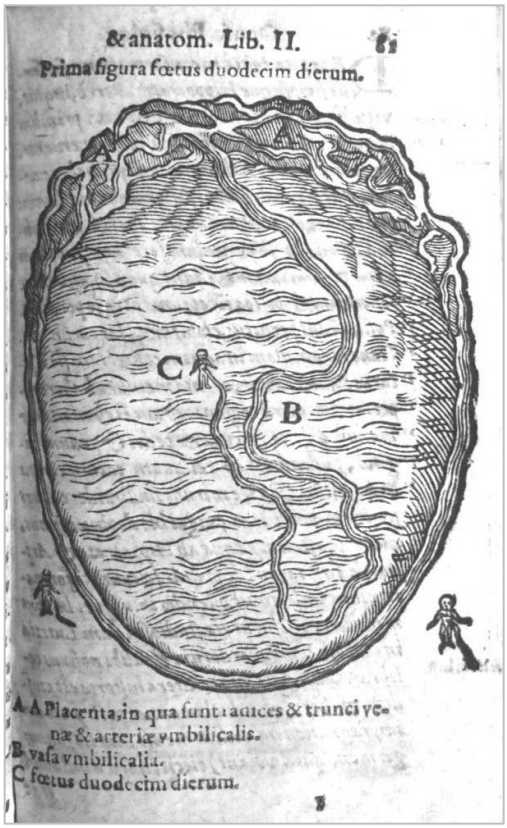

Figure 6.9

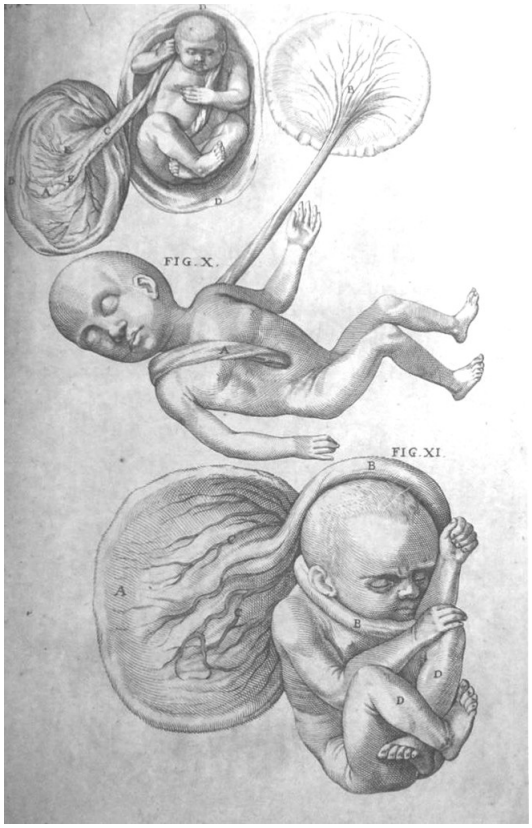

Figure 6.10

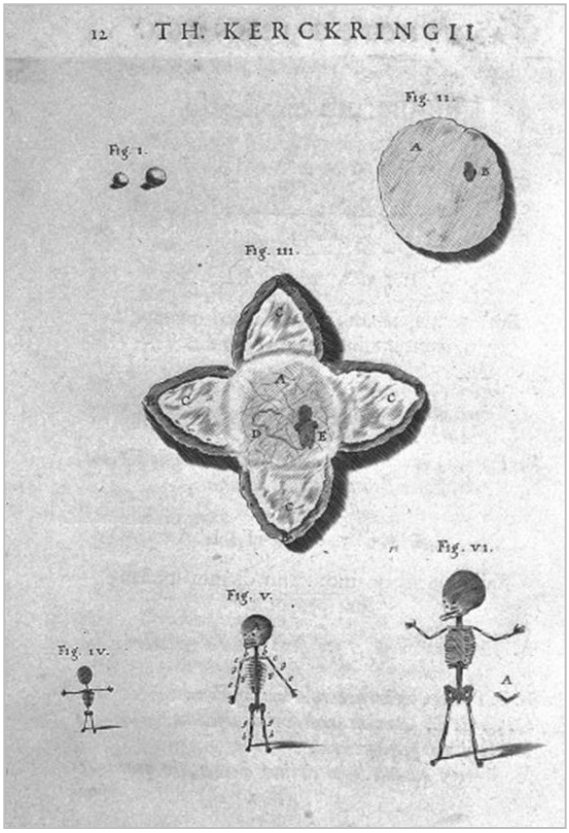

Figure 6.11

gave a fairly crude visual account of the exact appearance of both the foetus and the placenta and very little anatomical detail. Whether this reflected a certain degree of uncertainty about the exact appearance of the unborn at a specific developmental stage or was the result of artistic shortcomings has to remain open. In any case the representation of the idea of how the unborn should look after 12 days, especially its size, seemed to have been more important than anatomical detail. However, more detailed attention was given to the physical appearance of the unborn by one of Pineau's contemporaries, the Padua anatomist Hieronymus Fabricius of Aquapendente (1533-1619).[508]

During the first decade of the seventeenth century, Fabricius published his book *De formato foetu* (*On the Formed Fetus*). In the dedication of this book to Renato Borromeo (1555-1608), a member of a Milanese patrician family, he wrote that "[i]t is the first beginnings of life I am setting before you".[509] Fabricius thus made an ambitious claim which gave the text and illustrations of his *De formato foetu* an almost primordial dimension. In the first chapter of the book Fabricius divided his account of generation into three parts: Firstly, the generation of the semen, secondly, the generation and formation of the foetus, and thirdly the formed foetus until birth.[510] For Fabricius the formed foetus was alive and possessed a "whole body" as well as the ability to perform "actions", even though its only action in the uterus was growth. However, referring to Aristotle, he did not regard the foetus as an individual with sensory perception or even imagination, memory or reason, but regarded these abilities as "merely potential".[511] Fabricius discarded movements of the foetus described by women as female misperception and assigned "the cause in most instances to flatus instead".[512] If such movement actually occurred, it had to be the vital power of the foetus which

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508 Hieronymus Fabricius ab Aquapendente, *De formato foetu*. Padu Venice: Bolzetta, 1600. For an overview of Fabricius embryological works in the context of Renaissance anatomy see Andrew Cunningham, 'Fabricius and the "Aristotle Project" in Anatomical Teaching and Research in Padua', in Andrew Wear, Roger K. French and Iain M. Lonie (eds), *The Medical Renaissance of the Sixteenth Century*, Cambridge: Cambridge University Press, 1985, pp. 195-222.

509 Adelmann, *Fabricius*, 1967, vol. 2, p. 237.

510 Adelmann, *Fabricius*, 1967, vol. 2, 247.

511 Adelmann, *Fabricius*, 1967, vol. 2, pp. 277-278.

512 Adelmann, *Fabricius*, 1967, vol. 2, p. 279.

occasionally called the potentials incorporated in the foetus into action. Only with birth, those potentials would be fully realised.

It appears that for Fabricius the foetus remained in a liminal state which only changed with birth. This became particularly evident in the illustrations in *De formato foetu*, where five of the thirty-three tables in the book featured human foetuses (Table II to VI). The other illustrations featured female reproductive organs, placentae and animal foetuses. The human foetuses were depicted within and outside the uterus in various poses, with their arms and legs usually closely entangled to their bodies and showed much anatomical detail (Table III to Table V). However, Fabricius' representations of the human foetus lacked any attributes which would equip them with some kind of identity. While often in the older images of the unborn in midwifery books, for example, foetuses could be identified as male and female by their primary sexual characteristics, the foetuses in Fabricius *De formato foetu* did not have such features or other attributes which would refer to their gendered identity.

On table V in *De formato foetu*, two of the three figures (figure IX and figure XI) represented the foetus with arms and legs closely tangled to the body, attached to the placenta and in figure IX in the opened amnion (figure 6.10). Figure X, however, differed significantly from the other two. The foetus appeared to be lying on its back, with its arms and legs half outstretched and was attached to the placenta with the umbilical cord. Unlike in the other illustrations representing human foetuses, the body was neither shown in situ in the uterus, nor did its position resemble the foetal position in the uterus as depicted in the other figures. This suggests that the figure did not represent the foetus in the uterus but something else, which was reflected in the caption to the figure. While the other illustrations like figure IX and figure XI were identified as "foetus", figure X was identified as "infans", a still very small or very young child.[513] The changing appearance and terminology reflected that for Fabricius, the foetus would change its status only after birth and outside the womb. However, in *De formato foetu*

[513] Adelmann, *Fabricius*, 1967, vol. 1, p. 498. In Adelmann's translation of Fabricius' *De formato foetu* "infans" was translated with "fetus" (Adelmann, *Fabricius*, 1967, p. 337). Although "infans" can not only be translated as "small child", but also as "child inside the womb", the use of the term by Fabricius was significant, since this was the only occasion where Fabricius used the term "infans" when he identified the subject of his illustrations.

he did not detail how and into what the foetus would transform. Fabricius only spoke of "wonderful events which immediately follow birth and reveal the infinite providence of the Creator",[514] which suggested that the foetus would only be animated at birth and thus become an autonomous human being.

6.3 Visual representation and debates about preformation

Compared to the illustrations in Fabricius' *De formato foetu*, late seventeenth-century illustrations of the unborn were significantly different. Eve Keller has argued that the last few decades of the seventeenth century saw a significant shift in the notion of the unborn when authors such as the Dutch anatomist Theodor Kerckring (1638-1693) saw a "child" in the uterus at even shorter periods after conception of only a few days.[515] To underline the validity of his observation Kerckring added a plate to his little treatise on foetal development, which represented the little object showing the first rudiments of a human form (figure 6.11, Fig. II).[516] Keller interpreted such attributions of personhood as a response to the threats posed by mechanist theories of generation and suggested that they were fundamental for the formation of early modern identity, when

> distinguished features of autonomy and self-determination arise not so much as unencumbered achievements of human reason or human will, but rather as compensatory responses to perceived threats to the unique privileged status of human, and particularly masculine, identity. The more man in his physiology resembles a machine [...] the more it becomes necessary to ensure that he is known to be something other than a machine – that he is a person, a human, a subject, from the first moment of his conception, or even before.[517]

By the end of the seventeenth century, mechanist theories of generation and animalculist concept of pre-existence of man in the male semen were widely discussed in natural philosophy.[518] Key to this debate were the observations by the Dutch

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514 Adelmann, *Fabricius*, 1967, vol. 1, p. 326.

515 Eve Keller, *Generating Bodies and Gendered Selves: The Rhetoric of Reproduction in Early Modern England*, Seattle: University of Washington Press, 2005, pp. 125-127.

516 Theodor Kerckring, *Anthropogeniae ichnographia, sive conformation foetus ab ovo usque ad ossificationis principa, in supplementum osteogeniae foetum*, Amsterdam: Andreas Frisius, 1671, pp. 3-4 and 11-12 (index and plate).

517 Keller, *Bodies*, 2005, p. 155.

518 Peter J. Bowler, 'Preformation and Pre-existence in the Seventeenth Century: A Brief Analysis', *Journal of the History of Biology*, 4 (1971), 221-244. For general

microscopist Anton Leeuwenhoek, published in the *Philosophical Transactions* of the Royal Society, where he had first reported his observations of little animalcula in the male semen in 1677.[519] Later he would be credited with the discovery of the spermatozoon as one of the most significant discoveries of the microscope.[520] With regard to ideas about generation, Leeuwenhoek was a strong believer in preformationism and an animalculist, convinced that "the fruits coming from the male seed, and the females only contributing to the nourishment and growth of it".[521] However, he stopped short of subscribing to the idea of pre-existence. Although Leeuwenhoek was convinced that the entire human being was in the spermatozoon, he suggested that ultimately the exact appearance of the pre-formed man would remain unknown.[522]

Accordingly, Leeuwenhoek rejected illustrations of the spermatozoon which had been published under the pen-name Dalenpatius with a letter to the Royal Society in 1699.[523] Leeuwenhoek argued that because of the limitations of the microscope to make infinitely small objects visible, "one should find such a perfect Human shape [...]; I am

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older overviews of theories of generation see Francis J. Cole, *Early Theories of Sexual Generation*, Oxford: Clarendon Press, 1930 and Joseph Needham, *History of Embryology*, 2nd ed., Cambridge: Cambridge University Press, 1959; and with a focus on the long eighteenth century Elizabeth B. Gasking, *Investigations into Generation, 1651-1828*, London: Hutchinson, 1967.

519 Anton Leeuwenhoeck, 'Natis e semine genitali animalculis', *Philosophical Transactions*, 12 (1677/78), 1040-1046.

520 Edward G. Ruestow, 'Images and Ideas: Leeuwenhoek's Perception of the Spermatozoa', *Journal of the History of Biology*, 16 (1983), 185-224, p. 190.

521 Anton Leeuwenhoeck, 'An Abstract of a Letter from Mr. Anthony Leeuwenhoeck of Delft about Generation by an Animalcule of the Male Seed. Animals in the Seed of a Frog. Some Other Observables in the Parts of a Frog. Digestion, and the Motion of the Blood in a Feavor', *Philosophical Transactions*, 13 (1683), 347-355, p. 349.

522 Ruestow, 'Images', 1983, p. 211.

523 For a discussion of the identity of the author, the French naturalist Francois de Plantade (1670-1741) and the question whether the illustrations were a deliberate fraud and joke or represented Dalenpatius's true embryological views see Clara Pinto-Correia, *The Ovary of Eve: Egg and Sperm and Preformation*, Chicago: University of Chicago Press, 1997, pp. 230-232, who argues against the latter interpretation. Fig. VIII and Fig. IX on Figure 6.13 were copies of Dalenpatius' illustrations of what he claimed to have seen under the microscope.

certainly perswaded you will not allow of it".[524] Despite Leeuwenhoek's doubts the idea that a fully formed human being pre-existed in the sperm had already become a very convincing assumption and previously Nicolas Hartsoeker (1656-1725) had added an illustration to his *Essay de dioptrique* (1694), which showed a little human figure crouching in the head of a spermatozoon (figure 6.12).[525]

This illustration appeared at the end of a book on optics in the last chapter on the use of telescopes and microscopes. Here Hartsoeker gave a detailed description of the sperm including the illustration. But while the image of the unborn enclosed in the sperm was given a prominent place in a book which had only a few illustrations, even Hartsoeker had to admit that it only had limited explanatory power:

> We come to say that the little animal attaches itself to the egg by the thinnest part of its body. Now I believe that this part is the end of its tail, that this tail contains the umbilical vessels, and that if one could see the small animal through the skin which encloses it, we would see it probably like this figure shows it [...][526]

He was a strong believer in pre-existence and regarded the male semen as the ultimate origin of all life which enclosed tiny but fully formed beings and argued that

> each of these male animals encloses itself an infinitive [number] of other males and females of the same species; [...] and so forth; in a way that according to this thinking the first males had to be created with all those of the same species which were generated and which will have been generated until the end of time.[527]

Hartsoeker claimed that he first saw the semen of animals appearing to be little living beings in 1678 when he worked on the semen of fish. According to Hartsoeker each of

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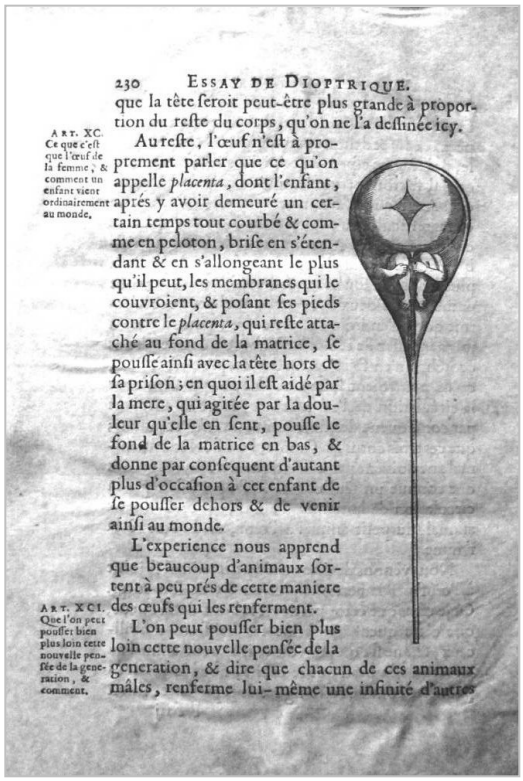
524 Anton Leeuwenhoeck, 'Part of a Letter from Mr. Leuvenhook, Dated June 9th, 1699, Concerning the Animalcula in Semine Humano, etc.', *Philosophical Transactions*, 21 (1699), 301-308, p. 303.

525 Nicolas Hartsoeker, *Essay de dioptrique*, Paris: Jean Anisson, 1694.

526 "Nous venons de dire que le petit animal se joint à l'oeuf par la partie la plus tendre de son corps. Or je crois que cette partie est le bout de sa queuë, que cette queuë renferme les vaisseaux umbilicaux, & que si l'on pouvoit voir le petit animal au travers de la peau qui le cache, nous le verrions peut-être comme cette figure le represente […]", Hartsoeker, *Essay*, 1694, pp. 229-230.

527 "chacun de ces animaux mâles, renferme lui-même une infinité d'autres animaux mâles et femelles de même espece; & ainsi de fuite; de sorte que selon cette pensée les premiers mâles auroient été créez ave tous ceux de même espece qu'ils ont engendrez & quis s'engendreront jusqu'à la fin des siecles." Hartsoeker, *Essay*, 1694, pp. 230-231.



230 ESSAY DE DIOPTRIQUE.

que la tête ſeroit peut-être plus grande à proportion du reſte du corps, qu'on ne l'a deſſinée icy.

ART. XC. Ce que c'eſt que l'œuf de la femme, & comment un enfant vient ordinairement au monde.

Au reſte, l'œuf n'eſt à proprement parler que ce qu'on appelle *placenta*, dont l'enfant, après y avoir demeuré un certain temps tout courbé & comme en peloton, briſe en s'étendant & en s'allongeant le plus qu'il peut, les membranes qui le couvroient, & poſant ſes pieds contre le *placenta*, qui reſte attaché au fond de la matrice, ſe pouſſe ainſi avec la tête hors de ſa priſon; en quoi il eſt aidé par la mere, qui agitée par la douleur qu'elle en ſent, pouſſe le fond de la matrice en bas, & donne par conſequent d'autant plus d'occaſion à cet enfant de ſe pouſſer dehors & de venir ainſi au monde.

L'experience nous apprend que beaucoup d'animaux ſortent à peu prés de cette maniere des œufs qui les renferment.

ART. XCI. Que l'on peut pouſſer bien plus loin cette nouvelle penſée de la generation, & comment.

L'on peut pouſſer bien plus loin cette nouvelle penſée de la generation, & dire que chacun de ces animaux mâles, renferme lui-même une infinité d'autres

Figure 6.12

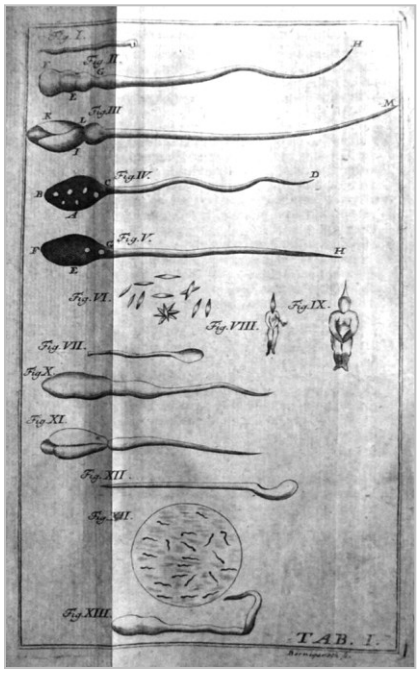


Figure 6.13

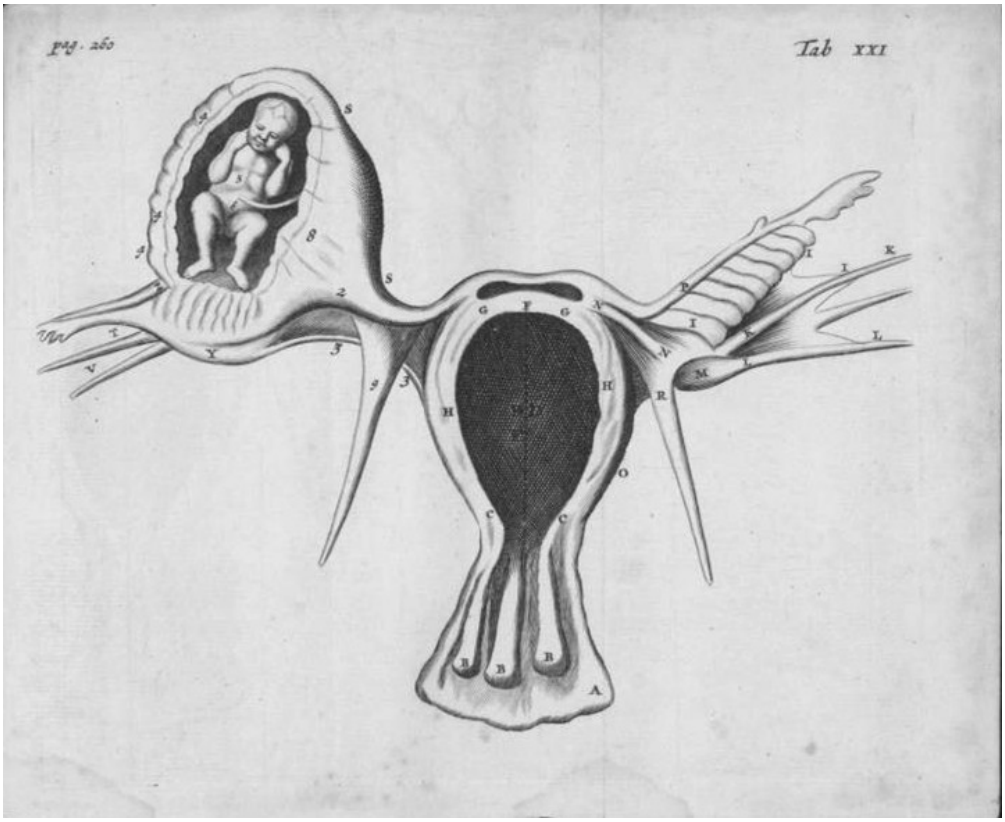


Figure 6.14

the little particles of semen contained either a little male or female fish. When the semen was ejaculated by the male and entered the ovaries of the female, the little animal contained in the semen would enter the egg to take residence and be nourished and grow. [528] This same principle applied to all other animals, as well as humans:

> One could assume the same kind of animals which show themselves in the semen of humans and quadrupeds, and say that each small animal actually contains and holds, and in miniature under a thin and tender skin a male or female animal of its own species in the semen where it finds itself; that when an animal entered into the egg which the female has ejected at the time of unification from her testicles or ovaries into the uterus through the tubes which the anatomists discovered there visibly [...][529]

Hartsoeker felt it necessary to strongly emphasize that the result of the little animal contained in the sperm taking up residency in the female egg was not a unification of the two bodies. Against the argument that through blood circulation mother and the little animal egg shared the same blood and humours and therefore formed a unity, Hartsoeker argued that the woman, the egg and the little animal must not be regarded as one single body but three separate bodies, since "the blood passes through circulation from the woman to the egg, from the egg to the small animal, from the small animal to the egg, and from the egg to the woman".[530] Apparently it was of great importance to him that the male sperm appeared as the active agent which was equipped with everything it needed in the womb. According to Hartsoeker, after a certain period in the "prison" of the womb, the child turned and pushed with its feet against the placenta to escape its cage. It was thereby helped by the mother who, in feeling the pain, pushed the uterus down so that the child had more resistance to push against and as a result was able to free itself and come into the world.[531]

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528 Hartsoeker, *Essay*, 1694, pp. 227-28.

529 "L'on peut supposer la même chose des animaux qui se voyent dans la semence des hommes & des quadrupeds, & dir que chaque petit animal renferme & cache actuellement & en petit sous une peau tendre & delicate, un animal mâle ou femelle, de la même espece de celui dans la semence duquel il se trouve; que lorsqu'un animal est entré dans l'oeuf que la femme tempore congressus, a jetté de ses testicules ou ovaries dans la matrice par des conduits que les anatomistes y découvrent visiblement; [...]" Hartsoeker, *Essay*, 1694, pp. 228-229.

530 "le sang passant par la circulation de la femme à l'oeuf, de l'oeuf au petit animal, du petit animal à l'oeuf, & de l'oeuf à la femme", Hartsoeker, *Essay*, 1694, p. 229.

531 Hartsoeker, *Essay*, 1694, p. 230.

However, what appeared to be icons of pre-existence theories did not establish an iconographic tradition in early modern embryology. The main reason seems to be that neither Hartsoeker nor Dalenpatius could convincingly claim that they had made their illustrations from what they had seen under the microscope. While Hartsoeker was only able to claim that his figure represented what we would see if we could see the little animal in the sperm through the skin which it hides, Dalenpatius' observations, which he described in great detail and tried to confirm with illustrations, were considered as unreliable by contemporaries such as Leeuwenhoek because of their high degree of imagination:

> Now if we consider the Postures of the Figures of 3 and 4, which show the shape of a Human Body so exactly, so that they lay straight extended, with their hands upon the Abdomen, and the Two Legs Straight out by one an other, I believe that no Member of the Royal Society will allow of the discovery of such a Creature, but rather take it to be a Fancy or imagination, then a real truth.[532]

It appears that both Hartsoeker and Dalenpatius failed to establish a generally accepted visual paradigm because of their inability to produce unambiguous empirical evidence for their observations. Yet this ambiguity also reflected the uncertainties in debates about generation and in particular preformationist and animalculist views at the end of the seventeenth and during the first half of the eighteenth century. Consequently visual representations of the spermatozoon and the unborn found it difficult to produce strong evidence for animalculist-preformationist theories of generation. They rather reflected the uncertainties surrounding theories of generation at the turn from the seventeenth to the eighteenth century and even authors such as Hartsoeker, whose theories they would have supported, had scruples about claiming that they were true naturalistic reproductions of experimental observations.

Hitherto the debates about generation during the period between from the 1670s and the Haller-Wolff debate of the 1760s and 1770s have often been characterized as dominated by animalculist-preformationist theories.[533] While preformationist theories became a

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[532] Leeuwenhoek, 'Letter', 1699, p. 305.

[533] See for example Änne Bäumer, 'Das Ei als Instrumentum Dei. Religion und Embryologie im 17. und 18. Jahrhundert', *Annali dell' Istituto Storio Italo-Germanico*, 11 (1985), 79-102. Clara Pinto-Correira went even further when she claimed that preformation theory was "to rule the scene for the next hundred years from the middle of the seventeenth century" (Pinto-Correira, *Ovary*, 1997, p. 3). On

valid view in debates about generation during the last three decades of the seventeenth century, the Haller-Wolff debate marked the decline of such theories. During this debate the Swiss naturalist Albrecht von Haller (1708-1777) failed to defend his preformationist views against the neo-epigenetic theory of generation by the young German physiologist Caspar Friedrich Wolff (1733-1794). However, a radical animalculist-preformationist position such as Hartsoeker's would argue that the child was preformed in the animalcula in the male semen and would enter the womb during conception, where it would take root by attaching itself to the uterus with its tail. Until birth the unborn would then simply grow bigger and bigger until it became the right size to be born, while the female egg was not necessary for generation. However, the story appears to be more complex, and rather than being dominated by a particular theory of generation, a variety of often overlapping theories competed in seventeenth and eighteenth-century debates about generation.[534] The French physician Nicolas Andry (1658–1742), for example, although he accepted the existence of animalcula in the male semen, was not prepared to abandon the existence of the female egg and its reproductive importance:

> It is more according to nature if one sticks to the idea of egg and attributes them with another use, which is mainly that the egg accommodates and nurtures the worm. Hence the problem can be understood as follows. When the egg is separated from the ovaries and fallen into the uterus, the semen-worms, which are constantly moving and jumping around the uterus, come to this egg, turn it over and jump on it; and because the spot where the egg has separated itself from the

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the Haller-Wolff debate see Shirley A. Roe, *Matter, Life, and Generation: Eighteenth-Century Embryology and the Haller-Wolff Debate*, Cambridge: Cambridge University Press, 1981. Roe also claimed a dominance of preformationist theories and a wide acceptance of animalculist ideas in the early eighteenth century (Roe, *Matter*, 1981, p. 9). Andrew Cunningham also identified preformation as the theory of choice to explain generation in the long eighteenth century (Cunningham, *Anatomist*, 2010, p. 168). For a different yet quite plausible interpretation, which saw preformationist and epigenetic theories rather in competition with each other than one theory being clearly dominant among early modern scholars see Robert J. Richards, *The Meaning of Evolution: The Morphological Construction and Ideological Reconstruction of Darwin's Theory*, Chicago: University of Chicago Press, 1992, pp. 5-16.

[534] The history of embryological theories has often been written as a history of a paradigm shift from epigenesis to preformation in the second half of the seventeenth century and then to neo-epigenetic theories from the middle of the eighteenth century. Fairly recently Pinto-Correia still claimed that from the middle of the sixteenth century preformationism "was to rule the scene for the next hundred years" (Pinto-Correia, *Ovary*, 1997, p. 3).

> ovaries has become a little hole, not different from the fruits, when they fall off their branch, so it is easy to understand that among so many one should crawl inside. [535]

Although Andry did not abandon the idea of the female egg, he reduced it to the role of nurturing the male "semen animal", which actively penetrated the egg to enter it and become a fully grown child. This predominance of the male animalcula was also reflected in his belief that every individual of each species that would ever be born was created by God at the beginning of the world.[536] This view had potentially problematic implications for the physical nature of each of those individuals, whether these individuals had a soul and how the wastefulness of nature could be explained.[537] Therefore Andry warned that "one could further develop this thought, if one would not have to worry that one looked too curiously into God's secret."[538] Whether Andry at this point was just being pragmatic or had got cold feet when he dismissed such speculations by demanding modesty in front of God's Creation has to remain an open question. Yet the avoidance of the further discussion of fundamental issues reflected the general inconclusiveness of the debates arising from the discovery of the animalcula.

Another eighteenth-century author who contributed to the discussion of how to interpret the newly discovered animalcula was the Italian physician and naturalist Antonio Vallisneri (1661-1730). He also accepted the existence of animalcula in the male semen and duly reproduced illustrations of the observations of other authors in his book on

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535 "Es it der Natur mehr gemäß, wenn man bey der lehre von eyern bleibt, und ihnen nur einen andern Nutzen zueignet, der hauptsächlich darinnen besteht, daß das ey den wurm in sich fasse, einwickle und ernehre. Man kann derohalben die sache also verstehen. Wenn sich das ey aus dem Eyerstock abgerissen, und in die bährmutter gefallen ist, so kommen die saamen-würmer, die in einer steten bewegung sind, und in der gantzen bährmutter herumspringen, zu diesem ey, weltzen es herum, springen darauf; und weil der ort an welchen sich das ey von dem eyerstock losgemacht hat, ein löchelgen bekommen hat, nicht anders als die früchte, wenn sie von ihrem stiel abgefallen sind, so kann man leicht begreifen, daß unter so vielen würmern nicht einer hinein kriechen solte." Nicolaus Andry, *Gründlicher Unterricht von Erzeugung der Würmer im menschlichen Leibe*, Leipzig: Thomas Fritschen, 1716 (1st ed., French, 1701), pp. 251-252.

536 Andry, *Unterricht*, 1716, p. 260.

537 Pinto-Correira, *Ovary*, 1997, pp. 79-85.

538 "Man könte diese gedanken noch ferner fortsetzen, wenn man nicht befürchten müste, daß man allzu curiös in Gottes geheimnüß hinein gucke." Andry, *Unterricht*, 1716, p. 260.

human and animal generation when he discussed the history of the animalcula (figure 6.13):

> Already in the year 1677, as we have mentioned previously, our author [i.e. Leeuwenhoeck] reported to the Royal Society in London how he had discovered these worms in the human semen; which its members as learned experts not only believed, but also applauded and found to be truth in new experiments. Of which see the according figures.[539]

Subsequently Vallisneri quoted a longer passage from Dalenpatius including his account of the observation of a bigger animalcule which began to peel off its skin and revealed a human form (legs, arms, and chest) but was too small to identify its sex.[540] Illustrations of this observation copied from Dalenpatius were also shown on the first plate and referred to in the margin as Tab. I. fig. 7. 8. 9.

Although Vallisnieri had accepted the existence of little "semen-worms", he rejected the idea that they were animalcula in which a human being was enclosed.[541] He thought of them as a kind of worms which could also be found in other parts of the body. Vallisneri also argued that they could not always be found in the semen yet could sometimes also be found in women.[542] According to Vallisneri, the true use of these semen-worms was not reproductive, but was to prevent the semen from coagulating by constantly stirring it with their movement.[543] Against this background the illustrations of previous authors of their observations of semen-worms became unproblematic and no longer posed a challenge that required an elaborate response. As a thinning agent the

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539 "Schon im Jahr 1677. wie wir vorhin erwehnet, hat unser Autor an die Königl Societät in London berichtet, wie er diese Würmchen, und zwar in dem menschlichen Saamen entdecket habe; Welches deren Mitglieder, als verständige Kenner, nicht allein geglaubet, sondern dazu auch ihren Bezfall gegeben, und in denen von neuen angestellten Versuchen solches wahr befunden haben. (b) Sehet hiervon die hier gehörigen Figuren." Antonius Vallisneri, *Historie von der Erzeugung der Menschen und Thiere. Nebst einer Untersuchung: Ob solche durch die Saamen-Würmer oder durch die Eyer geschehe. Welcher noch einige Briefe, seltsame Geschichte und Observationes angesehener Männer beygefüget sind*, transl. Christian Philipp Berger, Lemgo: Johann Heinrich Meyer (printer), 1739 (1st ed., Italian, 1721), p. 13. In the margin to this passage Vallisenri referred to the illustrations Tab. I, fig. 2. 3. 4. 5.

540 Vallisenri, *Historie*, 1739, pp. 13-14.

541 Vallisenri, *Historie*, 1739, pp. 126-127.

542 Vallisenri, *Historie*, 1739, pp. 164-171.

543 Vallisenri, *Historie*, 1739, pp. 198-199.

semen-worms could, unlike the animalcula, not enclose a little human being and had lost their significance in debates about generation, while their very existence could be accommodated in nevertheless. Therefore Vallisneri did not need to comment on the illustrations in detail, but could simply add them to his book and avoided with his explanation of the "semen worms" speculation on the implications of their discovery on matters of generation.

While both Andry and Vallisneri adopted the idea of animalcula in the male semen, the works of other authors who maintained a more traditional view, such as the French physician Nicolas Venette (1633-1698), still circulated well into the eighteenth century.[544] Venette even dismissed William Harvey's earlier ovist theories, which regarded the human egg as the origin out of which embryonic life grew and developed.[545] Against such theories Venette still maintained the Galenic view, according to which the foetus was gradually formed out of a mix of male and female semen in the "horns" of the uterus.[546] When it had grown too big for the restricted space of the "horns" the foetus would move into the uterus, a moment Venette was more than happy to illustrate in a crude drawing copied from Reinier de Graaf's *De mulierum organis generationi* (figure 6.14). The image showed how the foetus, which already appeared in a human form, put pressure on the "horns" (2) in order to move into the uterus. From this moment the foetus was attributed with a remarkable degree of subjectivity and had according to Venette the ability to give emotional responses to his mother and express feelings such as joy.[547]

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544 Nicolas Venette, *Abhandlung von Erzeugung der Menschen*, Königsberg: Eckart, 1738 (1st ed., French, 1687). Venette drew heavily on the work of the Dutch anatomist Regnier de Graaf (1641-1673), from where he also copied his illustrations. De Graaf's research was, while it was summing up previous anatomical work on the reproductive organs, providing the foundations for much of the late seventeenth-century research on reproduction (Reinier de Graaf, *De mulierum organis generationi inservientibus, tractatus novus: Tam Hominis & Animalia caetra omnia, quae Vivipara dicuntur, haud minus quam Ovipara ab Ovo originem ducere*, Leiden: Hackius, 1672). For a translation of his major works see H. D. Jocelyn, B. P. Setchell, 'Regnier de Graaf on the human reproductive organs. An annotated translation of 'tractus de virorum organis generationi inservenientibus (1668) and de mulierum generationi inservenientibus tractatus novus (1672)', *Journal of Reproduction and Fertility*, Supplement 17 (1972).

545 On Harvey's embryology see Gasking, *Investigations*, 1967, pp. 16-36.

546 Venette, *Abhandlung*, 1738, pp. 354-357.

547 Venette, *Abhandlung*, 1738, pp. 380-381.

How divided the opinions on matters of generation had been for about 100 years becomes even more obvious in the reflections of the French physician and accoucheur Joseph Raulin (1708-1784) on the previous debates in the late 1760s. He was keen to emphasise the particular importance of microscopy in these debates:

> The discovery of the microscope became the source for new systems of generation. Some philosophers abandoned the doctrine of the eggs, in order to come up with others which were even less likely. With it Leuwenhoeck and Hartsoecker believed to be able to see special bodies in the semen of most males, which appeared to them to be alive, and which they took for embryos, which were solely equipped to reproduce different species of animals over again.[548]

According to Raulin, this opinion was particularly popular among "philosophers" and attributed the male semen with all reproductive capacities, while the female uterus was reduced to nurturing the semen animals, which would grow and develop into a human being. The most extreme version of such beliefs, Raulin wrote, was proposed by a member of the faculty in Montpellier under the penname Dalenpatius, who had suggested that fully formed human beings existed in the semen, and that he had observed them himself. Yet while Dalenpatius, according to Raulin, had managed to trick a number of learned men into following his beliefs, they were too absurd. Instead Raulin argued for a revival of the theory of the male and female semen mixing for generation.[549] However, this crisis of pre-existence theories allowed, according to Raulin, other theories which emphasized the reproductive power of the organic matter in the male and female semen to succeed. Especially what Raulin promoted as Needham's idea of a "reproductive force in nature" was reminiscent of Blumenbach's idea of a formative drive (Bildungstrieb).[550]

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548 "Die Entdeckung des Microscops wurde eine Quelle von neuen Systemen über die Zeugung. Einige Philosophen verließen das Lehrgebäude von den Eyern, um andere hervor zu bringen, die noch weniger wahrscheinlich waren. Löwenhoeck und Hartsoecker glaubten vermittelst desselben in dem Saamen der meisten Männchen besonder Körperchen wahrzunehmen, die ihen belebt zu seyn schienen, und die sie für Embryonen ansahen, denen es vorbehalten wäre, verschiedene Gattungen von Thieren wieder hervor zu bringen." Joseph Raulin, *Von der Erhaltung der Kinder von dem ersten Augenblick ihres entstehens an bis zu ihrer Mannbarkeit*, transl. Johann Adelung, 2 vols, Leipzig: Siegfried Leberecht Crusius, 1770 (1st ed., French, 2 vols, 1768-1769), p. 12.

549 Raulin, *Erhaltung*, 1770, pp. 13-15.

550 "hervorbringende Kraft in der Natur", Raulin, *Erhaltung*, 1770, p. 17.

While Needham assumed a vital principle in all matter, which was the result of the interaction between an interior expansive force and an exterior resistant force, Blumenbach assumed the self-organisation of living organisms, which was caused by a vital force inherent in nature, the formative drive.[551] However, all these theories of generation still had their deficits for Raulin:

> If one has now gone through all these systems, one will still be far from forming a sufficient idea of the generation of living beings. They have to be seen as a new form of Creation, which can have its origin in the power of the Creator alone. Hence I will limit myself to research the uniformity of nature, insofar as she contributes, and support her with observations. This will be of greater benefit to doctors than the deceptive images which are represented by the microscope and abstract metaphysical concepts.[552]

Although Raulin admitted that only the male semen conveyed the reproductive power to fertilize the female egg, he dismissed the existence of "semen animals" as a fantasy. Although he had just warned of the deceptive images produced by the microscope, Raulin argued with the visual evidence gathered from observations with the magnifying glass to support his ovist theories, according to which the female egg was clearly the origin of the fruit and attached to the ovaries, from where it received its nourishment:

> One distinguishes under the magnifying glass on the unfertilized eggs a very minute spot in the shape of a half moon, which swims in the fluid which surrounds it. This spot is the origin of the fruit, wherein all the parts of man are sketched, especially when the egg has ripened, even before it has been fertilized. Through fertilization it merely

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551 Needham's theory of generation is discussed in Shirley A. Roe, 'John Tuberville Needham and the Generation of Living Organisms', *Isis*, 74 (1983), 159-184. On Blumenbach's formative drive see Peter McLaughlin, 'Blumenbach und der Bildungstrieb. Yum Verhältnis von epigenetischer Embryologe und typologischem Artbegriff', *Medizinhistorisches Journal*, 17 (1982), 357-372.

552 "Wenn man nun diese veschiedenen Systeme durchgegangen ist, so wird man sich dadurch noch bey weitem keinen hinlänglichen Begriff von der Zeugung der lebendigen Wesen machen können. Man muß sie als eine Art einer neuen Schöpfung ansehen, die ihren Ursprung bloß in der Macht des Schöpfers haben kann. Ich will mich daher nur darauf einschränken, die Gleichförmigkeit der Natur, insofern sie dazu mitwirket, zu untersuchen, und sie mit Beobachtungen zu unterstützen. Die Ärzte werden mehr Vortheile davon haben, als von den betrüglichen Bildern, welche ihnen das Microscop und abstrakte metaphysische Begriffe darstellen." Raulin, *Erhaltung*, 1770, vol. 1, pp. 17-18.

> begins to take effect, to develop, to nourish and to form and reach its perfection.[553]

Whether or not Raulin was making a point about the different epistemological values of observations under the microscope and the magnifying glass remained unclear in this passage.[554] Nevertheless, empirical visual evidence for the particular problem of animalculist pre-existence was difficult to establish while ovist embryologists had long been using illustrations of opened chicken eggs at different developmental stages. These illustrations were particularly useful to produce supporting evidence for epigenetic theories, as in the case of Fabricius. He added a plate to his treatise on the formation of the foetus in the egg, which represented the chicken embryo going through different developmental stages until it became a fully formed foetus.[555] The illustrations in Marcello Malpighi's work of the development of the embryo and in chicken eggs could be interpreted in a similar way. Although Malpighi was often regarded as a preformationist in earlier embryology, his theory was, as Adelmann has shown, a variation of epigenetic views, which was consistent with the illustrations in Malpighi's work, which showed that the chicken foetus was undergoing a series of morphological changes until hatching.[556]

Early modern images of generation were fundamentally different from the applied knowledge represented in midwifery manuals. Unlike the images showing the unborn in various positions just before birth, Ruf's series of illustrations of human generation, for example, were of no use to midwives or doctors who were attending complicated births. Midwifery books from the seventeenth and eighteenth century adapted the medieval manuscript tradition and continued a relatively coherent iconographic tradition. Early

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553 "Man unterscheidet durch das Vergrößerungsglas an den Eyern, die nicht angeschwängert sind, einen überaus kleinen Fleck, in Gestalt eines halben Monden, der in der Flüssigkeit, worinne er sich befindet, herum schwimmet. Dieser Fleck ist der Ursprung der Frucht, worinne alle Theile des Menschen abgezeichnet sind, vornehmlich wenn das Ey zu seiner Reife gelanget ist, so gar noch ehe es befruchtet worden. Durch die Anschwängerung fängt es blos an, wirksam zu warden, sich zu entwickeln, zu nähren, und sich geschickt zu machen, zu seiner Vollkommenheit zu gelangen." Raulin, *Erhaltung*, 1770, p. 26.

554 On early modern skepticism of the microscope as a valid source of empirical evidence see Catherine Wilson, *The Invisible World: Early Modern Philosophy and the Invention of the Microscope*, Princeton: Princeton University Press, 1995.

555 Hieronymus Fabricius ab Aquapendente, *De Formatione ovi et pulli*, Padua: Aloysius Bencius, 1621.

556 Adelmann, *Malpighi*, 1966, vol. 2, pp. 885-886.

modern embryological works, however, generally lacked the practical aspects. At the same time a coherent iconography of the unborn did not evolve in embryology, for which the two main reasons were the lack of a coherent theory of generation and the uncertainty created by the lack of or ambiguity of the empirical evidence. Images of the unborn in the context of seventeenth and early eighteenth-century embryology struggled with the naturalistic paradigm of visual representations when they tried to create evidence. In the case of the little human beings in the animalcula they failed, since this object could only be imagined. Only when images were drawn from a specific specimen with which they could be compared for their accuracy and detail, they could represent credible evidence. This was the case with Kerckring's foetal skeletons in his treatise on osteogeny (figure 6.11). This series of foetal skeletons could convincingly support his idea of a gradual development of the bones and transformations of the foetal skeleton.

However, both the illustrations in early modern midwifery books and the images of generation tended to shape the gendered female body as the passive matrix for the unborn. In the midwifery manuals, the focus was usually on the unborn and how it could safely be handled during birth, with the female body marginalized. In embryological works and works on foetal development the images of the unborn generally completely isolated it from the female body. Yet this visual emphasis on the unborn did not mean that the female body was not implicitly present, nor that the unborn was necessarily an autonomous individual or could be regarded merely as a biological fact. As Kathleen Crowther has shown, conception, pregnancy and childbirth were also closely associated with and interpreted through biblical history. In the debates about preformation this theme featured repeatedly when the question was discussed whether each individual had actually been created by God during Genesis. The creation of Adam and Eve and the fall of man provided a powerful framework for understanding the generation of human life as imperfectly modelled on God's creation of man while the pains and the dangers of labour could be understood as punishment for the original sin and the fall from paradise.[557]

[557] Crowther-Heyck, 'Genesis', 904-935.

6.4 Christianity, morality and the unborn

Especially in an anatomical context, images appeared that dealt with the complex narratives that linked human generation with religious beliefs and biblical history. The ways of representing the embryo in an anatomical context were quite different from the practical knowledge epitomized in the illustrations in midwifery books as well as the uncertainties manifest in the inconclusive images of generation in seventeenth- and eighteenth-century embryology. While some anatomical illustrations made it into midwifery manuals, such as the above mentioned illustrations of the embryo by Vesalius, Muscio's embryos never found their way into anatomical handbooks and atlases. Illustrations representing the unborn in an anatomical context first appeared at the end of the fifteenth century, usually in relation to accounts of the female reproductive organs and the pregnant uterus. In anatomical handbooks from the sixteenth century onwards they usually followed the sections on the male and female reproductive organs within the larger context of discussions of the anatomy of the abdomen (or lower cavity).[558]

For my purposes I want to propose a broader understanding of the anatomical representation of the unborn. From the sixteenth to the eighteenth century anatomy was always more than a discipline preoccupied with the physical structure of the human body. Anatomical research was not only regarded as an academic exercise of research into the human form, but moreover had a philosophical dimension when anatomy linked the microcosm of the body to the macrocosm of the whole Creation.[559] To discuss such relations it is necessary to not only look at the illustrations in anatomical handbooks and textbooks, but also the reception of anatomical knowledge. Therefore anatomical fugitive sheets, which popularized anatomical knowledge during the sixteenth and seventeenth century, will be used as well as Frederik Ruysch's catalogue of his anatomical collection and Johann Jacob Scheuchzer's (1672-1733) *Physica Sacra* (1731-1735).[560] Such material provides images which made assumptions about the

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558 Newman, *Positions*, 1996, p. 69.

559 See chapter 2.

560 Frederik Ruysch, *Thesaurus anatomicus*, Thesaurus II-VII, Amsterdam: Johannes Wolters, 1702-1707; Frederik Ruysch, *Thesaurus anatomicus* Thesaurus I, Amsterdam: Jansson-Waesberg, 1721; Johann Jacob Scheuchzer, *Kupfer-Bibel, In welcher Die Physica Sacra, Oder Geheiligte Natur-Wissenschafft Derer In Heil.*

identity of the unborn more explicit than the illustrations in many of the widely published but more cheaply produced anatomical handbooks and textbooks.

Some of the earliest images of the unborn in an anatomical context appeared on anatomical fugitive sheets of the sixteenth century. These single-leaf prints usually consisted of a pair of prints representing male and female anatomy. The figures were a product of the anatomical renaissance but based on a pre-Vesalian iconography which dated back to the medieval manuscript tradition.[561] The first of such prints appeared in the late 1530s in Augsburg (this print only showed female anatomy) and quickly spread throughout Europe. Already in 1539 similar prints appeared in Venice, Paris and Antwerp. The figures represented a male and a female body in a sitting position and were accompanied by explanatory texts and illustrations. While some of the prints showed both figures in the same pose, others chose different positions for the male and the female body, while some also introduced iconographic references, usually to Adam and Eve.[562] The sheets were often designed as flap anatomies so that the reader could lift different layers of the print and thereby look into the body in a kind of virtual dissection.

Already in the earliest anatomical fugitive sheets, the reproductive function was represented as a fundamental function of female anatomy. In the print by the Augsburg print maker Jost Negker from 1538 the naked female figure was shown sitting on a pedestal with the legs spread and the pubic area covered by cloth (figure 6.5). When the first flap was lifted readers would see the organs of the abdomen and the thorax such as the lungs, the spleen and the kidneys. However, it would also become clear that they had just opened a pregnant body with the unborn sitting in a crouched position in the uterus with its hand raised to the head. In the explanatory text it was made clear that the female body should be regarded as passive recipient and host for the unborn: "The

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Schrifft vorkommenden Natürlichen Sachen, Deutlich erklärt und bewährt, 4 vols, Augsburg: Johann Andreas Pfeffel, 1731-1735.

561 Carlino, *Bodies*, 1999, pp. 74-81. On the late-fifeteenth century images of the female reproductive organs in Johannes de Ketham's *Fasiculo di medicina* (1491 and 1495), which were models for some of the figures on the anatomical fugitive sheets see Park, *Secrets*, 2006, pp. 103-120.

562 Carlino, *Bodies*, 1999, Cat. 1 to 8, pp. 118-153.

matrix is a vessel, destined by the Lord, wherein the children are received, nurtured and formed into a human body."[563]

However, the iconography of the pregnant female body in the flap anatomies was more complex. Already in the earliest print of 1538, the covering of the pubic area cannot only be read as a concession to decency, but also as a reference to the Fall of Man, which becomes more explicit in later prints through the depiction of male and female anatomy on complementary figures as well as the introduction of more explicit iconographic references such as the fruit or leafs covering the pubic areas.[564] The references to the Fall of Man put the passiveness of the female body into perspective, when Eve was often understood as the seducer of Adam and thereby attributed the active part in committing the original sin, with the pain of labour as a punishment for Eve's role. Meanwhile the child before birth was shown as passive within the female body where it was nurtured until birth.

This did not change fundamentally when Vesalian anatomy began to be incorporated in anatomical fugitive sheets later on.[565] In the *Fabrica* Vesalius added drawings of the unborn in the fifth book, following the discussion of the female reproductive organs. These images showed the pregnant uterus, the membranes covering the foetus, the placenta and the foetus itself. The unborn was shown attached to the placenta via the umbilical cord and represented in a crouching position, which Vesalius claimed to be the usual position of the foetus in the uterus, similar to the older illustrations on the fugitive sheets, not in a frontal view, but in semi-profile.[566] These images were not only copied on the anatomical fugitive sheets, but also in anatomical handbooks which drew heavily on the illustrations in the *Fabrica* such as Juan Valverde de Hamusco's *La anatomia del corpo umano* (1586).[567]

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563 "Die mutter ist ein fürgeordnet faß von Gott dem Herrn, darin die Kindlen empfangen, ernert, und zu eines menschen körpers formiert werden." Carlino, *Bodies*, 1999, Cat. 2, p. 121.

564 Carlino, *Bodies*, 1999, Cat. 6, p. 140 and Cat. 8, p. 152.

565 Carlino, *Bodies*, 1999, Cat. 30, p. 243.

566 J. B. de C. M. Saunders and Charles D. O'Malley, *The Illustrations of the Works of Andreas Vesalius of Brussels: With Annotations and Translations, a Discussion of the Plates and Their Background, Authorship and Influence, and a Bibliographical Sketch of Vesalius*, Cleveland: The World Publishing Company, 1950, pp. 174-175.

567 Valverde, *Anatomia*, 1586, book III, table VI.

On Valverde's plate the foetus was, just like on the anatomical fugitive sheets, removed from, yet still in close proximity to the female body (figure 6.15). The pregnant female body was represented by a female figure in the pose of a Venus pudica, modestly covering her vulva and her breast while averting the gaze of the beholder. Her abdomen was opened and revealed the intact pregnant uterus. Katharine Park interpreted this figure as representing female passiveness and availability to both the reader and the foetus next to her.[568] However, the iconographic reference to Venus as the goddess who incorporated love and beauty but also lust, eroticised the female body and associated it with the potential dangers of carnal love. Such eroticized images of the reproductive female body were not uncommon in early modern anatomy and could also be found in Charles Estienne's *De dissectione partium corporis humani* (1545).[569] In his anatomical plates, Estienne also showed the pregnant female body at different stages of dissection and some of the uteruses contained foetuses. The female figures were generally depicted in erotic poses that suggested sexual availability and were modelled on contemporary erotic prints, illustrating scenes from Ovid's *Metamorphoses*.[570] The unborn, however, remained passive and was modelled on the traditional crouching figure from the fugitive sheets and the medieval manuscripts, as on the plate on page 275 in Estienne's anatomy book (figure 6.16).

The illustration showed a naked female figure sitting on a cushioned chair, surrounded by architecture which opened to a mountainous landscape in the background. Her abdomen and uterus were opened and reveal a foetus depicted in profile in a crouching position. The whole scene was overlooked by a spectator from a window at the top left, wearing an academic robe, spectacles and holding a scroll. While the female figure was most likely alluding to Ceres in a print by Jacopo Caraglio (figure 6.17), the active engagement of Ceres with Vulcan was replaced by the passiveness of Estienne's figure with her closed eyes.[571] Therefore Estienne's anatomical tables of the pregnant female

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568 Park, *Secrets*, 2006, p. 267.

569 Charles Estienne, *De dissectione partium corporis humani libri tres*, Paris: S. Colinaeus, 1545.

570 Bette Talvacchia, *Taking Positions: On the Erotic in Renaissance Culture*, Princeton: Princeton University Press, 1999, especially Chapter 8, pp. 161-187.

571 Talvacchia makes a very good case for such an interpretation (Talvacchia, *Positions*, 1999, pp. 168-170).

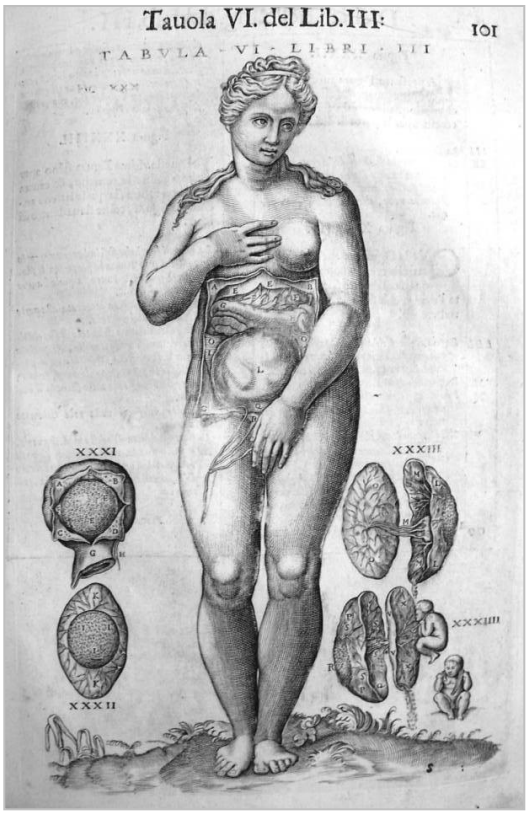

Figure 6.15

Figure 6.16

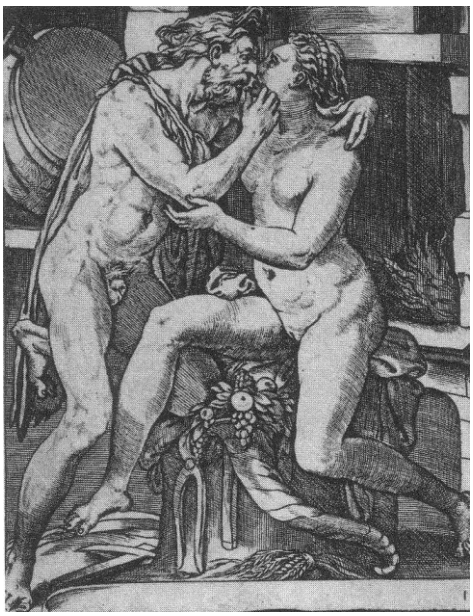

Figure 6.17

body and the unborn remained somehow ambiguous. While the female body was highly sexualized, the foetus remained fairly untouched by these associations. Meanwhile the iconographic references to Christian narratives, especially the Fall of Man, were absent from Estienne's prints.

Other images were more explicit about the identity of the unborn as well as the female body, such as the illustrations in *De formato foetu* by the Padua anatomy professor Adriaan van den Spiegel (1578-1625), which was published posthumously in 1626. Drawing heavily on Fabricius's embryological works, the account of the foetus by Spiegel was mainly based on Aristotelian ideas of generation. His plates, however, were reflecting both the implications of Christian salvation history, obvious on the anatomical fugitive sheets, and the eroticism of Estienne's anatomical figures. The plates in Spiegel's work on foetal anatomy had originally been produced by his teacher Julius Casserius (1561-1616), who had followed Fabricius in the chair for anatomy in Padua.[572] Although Spiegel's account of foetal anatomy was closely following Fabricius' *De formato foetu*, the illustrations he used differed significantly. While the female body appeared in Fabricius' illustrations only as a uterus detached from the rest of the body,[573] four of the nine plates in Spiegel's book represented complete female figures (figures 6.18a-6.18d). Two further plates represented the placenta, while three plates represented foetuses outside the mother's body (figures 6.19a-6.19c). The illustrations Spiegel used for his book made a number of significant claims about the nature of the female and the foetal body which went far beyond the text. The first four figures identified the foetal and the female body within Christian salvation history, while the three images of the foetus outside the womb were of a both erotic and moralizing nature.

The female figures on the first four illustrations were depicted naked in different poses in a mountainous landscape with a river. Their abdomen had been opened to show the

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572 Casserius himself had also been a student of Fabricius ab Aquapendente before he succeeded him on the chair for anatomy at Padua (Choulant, *History*, 1921, pp. 223-225).

573 For a more detailed discussion of Fabricius see above. However, it s worth noting that Fabricius' treatise was rather a focused embryological treatise preoccupied with questions of embryonic and foetal development than an anatomical work with a wider philosophical scope.

Figure 6.18a

Figure 6.18b

Figure 6.18c

Figure 6.18d

Figure 6.19a

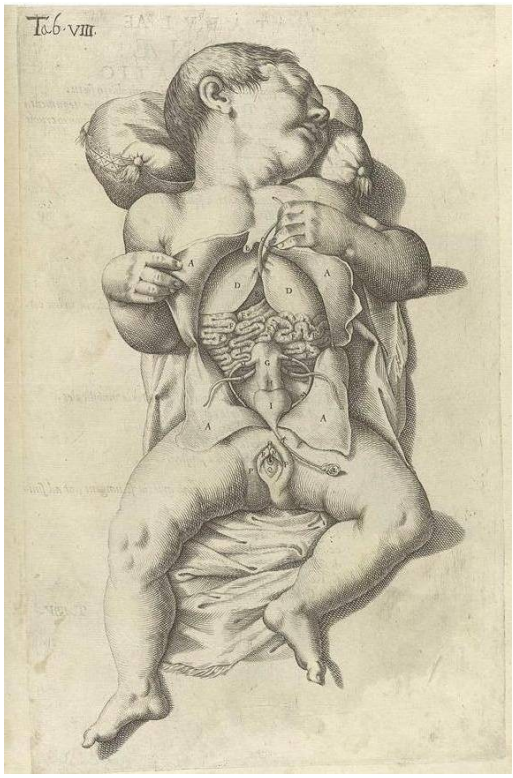

Figure 6.19b

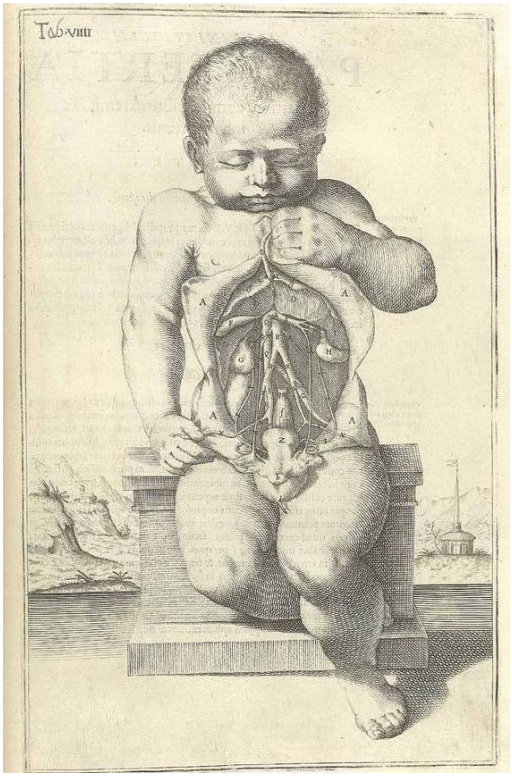

Figure 6.19c

Figure 6.20

pregnant uterus. The various layers of the uterus were peeled off subsequently to finally reveal the foetus. At the first glance the figures only differed in their poses and the different stages of dissection. However, while the figures on the first three plates were quite similar, the fourth plate showed some significant alterations: the pubic area of the female figure was covered by leaves and she was holding a fruit in her left hand behind her back, while in the background a stranded ship could be seen on the shore. The fruit and the hidden vulva were conventional attributes of Eve in Christian iconography. Within the powerful narrative of the Fall of Man, the female role was peculiar, because she was identified as the origin of sin, since Eve was usually regarded as the seducer of Adam since she had taken the fruit from the forbidden tree and offered it to Adam. From the moment of the original sin Adam and Eve also became aware of themselves, their nakedness and their sinfulness and covered their shame with leaves. On Spiegel's anatomical tables the sexual seductiveness of Eve was obvious in the naked female body, while the seriousness of the fall of man for the human fate was emphasized by the shipwreck appearing on the fourth plate which turned a previously paradise-like landscape into the scene of a disaster.

In the series of figures in Spiegel's *De formato foetu* this narrative also made crucial claims about the identity of the foetus. It was significant that a figure with Eve's attributes only appeared at the end of the virtual dissection of the uterus, when the foetus was fully uncovered. This signified that at the moment when the unborn entered the world it became subject to the original sin and lost its innocence. This new identity of the foetus as a sinful human being who had fallen for the temptations of the flesh but had also self-awareness, was also reflected in the illustrations showing the three foetuses on their own. The first illustration represented a male foetus lying on a cloth, attached to the placenta by an umbilical cord, while the second illustration represented a female foetus in a similar pose, but from a different angle. The third foetus was also female but sitting on a pedestal in front of a coastal landscape and revealed its abdomen with her reproductive organs. While the first two foetuses were draped in erotic poses, the third foetus served as a moralizing memento mori.

The erotic nature of the foetus-illustrations becomes clear when they are compared to contemporary erotic prints such as the engraving from Jacopo Caraglio's series *The Love of Gods*, representing Jupiter disguised as Satyr and Antiope (figure 6.20). Such

illustrations were widely circulating during the Renaissance in erotic literature, but also used as models for anatomical illustrations.[574] In the context of Spiegel's *De formato foetu*, the reference to erotic prints was not simply a bizarre form of morbid eroticism. Rather it labelled the body as a sinful object of sexual desire and was simultaneously a reminder of the inescapable mortality of man. Such moralising implications were underlined by the last foetus in Spiegel's series. The female foetus on the pedestal made the whole series of foetuses a moralising memento mori and invited to self-reflection. It stood for the "nosce te ipsum" – know yourself – the ubiquitous motto of early modern anatomy. This motto appeared on banners in anatomical theatres, and on frontispieces and epitomized in figures of self-dissection.[575] Spiegel's series of anatomical tables drew a complex picture of both foetal and female identity. In the sexually charged images of the pregnant female body and the foetuses, both men and women were represented as subject to the temptations of carnal lust. Meanwhile the autoptic images of the foetuses also suggested that both sexes were conscious about this and the consequences of their sinfulness. However, the unborn itself was still protected from the consequences of the original sin. Within the womb it was safe from damnation. Only when it entered the world and was separated from the mother's body it became an autonomous and self-aware subject and thus a sinful human being.

Compared to Spiegel's images of the unborn that were linking it to metaphysical issues by clear iconographic references, the illustrations in Govard Bidloo's (1649-1713) *Anatomia* (1685) of foetuses and foetal skeletons about two generations later were very different.[576] What was striking about the anatomical tables of the Leiden anatomy professor was their naturalism, with the drawings being made from particular specimens.[577] They were immediate representations of the torn flesh of the dissected corpses which rather bore the marks of the dissection than obvious references to Christianity. This also applied to the images of foetuses and foetal skeletons in Bidloo's

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574 Talvacchia, *Positions*, 1999, pp. 161-187.

575 See chapter 3.2.

576 Govard Bidloo, *Anatomia humani corporis, centum & Quinque tabulis, per artificiosiss. G. de Lairesse ad vivum delienatis*, Amsterdam: Someren, Dyk, Boom, 1685.

577 Rina Knoeff, 'Moral Lessons of Perfection: A Comparison of Mennonite and Calvinist Motives in the Anatomical Atlases of Bidloo and Albinus', in Ole P. Grell and Andrew Cunningham (eds), *Medicine and Religion in Enlightenment Europe*, Aldershot: Ashgate, 2007, pp. 121-143, here p. 123.

Anatomia. They were part of the section on the pregnant uterus and the foetus which consisted of ten tables of which the third, forth, ninth and tenth plate show images of the unborn. On the first plate (table 56), a foetus of seven months was represented in a crouched position within the opened womb. The subsequent plate showed a male foetus of eight months together with a number of foetuses and eggs of different age from "impregnation" to three months (figure 6.21). The final two images of the foetus in the series represented a dissected foetus of seven months, lying on a board with the abdomen opened on the first plate and the umbilical cord lifted by a string attached to a little stick (table 62), with the thorax opened (table 63, figure 6.22).

The series of eggs and foetuses on table 57 in Bidloo's *Anatomia* conformed to widely held ovist theories of generation at the end of the seventeenth century, but apparently also did not necessarily contradict animalculist positions. Bidloo's plagiarist William Cowper,[578] for example, was more than happy to embrace such views, when he adopted Leuwenhoek's animalculist preformationist theory of generation. According to Cowper, the egg was simply the residence of the animalcula and from where they would receive their nourishment, while the uterus was the place where the egg would be kept until the foetus was fully grown and ready for birth.[579] The figures on the plate represented different developmental stages of the unborn and showed how it gradually reached perfection, which was mirrored by the foetal skeletons on table 100, which showed how the cartilaginous skeleton of the early foetus became more solid during ossification. Meanwhile, the two images of the foetus at the end of the series (table 62 and 63) continued the theme of representing mortality and suffering through the exposure of dead flesh.[580] While their poses were not that dissimilar to the poses of the foetuses in Spiegel's illustrations, they lacked their erotic suggestiveness and merely showed dead and dissected flesh. However, as Rina Knoeff has shown, Bidloo's naturalistic representation of dissected cadavers was not without religious and moral implications. On the one hand they celebrated suffering, which has to be understood against the

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578 On the plagiarism of Bidloo's plates by Cowper see Cunningham, *Anatomist*, 2010, pp. 282-283; and for a more detailed account see Paule Dumaître, *La curieuse destinée des planches anatomiques de Gérard de Lairesse, peintre en Holland: Lairesse, Bidloo, Cowper*, Amsterdam: Rodopi, 1982.

579 Willam Cowper, *The Anatomy of Humane Bodies: With Figures Drawn After the Life by Some of the Best Masters in Europe and Curiously Engraven*, London: Samuel Smith and Benjamin Walford 1698, fol. 7v-8r.

580 Knoeff, 'Lessons', 2007, pp. 134-135.

Figure 6.21

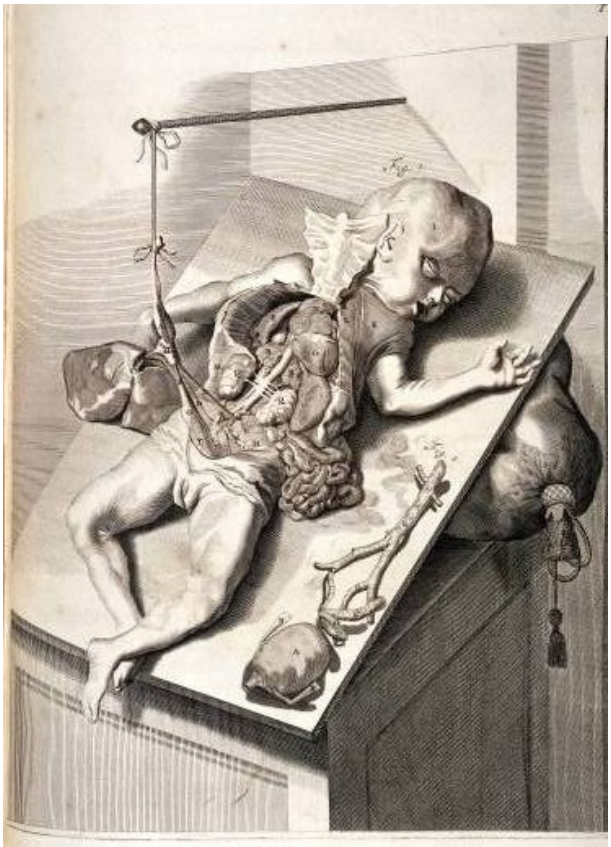

Figure 6.22

background of Bidloo's Mennonite beliefs and the fascination with martyrdom. For Dutch Mennonites in the seventeenth century suffering in this world was regarded as necessary preparation for the next world, while they also advocated social and moral discipline. Thus tales about the suffering of the saints became very popular reading among Mennonites in the seventeenth century, and Bidloo himself contributed to this genre with a collection of martyr stories.[581] On the other hand Bidloo's naturalism intended to represent the perfection of the Creation. In this context the dissected foetuses were perfect examples to illustrate the fragility of life and the magnificence of God at the same time.[582]

Reflections on the status of the unborn within the Christian salvation narrative, the sinfulness of man and self-awareness as integral to human identity were not uncommon in the context of foetal anatomy in the seventeenth and eighteenth centuries and familiar to a wider learned audience. The famous Amsterdam anatomist Frederik Ruysch, for example, kept several tableaux assemblages which incorporated foetal skeletons in his anatomical collection, which was a popular with young gentlemen on their grand tour.[583] Ruysch added prints representing some of these still lifes to the catalogues of his collection. On the third plate from his *Thesaurus anatomicus primus* (1721) Ruysch represented an object where gallstones and vascular trees were piled together with three foetal skeletons on a wooden base (figure 6.23).[584] One of the skeletons held a tiny sickle, while the skeleton to the right was weeping in a handkerchief as if it was mourning. The accompanying text in the catalogue was not just explaining the figures, but contained moralising biblical and classical quotes such as "Man, who is born of woman, is short-lived and full of turmoil" and "nor spares the hamstrings of the unwarlike youth".[585] Such mottos suggested that mortality and sinfulness were

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581 Knoeff, 'Lessons', 2007, pp. 126-132. Govert Bidloo, *Brieven der gemartelde apostelen*, Amsterdam: Barend Visser and Willem Lamsvelt, 1698 (1st ed. 1675).

582 Knoeff, 'Lessons', 2007, p. 136.

583 Hansen, 'Death', 1996.

584 Frederic Ruysch, *Thesaurus anatomicus primus*, Amsterdam: Jansson-Waesberg, 1721.

585 Ruysch, *Thesaurus*, 1721, pp. 8-9. "homo natus de muliere, brevi vivens tempore, repletur multis miseris" (Job 14, 1-4); "[dulce et decrum est pro patria mori: mors et fugacem persequitur virum,] nec parcit imbellis juventae poplitibus [timidove tergo]." (Horace, *Odes*, 2004, III.2.13-16, p. 144). The complete passage from Horace translates as: "It is sweet and fitting to die for one's country. Death hunts

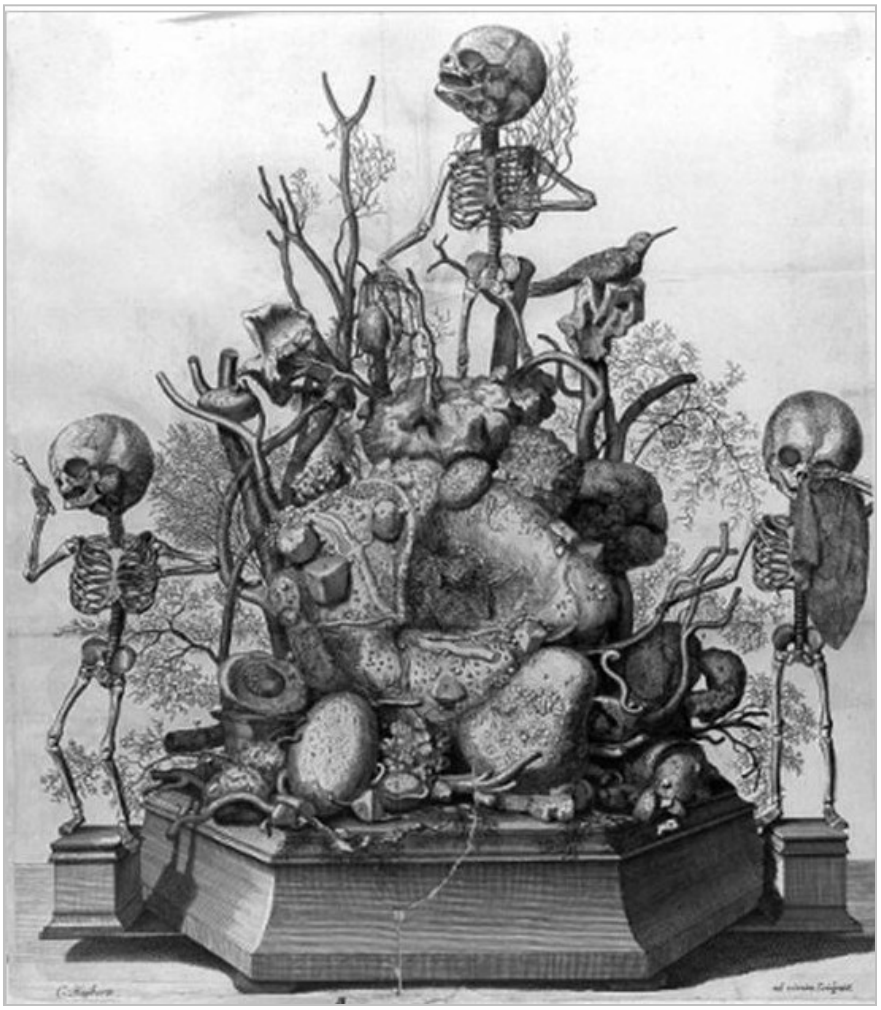

Figure 6.23

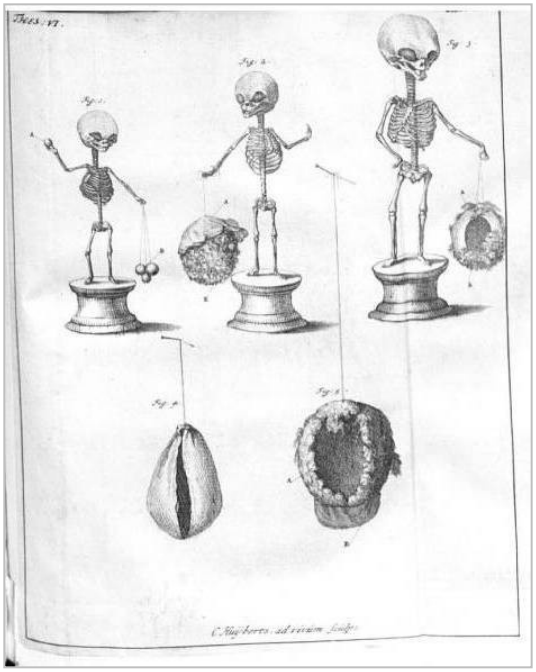

Figure 6.24

inextricably linked with human existence and inescapable for every individual since the beginning of the world, while salvation would only come after death. In Ruysch's *Thesaurus I* this insight was emphasized by two further references to the philospophers Heraklit and Demokrit, when the former bemoaned his own mortality, while the latter celebrated the victory over life in death.[586]

Ruysch's allegorical composition could be read as a preformationist comment on the inevitable fate of every human being. After all, Ruysch published his catalogues during a time when debates about theories of generation were one of the big issues in the European republic of letters. In these debates not only was Ruysch himself a key player when he positioned himself as a supporter of ovist preformationist views;[587] not at least in the illustrations of the catalogues of his collection. The sixth catalogue, for example, came with a series of prints showing foetal skeletons and human eggs.[588] On the first of these plates the first figure represented a foetal skeleton holding a human egg in its right hand and further three eggs, tied to hairs with its left hand (figure 6.24). The subsequent plates showed further foetal skeletons and dissected eggs containing embryos with a rudimentary human form. While Ruysch gave the age of the foetal skeletons in the descriptions of the plates, he remained rather vague about the eggs and embryos. The arrangement however suggested that while the foetus originated from the egg, it was also inseparable from and identical with it.

A view on both human fate and human generation similar to Ruysch's was presented in the *Physica sacra* by the Swiss physician and naturalist Johann Jakob Scheuchzer (1672-1733), which was published between 1731 and 1735 in four folio volumes illustrated with 761 copper engravings.[589] This biblical natural history had its

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down also the man who runs away, and has no mercy on the hamstring of the unwarlike youth and his cowardly back." Horace, *Odes*, 2004, III.2.13-16, p. 145.

586 Ruysch, *Thesaurus*, 1721, pp. 9-10; Robert Felfe, *Naturgeschichte als kunstvolle Synthese: Physikotheologie und Bildpraxis bei Johann Jakob Scheuchzer*, Berlin: Akademie Verlag, 2003, p. 36.

587 H. P. Bayon, 'William Harvey (1578-1657): His application of biological experiment, clinical observation, and comparative anatomy to the problems of generation', *Journal of the History of Medicine and Allied Sciences*, 2 (1947), 51-96, p. 84.

588 Frederik Ruysch, *Thesaurus anatomicus sextus*, Amsterdam: Johannes Wolters, 1705, Table I-III.

589 Scheuchzer, *Kupfer-Bibel*, 1731-1735.

intellectual background in physico-theology, which held that science would lead to God and functionalized a mechanical world-view to prove the existence of God. The twenty-third plate in Scheuchzers's *Physica sacra* represented Adam in paradise and was part of a series of illustrations of Genesis (figure 6.25). The scene was framed with female eggs, embryos and foetal skeletons of different developmental stages. They were copies from Ruysch's *Thesauri primus* and *Thesaurus sextus* and underlined the inevitable fate of human sorrow, even before the Fall of Man, already from the Creation of man, with a preformationist argument.[590]

The centrepiece of the plate showed Adam alone in paradise, sitting under a tree with a rabbit at his feet. The background depicted a prosperous landscape with numerous pairs of animals. Adam's gaze was drawn in a mix of fear and admiration to the top left by a divine light from the sky. The picture was framed by the foetal skeletons, embryos and human eggs from Ruysch's *Thesauri*. The most prominent of these objects were the mourning skeleton on the right and the skeleton holding the eggs at the top right. Robert Felfe interpreted the composition as a memento mori and prediction that with generation man will become subject to mortality.[591] However, the print also allows an alternative reading. The vanitas iconography of the foetal skeletons, together with the depiction of different developmental stages from the beginnings of the human egg made clear that mortality and sinfulness were not just the future fate of man. They showed that from a preformationist point of view every individual had been sinful since the Creation and already before the Fall of men exposed to the perils of carnal desire, represented by the rabbit at Adam's feet, which was a traditional symbol of fertility, but also sexual exuberance.[592] Scheuchzer was therefore using a preformationist argument to underline the Protestant key doctrine of predestination, which made the individual immediately responsible to God alone, which was emphasized by the divine light on Adam's face.

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590 Felfe, *Naturgeschichte*, 2003, pp. 25-39, here pp. 27-28; Gijsbert M. van de Roemer, 'From vanitas to veneration: The embellishments in the anatomical cabinet of Frederik Ruysch', *Journal of the History of Collections*, (2009), 1-18 (first published online, 20 October 2009, doi: 10.1093/jhc/fhp044), pp. 14-15.

591 Roemer, 'Vanitas', 2009, p. 28.

592 On Scheuchzers ovist preformationist views in relation to plate XXIII in his *Physica Sacra* see also Stafford, *Body*, 1991, pp. 238-242.


TAB. XXIII.
I.
II.
III.
IV.
VIII
IX.
X.
XI.
VII
VI
GENESIS cap. I. v. 26. 27.
Homo ex Humo.
I. Buch Mosis Cap. I. v. 26. 27.
Erschaffung und Zeugung des Menschen.
J. A. Fridrich sculp.

Figure 6.25

Sixteenth and seventeenth-century anatomical images of the foetus were often associated with a moralising iconography. Images such as the illustrations in Spiegel's *De formato foetu* (1626) alluded to the inherent sinfulness of self-conscious human beings. Thereby they defined the status of the human as a subject within the Creation. This reflected the ambitions of early modern anatomy as natural philosophy. Instead of merely representing the physical appearance and structure of the human body the aim was to achieve and mediate a superior knowledge of the status and role of mankind within Creation. Early modern anatomists regarded their project as essential for the understanding of the metaphysical meaning of the body with regard to human nature. While early modern anatomical representations of the unborn also reflected changing theories of generation, the moralising and metaphysical iconography remained a key element of the visual representation of the foetus in anatomy into the eighteenth century, which is evident from both Frederik Ruysch's tableaux-assemblages and Johann Jakob Scheuchzer's *Physica sacra*.

6.5 The biological facts of reproduction

While seventeenth and early eighteenth century images of the unborn were deeply rooted in cosmological concepts, a very different picture emerged in the second half of the eighteenth century. The most important concern with visual representations of the unborn (and anatomy in general) was now the question how to convey most truthful images of nature, which were framed by enlightenment aesthetics rather than religious or moral concerns. When William Hunter published his *Anatomy of the Human Gravid Uterus* in 1774,[593] he produced a huge folio set of anatomical plates of the pregnant uterus and the foetus, which were skilfully executed and followed an ideal of truth to nature which was based on accurate delineation of natural objects (figure 6.7).[594] The images were characterized not only by a high degree of anatomical detail and their immediacy in exposing the dissected flesh, they also showed an intimate relationship between the female and the foetal body which made the body of the mother and the child one and subjected them to the gaze of the anatomist.[595]

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593 Hunter, *Anatomia*, 1774.
594 Jordanova, 'Gender', 1985, pp. 394-398.
595 Jordanova, 'Gender', 1985, pp. 407-409.

The objectification of the female and the foetal body was emphasized by the lack of a clear purpose and audience of Hunter's plates. Unlike Smellie's *Anatomical Tables* (1754) they were not representing applied knowledge, but invited a more general interpretation, embracing socio-cultural values and notions of the body of both mother and child.[596] Roberta McGrath has argued that Hunter's plates reduced the female body to its reproductive function: "The idea of 'Woman' started and stopped at the womb. In contrast to the foetus, which was granted integrity, the woman was much less than herself […]".[597] However, this leaves the question of the identity of the unborn unanswered which Jordanova suggested was shaped by bourgeois subjectivity. She argued that the intimate relationship between the mother's and the child's body represented on Hunter's plates "emphasised the intertwining of maternal and child welfare" which had to be cared for in order to create legitimate and healthy offspring.[598]

However, I would suggest an alternative interpretation of eighteenth-century naturalistic images of the unborn like those in Hunter's *Anatomia*. At the end of the eighteenth century the German anatomist Samuel Thomas Soemmering published a plate that represented 17 embryos from about three weeks to four months in his *Icones embryonum humanorum* (1799, figure 6.26).[599] This plate was intended as a supplement to Hunter's tables, and together they would represent "a complete series of human foetuses from the first beginnings until complete maturity".[600] The drawings for the

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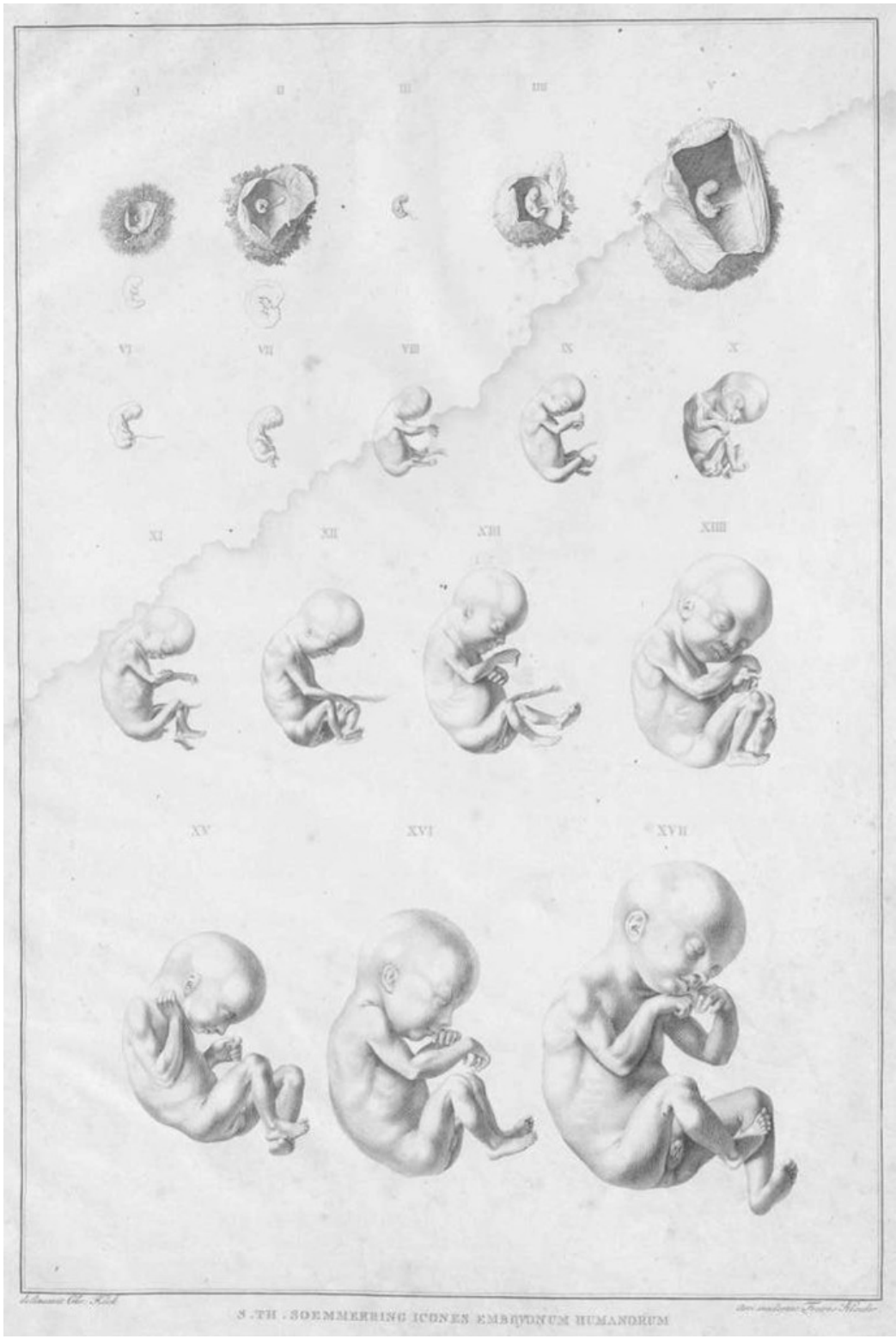
596 William Smellie, *A Sett of Anatomical Tables, with Explanations, and an Abridgement of the Practice of Midwifery, With a View to Illustrate a Treatise on that Subject, and Collections of Cases*, London: 1754; Jordanova, 'Gender', 1985, pp. 399-400.

597 McGrath, *Sex*, 2002, p. 82.

598 Jordanova, 'Gender', 1985, p. 409.

599 Samuel Thomas Soemmering, *Icones embryonum humanorum*, Frankfurt: Varrentrapp and Wenner, 1799. Subsequently the edition and translation by Ulrike Enke (=Samuel Thomas Soemmering Werke 11) is used: Samuel Thomas Soemmering, *Schriften zur Embryologie und Teratologie*, Basel: Schwabe, 2000, pp. 165-189, here p. 168.

600 "eine vollständige Abfolge menschlicher Feten von den ersten Ursprüngen bis zur vollständigen Reife", Soemmering, *Schriften*, 2000, pp. 173. On the production of Soemmering's plates see Ulrike Enke, 'Vom Präparat zur Bilderfolge. Die Visualisierung der Regelhaftigkeit im Werk Samuel Thomas Soemmerings', in Rüdiger Schultka, Josef N. Neumann (eds), *Anatomie und anatomische Sammlungen im 18. Jahrhundert. Anläßlich der 250 Wiederkehr des Geburtstages von Philipp Friedrich Thodor Meckel (1755-1803)*, Berlin: LIT Verlag, 2007, pp. 251-268.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XVII
S. TH. SOEMMERRING ICONES EMBRYONUM HUMANORUM

Figure 6.26

plate had been made from Soemmering's own preparations of miscarried embryos and specimens from anatomical collections. Unlike earlier images of human generation, these pictures represented a coherent series of embryos undergoing morphological changes, based on empirical observation.[601] They reflected Soemmering's embryological views, which had become closer to Wolff and Blumenbach's concepts of epigenesis,[602] although Wolff disagreed with Blumenbach on the nature of the *Bildungstrieb*. Wolff contrasted the formative drive with his idea of an essential vital force, the outcome of which was dependent on particular situations, while Blumenbach's formative drive was what could be regarded as a self-reproductive mechanism.[603] Nevertheless, both Wolff's essential force and Blumenbach's formative drive were quite similar in the sense that both had the ability to form matter and provide it with vital properties.[604]

Recently Janina Wellmann argued that instead of representing epigenetic development, Soemmering's plate rather offered a comparative view of isolated specimens.[605] Although it is difficult to determine whether these illustrations represented a particular view on theories of generation or not, since Soemmering did not explicitly discuss the problem in the *Icones*, there are some indicators that the series of embryos might be understood as a representation of epigenetic development when he suggested that his plate should allow the reader to see the "growth and development" of the human body.[606] But this development should be understood as the development of a specific,

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601 On the interpretation of Soemmering's plate as a representation for an emerging sense of embryonic development rather than mere growth see Nick Hopwood, 'Producing Development: The Anatomy of Human Embryos and the Norms of Wilhelm His', *Bulletin of the History of Medicine*, 74 (2000), 29-79, pp. 33-34.

602 Soemmering, *Schriften*, 2000, pp. 16-17. On Wolff's theory of epigenesis see Roe, *Matter*, 1981, pp. 46-50; Johann Friedrich Blumenbach, *Über den Bildungstrieb und das Zeugungsgeschäfte*, Göttingen: Dietrich, 1781.

603 Roe, *Matter*, 1981, pp. 116-118.

604 On the relation between Wolff's idea of an "essential force" and Blumenbach's "formative drive" see Robert J. Richards, 'Kant and Blumenbach on the Bildungstrieb: A Historical Misunderstanding', 31 (2000), *Studies in History and Philosophy of Biology and. Biomedical Sciences*, 11-32, pp. 18-19.

605 Janina Wellmann, 'Keine Ikone der Entwicklung. Die Icones embryonum humanorum von Samuel Thomas Soemmering', in Ulrich-Johannes Schneider (ed.), *Kulturen des Wissens im 18. Jahrhundert*, Berlin: Walter de Gruyter, 2008, pp. 585-594, here pp. 586-587.

606 The Latin original reads "incrementum et metamorphosis", which is translated as "Wachstum und Entwicklung" (Soemmering, *Schriften*, 2000, pp. 172-173).

determined form of a new organism which would not allow endless variation.[607] Soemmering's embryonic table represented a specific idea of the development of the unborn and his reflections on the illustrations talked about the embryos using aesthetic categories which were borrowed from neo-classical art theory. Just like Hunter, Soemmering was very aware of and involved with contemporary aesthetic debates and art theory; in the introduction to his *Icones* Soemmering marvelled at the beauty of the body of the unborn.[608] Such views were informed by contemporary neo-classical art theory, which linked beauty with truth, for example, in the work of the British painter Sir Joshua Reynolds or the German art historian Johann Joachim Winckelmann.[609]

In the case of Soemmering, Winckelmann's reflections on ancient art had a strong influence on his ideas about anatomical perfection form.[610] According to Winckelmann beauty and perfection could no longer be found in nature alone. He regarded the study and imitation of ancient art as the appropriate approach to discover ideal beauty and natural perfection.[611] This confronted Soemmering, who was interested in producing truthful images of the anatomical body, with the problem how to solve the tensions between ideal and reality without referring back to ancient works of art. He tried to overcome this problem by choosing from a variety of objects typical specimens that represented perfection and beauty.[612] Soemmering's images of the embryo aimed to achieve a truthful representation of the unborn which allowed generalisations about the nature of their subject by identifying them as examples of perfect beauty.[613] In the caption for the seventeenth illustration he argued that this was a particularly good

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607 Ulrike Enke, 'Von der Schönheit der Embryonen. Samuel Thomas Soemmerings Werk Icones embryonum humanorum (1799)', in Barbara Duden (ed.), *Geschichte des Ungeborenen: Zur Erfahrungs- und Wissenschaftsgeschichte der Schwangerschaft, 17.-20. Jahrhundert*, Göttingen: Vandenhoeck und Ruprecht, 2002, pp. 205-235, here pp. 214-215.

608 Enke, 'Schönheit', 2002, p. 173.

609 See also chapter 5.4 on close connections between Enlightenment art theory and anatomy.

610 Sigrid Oehler-Klein, 'Anatomie und Kunstgeschichte. Soemmerings Rede Über die Schönheit der antiken Kinderköpfe vor der Société des Antiquités in Kassel (1779)', in Manfred Wenzel (ed.), *Samuel Thomas Soemmering in Kassel (1779-1784). Beiträge zur Wissenschaftsgeschichte der Goethezeit*, Stuttgart: Steiner, 1984, pp. 189-239.

611 Oehler-Klein, *Anatomie*, 1984, p. 191.

612 Oehler-Klein, *Anatomie*, 1984, p. 207.

613 Enke, 'Schönheit', 2002, p, 227.

example to finish the series of embryos because of its perfect proportions and "gracefulness of the very lovely face" of this female embryo.[614] These were not only the words of a learned man absorbed by his subject, but also added validity to Soemmering's illustrations of embryos and foetuses. At the same time, he claimed authority over his subject when he made himself the judge over the correct arrangement and delineation of his embryos.[615] However, both Soemmering and Hunter also used an aesthetic framework for the visual representation of the unborn within which it was no longer necessary to understand human generation and the identity of the unborn within the Christian salvation narrative or cosmology or see the unborn in relation to the female body. Embryos and foetuses had been turned into mere objects of scientific investigation with their biological sex as the only remaining signifier for their identity.

6.6 Conclusions

This overview over roughly three hundred years of images of the unborn has shown that the story of the identity of the unborn is more complex than simple subjection of the unborn to male concepts of the autonomous individual. Depending on the context images of embryos and foetuses represented very different ideas of their identities. In midwifery books, for example, it was most important to see the unborn in the moment immediately before birth. In this crucial moment it was necessary for the midwife or the attending doctor to know what they had to expect as possible complications from unnatural positions of the foetus in the womb and how they could deal with them. At the same time, many embryological illustrations were not so much representations of practical knowledge as either records of observations, as in the case of Fabricius, or imaginary images, as in the case of many animalculist preformationist illustrations. Other images, such as Spiegel's series were reflections on the metaphysical meaning of generation and how this affected the identity of the unborn as a sinful human being. Finally the highly aestheticized plates of Hunter and Soemmering were cementing the authority of their creators while they established a visual language that turned the unborn into a mere biological entity.

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614 Soemmering, *Schriften*, 2000, p. 185.
615 Enke, 'Schönheit', 2002, pp. 226-227.

But early modern images of the unborn not only represented practical knowledge or changing embryological research and theories. These images also made more fundamental statements about the nature of the unborn and life itself, which changed fundamentally from the sixteenth to the eighteenth century. The question when human life begins received quite different answers. In Spiegel's early seventeenth-century plates on foetal anatomy, for example, the unborn remained in a liminal state until birth. Only when it entered the world, it gained its full status as a human being subjected to the original sin. Within the debates about preformation as well as in Enlightenment debates about generation, however, both mechanist and vitalist theories of generation suggested that life was always there since the creation of the world, which raised important metaphysical questions. For preformationists this could lead to physico-theological reflections on predestination and whether all beings were actually created at the beginning of the world, as in Johann Jacob Scheuchzer's *Physica sacra*. While such ideas accommodated a mechanist understanding of generation, vitalist concepts of generation also extended the beginnings of life far beyond birth or even conception, when authors such as Johann Friedrich Blumenbach proposed that a formative drive (Bildungstrieb) was inherent in nature.[616]

Such changing views on the beginnings of life also resulted in changing notions of the unborn as an object of knowledge. Earlier visual representations of the unborn were occasionally highly eroticized. From the late seventeenth and into the eighteenth century, however, this potentially dangerous sexualized discourse of generation was tamed by the rationalizing and asexual debates about preformation and epigenesis and neo-classical aesthetics.[617] Images of earlier ideas of generation drew on an elaborate iconography that understood the unborn within natural philosophy and Christian cosmology. Especially in the context of vitalist concepts of generation categories such as "beauty", "perfection" or "ideal" provided a secularized language to describe the quality of anatomical specimens and images. The aesthetic categories of Enlightenment

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616 On Blumenbach's vitalism see François Duchesneau, 'Vitalism in Late Eighteenth-Century Physiology: The Cases of Barthez, Blumenbach and John Hunter', in William F. Bynum and Roy Porter (eds), *William Hunter and the Eighteenth-Century Medical World*, Cambridge: Cambridge University Press, 1985, pp. 259-295, here pp. 269-278.

617 Thomas Lacquer also discussed the sexualized nature of early modern debates about generation and how biological facts of sexual difference began to determine reproductive issues (Laqueur, *Sex*, 1992).

art theory allowed to be displayed the unborn as a natural object that was subject to the biological facts of life. These changing ways of looking at the unborn also had consequences for the identity of the unborn. Before the Enlightenment human identity was inextricably linked to Christian cosmology. Both the self-aware individuals represented by Spiegel's embryos, which were conscious about their sinfulness as human beings and the embryonic individuals of Ruysch and Scheuchzer, who were subject to predestination, were firmly placed within the Christian salvation narrative as inherently sinful human beings. However, these images did not necessarily imply personhood of the unborn,[618] but rather represented the unborn as a liminal being in a precarious position whose future salvation was at stake.

A new and very different way of seeing the embryo and the foetus was introduced by authors such as Hunter and Soemmering, who represented the unborn as an autonomous individual. Previously the foetal and the gendered female body had to be understood within Christian cosmology. The gendered identity of both was determined in relation to each other and by their place in salvation history. Now the foetal and the female body were created as separate entities, which were defined by their biological sex and reproductive capacities. As a result, the unborn was reduced to a biological entity, only identified by sex difference. This natural object was clearly defined, measurable, comparable and manageable and could potentially be subjected to medical and eugenic interventions. The unborn was liberated from the defining bond with the female body and its metaphysical implications. When by the second half of the eighteenth century the identity of the unborn was no longer defined by its relationship to the female body and the way it was thereby placed in the Christian narrative of salvation, a recalibration of embryonic and foetal identity became necessary. As a result the unborn became a more and more autonomous entity and as a consequence the question when the unborn had the right to life became key to modern concepts of the identity of the unborn. This notion of the unborn as a (potentially) autonomous individual is still at the heart of contemporary ethical debates abortion or embryonic stem cell research.

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[618] Eve Keller made such a reductionist argument for personhood before birth (Keller, 'Indiviuals', 2000), but thereby ignored the complexities and ambiguities of early modern images of the unborn (McTavish, *Childbirth*, 2005, p. 207).

7. Conclusions

The anatomical body of the sixteenth and most of the seventeenth century generally represented relations between the microcosm of the human body and the macrocosm of the divine creation. Such connections could be made by referring to occult ideas, as in the case of Robert Fludd (figure 2.7), as well as by referring to humoural ideas of the body that would relate it to the world, as on the frontispiece to Jacques Guillemeau's *Tables anatomiques* (figure 2.8). At the same time visual representations of anatomical dissections were used to legitimize anatomy and establish anatomy as an academic discipline by imagining the anatomical body as a source of divine knowledge and the anatomist as the legitimate expert who had the skills to interpret human nature within God's creation. Images such as the frontispieces discussed in chapter one and two were also powerful reminders of the sinfulness of man and mortality and demanded self-reflection from both the anatomists and their audience. While they required a high level of self-awareness from their audience, these images also allowed anatomists to represent themselves as honourable, dignified and decent scholars. When anatomists identified themselves with the anatomical subject, as Steven Blankaart did on the frontispiece of the 1678 edition of his anatomical handbook (figure 3.9), they engaged in a playful exploration of the boundaries of their professional identity and human nature in general.

In the double portrait of Blankaart at the dissecting table and on the flayed skin, the author made clear that he was well aware of his own mortal and sinful existence. However, he also challenged the notion of the anatomical body as a dishonourable body, which was suggested by the use of the corpses of executed criminals in early modern public anatomy. By definition the delinquent had lost all honour and often all hope for salvation, yet anatomies were often staged as events which ended in a Christian burial of the remains. Hence seventeenth-century images of anatomical dissections not only shaped the professional identity of the anatomist, but they also created the anatomical body as his legitimate subject. Once anatomy had acquired such legitimacy, anatomists were able to overcome the limitations of the need to justify their practice by relating it to cosmological concepts of the body posed on them. Consequently the emphasis shifted in visual representations of anatomical dissections of the late seventeenth century from the anatomist's ability to convey divine knowledge of the body to his skills and detailed knowledge of human anatomy. Such changes were

obvious in the paintings representing the anatomies of Frederik Ruysch which celebrated the ability of their main sitter to undertake difficult anatomical procedures such as dissecting the lymphatics and producing anatomical specimens of remarkable beauty (figures 3.16 and 3.17). By the second half of the eighteenth century this shift allowed anatomists such as William Hunter to present themselves as members of polite society who could be admired for their mastery of the art of anatomy. For William Hunter and his contemporaries this (self-)notion was obvious when they commissioned portraits that represented the three roles of gentleman, artist-anatomist and man of letters; all united in the person of William Hunter (figures 3.18-3.20).

The changes in the visual representation of the anatomical body from the Renaissance to the end of the eighteenth century signified fundamental transformations from a cosmological understanding of the human body to a notion of the body as a biological entity. These changes were not merely the result of an advancement of anatomical practice and knowledge or more and more sophisticated techniques of visualizing the body. Rather they were informed by more fundamental changes in the socio-cultural meaning of the body and had to respond to similar challenges as artists. The question of whether to produce images of the ideal body or reproduce a particular specimen as faithful to nature as possible was a matter of debate throughout the early modern period for both artists and anatomists. In anatomy sophisticated techniques were developed to produce more truthful images of the anatomical body such as Siegfried Albinus's complicated grid system. The changing meanings of the anatomical body were also reflected in the changing iconography and aesthetics of anatomy. In Renaissance and seventeenth-century anatomical images Christian iconography and references to cosmology were ubiquitous. Even the references to ancient sculpture can be regarded as representations of cosmological concepts of the body, if the use of Vitruvian proportion in anatomical figures is understood as the mathematical interpretation of a divine order.[619]

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[619] The mathematical interpretation of the microcosm and the macrocosm was essential to the ealry modern understanding up to the end of the seventeenth centruy. This was not just reflected in the use of Vitruvian proportion in anatomy, but also in the mathematical models of musical cosmologies (Jamie C. Kessler, *Music, Science, Philosophy: Models in the Universe of Thought*, Aldershot: Ashgate, 2001; Jamie James, *The Music of the Spheres: Music, Science, and the Natural Order of the Universe*, London: Abacus, 1995).

Although holistic ideas and Christian moralising interpretations of the body never completely disappeared, they gradually became marginalized in anatomy from the turn of the seventeenth to the eighteenth century. Evidence of such a shift can be seen in the Dutch anatomical frontispieces of the late seventeenth century. After a significant number of frontispieces showing dissection scenes had been published during the last three decades of the seventeenth century that featured a whole array of moralizing and Christian motifs, such images almost disappeared within the first decade of the eighteenth century. Although vanitas motifs as well as Christian iconography continued to feature in anatomical illustrations, such as the images in the *Osteographia* (1733) by the English surgeon William Cheselden (1652-1752, figure 7.1), it was significant that the vignette on the title page did not make any reference to the metaphysical aspects of anatomy, but showed how the camera obscura was used to make the drawings on which the illustrations in the book were based (figure 7.2).[620] What now defined anatomical knowledge was no longer the moral lesson to be learned from dissections but the ambition of the anatomist to achieve the most perfect knowledge of the structure of the human body, putting to use all the technologies available to early modern art and science.

The changing values anatomy represented that saw a shift in emphasis from the moral meanings of anatomy to knowledge, skill and diligence as anatomical virtues from the end of the seventeenth century onwards was only possible after anatomy had been firmly established as an academic discipline and public spectacle in European urban, academic and court culture. At a time when public anatomies were held on a regular basis by the surgeons' guild in many cities, were an integral part of the university calendar and satisfied the curiosity of the nobility at many courts, the legitimizing function of a moralizing Christian iconography of anatomy became more and more redundant. As a result paintings such as the group portraits representing Frederik Ruysch's anatomical lessons stressed the knowledge and skills of their main sitter, while on anatomical frontispieces allegories and mythological figures that represented knowledge and wisdom such as Apollo or Minerva became more prominent. As the pressure to represent anatomy as an honourable, dignified and decent activity eased, the

620 William Cheselden, *Osteographia, or the Anatomy of the Bones*, London : [William Bowyer for the author?], 1733.

Figure 7.1

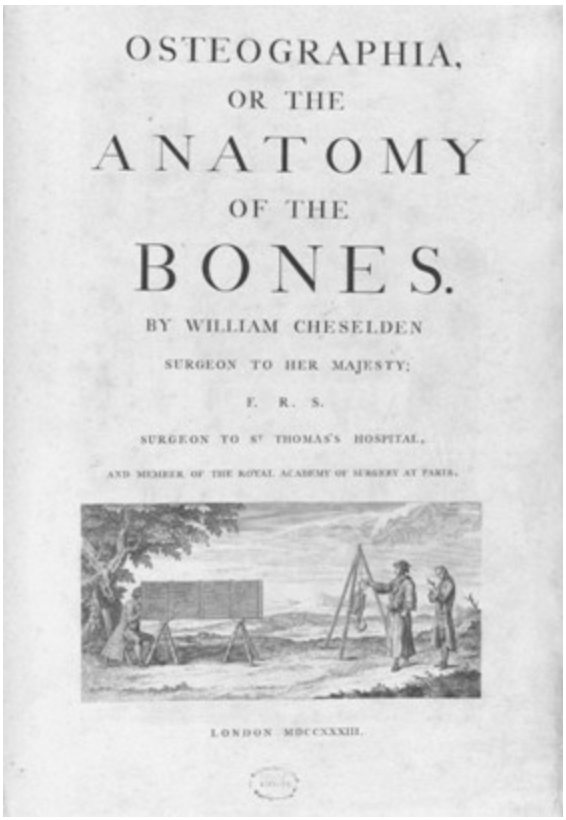

Figure 7.2

moralizing (visual) language of anatomy gradually lost its significance to make representations of the anatomical body meaningful. It was gradually replaced by a (visual) language that drew on eighteenth-century neoclassical aesthetics and allowed anatomists to produce "truthful" representations of the anatomical body. By adopting this secularized language to represent the anatomical body, the body itself could be more easily turned into a mere object of learned curiosity.

The liberation of anatomy from the constraints of cosmological models of the human body signified an important epistemological shift. The task of the anatomist was no longer to reveal a divine truth hidden in the human body, but to create new knowledge, discover new anatomical structures or refine ideas about the appearance, nature and function of already known parts of the human body. Accordingly, anatomical knowledge underwent fundamental changes during the last few decades of the seventeenth century and the second half of the eighteenth century. The changes of the late seventeenth century were characterized by the desire to accurately dissect and describe the human body based on first-hand experience and without pre-conception. However, the lack of a (visual) language of anatomy that would abandon the moralizing and religious implications of anatomy and the predominance of holistic concepts of the body did not allow anatomists to radically reconsider the anatomical body. Rather than revolutionizing early modern anatomy at the end of the seventeenth century, thoroughly empirical approaches to anatomy and Cartesian concepts of the body laid the foundations for a process that reshaped ideas of human anatomy throughout the eighteenth century. Anatomists therefore focused primarily on the appearance and structure of the body, which, from a Cartesian point of view, could be considered as a material entity separated from the metaphysical problems associated with the nature of the soul. However, only during the second half of the eighteenth century a more secularized anatomical discourse made it possible to re-conceptualize the anatomical body without references to Christian cosmologies.

The three examples of the rete mirabile, the lymphatics and images of the unborn have shown that anatomical controversies in the late seventeenth and during the second half of the eighteenth century reflected those epistemological shifts. By the end of the seventeenth century the rete mirabile was no longer discussed within Galenic physiology as a crucial organ for transforming the vital spirits into the animal spirits and

its exact appearance (or whether it existed at all) in human bodies was seriously questioned on the grounds of anatomical dissections. However, it still remained part of the anatomical discourse into the eighteenth century, but became strongly associated with inferiority and physical as well as mental deficiency. Similarly, in the case of the lymphatics, the later seventeenth century saw more and more accurate accounts of the lymphatic vessels which prioritised empirical observation over traditional anatomical concepts of the human body. The detailed accounts of the function of the lymphatic vessels by Frederik Ruysch as well as the minute descriptions by Anton Nuck formed the basis for a new concept of the lymphatics as a system of absorbing vessels. Yet only during the second half of the eighteenth century injection techniques were sophisticated enough to demonstrate that this delicate structure could be found throughout the body. By this time a new discourse about how to properly produce and use anatomical illustrations had developed. The secular categories of neoclassical art theory allowed formulating principles for the production of "truthful" visual representations of the anatomical body that did not have to refer to moralizing or Christian motifs. These new aesthetic categories allowed, for example, William Cruikshank to produce a figure in classical pose representing an ideal yet naturalistic image of the lymphatics as a system of absorbing vessels throughout the whole body (figure 5.9). In late seventeenth-century embryology, finally, a variety of theories of generation were discussed widely and controversially with frequent references to observations under the microscope and observations on embryos and foetuses during dissections. The debate as to whether Aristotelian epigenesis or theories of preformation would be best suited to explain matters of generation was not overcome until late in the eighteenth century. Meanwhile questions about the mechanisms of generation were still tightly bound to and had immediate effect on the identity of the unborn. Yet after the Haller-Wolff debate the old antagonism of epigenetic and preformationist theories was overcome. The unborn was turned into an object of scientific curiosity and the skill to describe, accurately dissect and depict it and to show knowledge of its physical development became rated above the ability to speculate about its identity and metaphysical status within the divine creation.

The three case studies of the rete mirabile, the lymphatics and the unborn have shown that images had always been crucial for the production of knowledge in early modern anatomy. Illustrations of the rete mirabile reflected the epistemological uncertainties

about the exact appearance, structure and nature of this elusive organ. This uncertainty was aggravated by the iconographic inconsistency of the images representing the marvellous network. Although Andreas Vesalius had dismissed the rete mirabile from human anatomy, it was still too important to explain the function of the body to be dropped immediately and continued to feature in early modern anatomy. But the increasing value attached to dissection and empirical observation in anatomy corresponded with the artistic ideal of producing images of the body "after life". This resulted in images with an incoherent iconography that did not allow for the rete mirabile to be established as an anatomical matter of fact. In the case of the lymphatics the images produced during the second half of the seventeenth century also corresponded with the observations made during dissections. They established a coherent iconography of these vessels that created certainty about the nature of the lymphatics as a distinct kind of vessels. Yet only by the second half of the eighteenth century enough evidence was gathered that allowed showing that the lymphatics were a vascular system that could be found throughout the whole body, as it was illustrated in great detail on Pauolo Mascagni's plates (figures 5.10-5.12). The empiricism and comprehensiveness of drawings of the lymphatics after life together with neoclassical aesthetic theory that associated beauty with truth allowed establishing the idea of the lymphatics as a separate "system of absorbing vessels" with a distinct function.

Beyond their usefulness to legitimize anatomy and shape the professional identity of the anatomists, images could be used in early modern anatomy as evidence or argument and convey practical knowledge. The use of images of the unborn for either of these purposes was very much dependant on their functional context. The dissected foetuses in Govert Bidloo's anatomical atlas (figures 6.21 and 6.22), for example, were evidence of the foetal anatomy, while the illustrations of observations on male semen under the microscope were frequently used as argument in late seventeenth and early eighteenth-century debates about preformationist generation. Images such as the illustrations in Justinia Siegemund's midwifery book, however, were designed to give specific advice on how to handle the unborn just before birth when it was in the wrong position and how to bring it with the head down for a safe birth (figure 6.6). The credibility of these images was dependant on whether they could fulfil their intended function and conformed to iconographic and aesthetic conventions. Samuel Thomas Soemmering's embryological plates (figure 6.26), for example, could only claim to be truthful

representations of embryos at different developmental stages by referring to the neoclassical aesthetic ideal of beauty.

Yet the truth about the unborn all these images represented was not merely concerned with its anatomical structure, nature of its development or the physical appearance in the womb. Such images also made fundamental statements about the identity of the unborn and life itself. The images published by Adriaan Spiegel (figures 6.19a-6.19c) showed the unborn as a liminal being that was in utero protected from the consequences of the original sin, but in constant danger of becoming a mortal and sinful human being once it had entered the world. A different account of the identity of the unborn was given by Johann Jacob Scheuchzer a century later (figure 6.25), who used images of fertilized eggs, embryos and foetal skeletons to frame a scene showing Adam in paradise. Associated with preformationist theories these images made the physicotheological point that every human being, born or unborn, was subjected to the fate of being a sinful mortal, to which it was predestined. Even the seemingly neutral images on Soemmering's anatomical tables determined the identity of the unborn. They made no reference to Christian narratives at all, but portrayed the unborn as a biological entity and mere object of scientific curiosity.

As Daston and Galison have shown, scientific objectivity quickly established itself as the dominant epistemological paradigm in the early nineteenth century. For this development, the reconfiguration of (visual) epistemologies in eighteenth-century natural history and natural philosophy was essential. When eighteenth-century anatomy adopted the aesthetic values of Enlightenment art theory such as beauty, truth and accuracy, the foundations were laid for the objectification of the anatomical body. Instead of referring to cosmological models, a secularized visual language was now employed to create meaningful images of the natural world. When anatomy started to use this new visual language the old question as to whether anatomical illustrations should depict an idealised body or be drawn from a specific specimen remained a contested issue. However, when William Cruikshank tried to justify his whole-body figure representing the system of the absorbing vessels as a pragmatic combination of both approaches, his argument reflected the limitations of both approaches. The question of whether the images of the anatomical body should represent an ideal or a specific specimen was not overcome until well into the nineteenth century. Ruth

Richardson has argued that what set *Gray's Anatomy* (1858) and its illustrations apart from previous anatomical handbooks was that it had incorporated the idea of variation in the natural world and accordingly aimed at representing what could normally be expected to be found during dissections.[621] However, such a new approach was only possible after the idea of artistic representation as a distinct form of representation had emerged in the early nineteenth century with the idea of *l'art pour l'art,* which set up a dichotomy between art and the new virtue of objectivity epitomized in scientific representations of the natural world.

In the case of anatomy this separation of artistic representation from scientific representation reinforced the disciplinary boundaries that were redrawn towards the end of the eighteenth century. When anatomy adopted neo-classical art theory, it became the discipline whose primary focus was on the truthful description of the appearance and structure of the human body. As a result the anatomical body became a biological entity and scientific matter of fact. The anatomical body of the eighteenth century represented the core values of truthfulness, accuracy and objectivity. These values were reflected in both the self-representation of anatomists and in the images of the anatomical body they produced. When scholars such as William Hunter or Samuel Thomas Soemmering engaged with contemporary art theory they adopted the language of neo-classical art theory to demonstrate that they were able to adhere to the new values of anatomy. This approach allowed them to overcome the older cosmologies of the body that required an explanation of the natural world in relation to the divine Creation. Using a secularized (visual) language allowed them to truthfully and accurately represent the anatomical body as an object of their learned knowledge. Yet this secularization of anatomical knowledge did not happen overnight, and cosmological ideas continued to circulate and indeed are still part of our cultural heritage today. However, since the late seventeenth century empiricism gained in currency among European scholars and gradually led to an epistemology that valued deduction from empirical observation above any other method of investigation into the natural world. Only by the middle of the eighteenth century, however, was the Enlightenment able to provide an ideology which allowed for the independent mind to understand the world in its own terms. This resulted in a secularization of the natural world and the objectification of the anatomical body,

[621] Ruth Richardson, *The Making of Mr Gray's Anatomy: Bodies, Books, Fortune, Fame*, Oxford: Oxford University Press, 2009, pp. 218-288.

making it possible to integrate the discipline of anatomy into the emerging sciences at the turn of the nineteenth century.

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