Part V of the *Discours de la Méthode*, published anonymously in 1637 at Leyden, offers the reader ‘in particular the explanation of the movement of the heart’. This detailed account (nearly half of the fifth part), which includes Harvey’s discovery of the circulation of the blood, is a pre-eminent example of Descartes’ méthode, and introduces numerous innovations which illustrate an important aspect of what is at stake in Descartes’ medical and physiological research. In the *Dioptrique*, one of the *Essais* which accompany the *Discours*, Descartes also discusses the structure of the eye, focusing on the optic nerves in the third Discourse, and explains the structure and use of the nerves in the fourth Discourse dealing with senses. In Discourse IV, he shows how critical he can be towards ‘anatomists and physicians’ who have not explained the use of the nerves. We must note, in this context, both the citing of William Harvey’s name (Harvaeus) and of the title of Harvey’s book (*De Motu Cordis*) in the margins of the *Discours*, as well as the appraisal given in the text of ‘an English physician, who must be praised for having broken the ice’ on the circulation of the blood. Harvey is indeed the only author’s name quoted in the *Discours*, and his name is quoted respectfully, as that of someone having made a genuine discovery.

In order to understand properly Descartes’ attitude towards Harvey, and Descartes’ aim in medicine, we must take into account the medical context of the seventeenth century. It means that we – as readers at the beginning of the twenty-first century, accustomed to the use of the microscope, and of various recording devices dealing with the human body, the heart, its movements, and the circulation of the blood – must forget nearly all that we have been taught on this subject. Such an attitude is all the more difficult to adopt for modern physicians, who must forget their practice of X-rays, echographies, and NMR. It is also worth noting that in the seventeenth century, the anatomy of the heart and of the vessels was described otherwise than it is today, and as a result the terminology used by Harvey and Descartes is different from the vocabulary we are now used to. Further, medicine had strong links with philosophy, as can be seen from the example of the famous School of Padua, where Harvey went to study medicine.
If we take into account the medical context of the first half of the seventeenth century, we must mention first that the choice of the heart as a subject of study is significant. The heart, the ‘principal’ organ since Aristotle, vied for the role of mediator between the soul and the body with the brain or part of the brain. The heart was indeed a theme of traditional importance in medical treatises. Anatomists who studied the heart insisted that it was very difficult ‘to describe its admirable composition and structure’, but by doing so one gains access to ‘marvellous secrets of Nature’ (Naturae arcana). The choice of an explanation of the movement of the heart is the second point to comment on. To begin with, in trying to explain this motion, which is so difficult to observe, one arrives, so to speak, at the heart of physiology. Fernel, who coined this term, claimed that it is a matter of reasoning, because physiology deals with what can only be known thanks to reasoning, and not to the external senses. Then, according to Laurentius, ‘the nature and cause of its perpetual movement is entangled with so many layers of difficulties and such great ones, that the learned Fracastorius thought that it was known only to Nature and to God alone’. And in the first chapter of his 1628 treatise, demonstrating the movement of the heart and the blood, Harvey refers to Fracastoro to show both how complex the question is – and how daring his own explanation. Harvey also quotes Laurentius: ‘I did not wonder at that which Andreas Laurentius had written, that the motion of the heart was like the ebbing and flowing of Euripus to Aristotle.’ This first reference to Aristotle in Harvey’s book alludes to Aristotle’s exile in Chalcidia, where he could not discover the cause of the motion of the narrow strait of Euripus, ‘which ebbs and flows at set intervals seven times by day and night’. Laurentius also mentions that ‘Aristotle was so stricken with grief’ that he died. The difficult question of the movement of the heart demonstrates how much philosophical themes and medical research were entangled in the seventeenth century, because the subject brought many important questions in its wake: the link between soul and body, the possibility of explaining Nature and discovering its secrets, and the status of Nature.

The question of the movement of the heart also leads to a study of a very important period in the history of medicine, because writing about the movement of the heart in 1637, as Descartes did, was to align oneself on one or other side of the debate generated by Harvey’s *Exercitatio de Motu Cordis et Sanguinis in Animalibus*, which was published less than ten years earlier. Moreover, claiming, as Descartes does, that the movement of the heart is ‘the first and most widespread’, that is to say, that this movement is the one to which others are subordinated, was indeed a daring claim at a time when the discovery of the circulation of the blood was proceeding to demolish the traditional divisions of the body to be found in anatomical treatises. It should in fact be remembered that the prevailing view before Harvey, derived from Galen, associated the liver with the veins and the ‘pneuma phusikon’ (to become the *spiritus naturalis* ‘natural
spirits’), the heart with the arteries and the ‘pneuma zotikon’ (to become the spiritus vitalis ‘vital spirits’), and the brain with the nerves and the ‘pneuma psuxikon’ (to become the spiritus animalis ‘animal spirits’). And, in fact, what is at stake in these pages of the fifth part of the Discours (which are not merely quoting the passages dealing with man in the unpublished L’Homme) is an essential aspect of the resurgence of medicine and physiology in the first half of the seventeenth century.

Descartes makes a major breakthrough in physiology by rejecting the interpretation which worked in terms of faculties previously used to characterise the functions of the body (the vegetative faculty dealing with the liver, the vital faculty dealing with the heart, and the animal faculty – in which ‘animal’ means relating to anima, i.e. soul – dealing with the brain). Descartes’ major breakthrough is also associated with Harvey’s discovery of the circulation of the blood and with a Cartesian mechanical explanation of the heat of the heart (rather than the traditional ‘innate heat’), understood as the principle of life. In dissociating the heart from the soul, and rejecting any connection between the heart and the sun, at the very time that Harvey was making use of the metaphor of the heart as a microcosmic sun (the heart in the microcosm being like the sun in the macrocosm), Descartes demonstrates how remarkable his conceptions are. Moreover, Descartes defends a thesis about the cause of the movement of the heart that differs from the one given by Harvey in the first part of his book published at Frankfurt am Main in 1628. Since Descartes accepts with Harvey’s discovery of the circular movement of the blood, he retains the second part of Harvey’s book, dealing with the demonstration of the circular motion of the blood in living animals. He focuses his attention on some points of Harvey’s discovery of the circulation of the blood. As I shall show, Descartes’ approbation is in fact a rewriting of this discovery, because Descartes conveys Harvey’s discovery in a different context from the one in which it was first presented. Descartes’ assumption of a mechanistic context, linked to the definition of a new anthropology, will obliterate Harvey’s own Aristotelian and vitalistic context.

When Descartes mentions the ‘perpetual circulation’ of the blood in the body, he refers to ‘an English physician’ and quotes his name in Latin, Hervaeus, and the title of his book, De Motu Cordis, in the margin of the Discours. In this book written in French, rather than Latin, Descartes spreads Harvey’s discovery among a new reading public – and not only among the learned.

The laudatory approval given by Descartes to the genuine novelty of Harvey’s 1628 demonstration of the circulation of the blood, which can also be found in his correspondence, in the Passions de l’Âme, and in the Description du Corps Humain, is all the more interesting since Descartes is usually reluctant to mention his sources. It is also worth noting because the recognition of the Harveian thesis of the circulation of the blood took a long time and provoked many objections, especially in France. The most
famous of these, *Le Malade Imaginaire*, a play written in 1673 – that is, 36 years after the publication of the *Discours*, 45 years after the publication of the *De Motu Cordis et Sanguinis* – shows the young Diafoirus, Thomas, proud of offering his medical thesis against the ‘circulateurs’ (the name given to the followers of Harvey) to Angélique. If Thomas Diafoirus behaves like a rather ridiculous lover, he does not behave like an old-fashioned physician: the play was written the year after King Louis XIV decided to have the circulation of the blood taught in Paris, in his gardens (in those days *Le jardin du Roi*, now *Le jardin des plantes*), by Dionis, a surgeon. In seventeenth-century France, Faculties of Medicine were very conservative, even at Montpellier, as can be seen from John Locke’s *Journal*. When Locke (both philosopher and physician) travelled in France in 1676, he reported in his *Journal*, on Wednesday 18 March, on ‘the manner of making a doctor’ at the University of Montpellier, giving his low opinion of the orations and writing that the Chancellor’s oratory was directed ‘against innovation’.

Descartes’ publicising and supporting Harvey’s discovery of the circulation of the blood, and debating with Harvey on the cause of the motion of the blood, is all the more striking because Descartes was not a doctor of medicine and had never attempted to get a degree in medicine. Harvey was a fully qualified medical doctor, having studied at Cambridge and above all at Padua, the famous university that offered medical students a good training both in theory and in practice; this was exceptional in those years when medical training was characterised by the variations in length of the studies according to the university, the poor quality of teaching and the inadequate use of human dissection. And although Harvey was not, at the time of publication of the *Discours*, considered to be the founder of modern physiology, he was nevertheless important both as a physician and as a lecturer. From 1609 onwards he had been a physician appointed to St. Bartholomew’s Hospital, London; from 1616 he had held the important post of Lumleian lecturer to the College of Physicians of London, and it was here that he first alluded to his discovery. In 1618 Harvey had also been appointed physician to the King (Medicus Regis juratus, ‘sworn physician to the King’).

As for Descartes, it is worth noting that from the moment when, at the end of 1629, he became interested in medicine, he read many books and performed many experiments. This point is very important – not only because we should reject the idea of Descartes as a mere ‘amateur’ in medicine, but also to remind ourselves of the letters that fully qualified physicians wrote to Descartes about medical problems, and to recollect that Harvey himself discussed Descartes’ ideas on the movement of the heart in his second *Reply to Riolan the Younger*. 
Descartes, Harvey, and medicine: ‘Vesalius and the others’

From Amsterdam, where he was performing dissections, Descartes wrote to Mersenne, on 15 April 1630: ‘I am now studying chemistry and anatomy simultaneously; every day I learn something that I cannot find in any book.’ Descartes did not say anything about the books he was reading. But, on 20 February 1639, writing about the readings and the anatomical experiments he had been dealing with for ‘eleven years’ (which means from 1629, because Descartes used to count including both the initial and final year), Descartes said: ‘In fact, I have taken into consideration not only what Vesalius and the others write about anatomy, but also many details unmentioned by them, which I have observed myself while dissecting various animals.’

From this quotation, it is clear that Descartes acknowledges a debt towards Vesalius, and towards the ‘others’, for his knowledge of anatomy. This point should be taken seriously, because examining this reference to ‘Vesalius and the others’, and observing that in this quotation Descartes is promoting medical experiment, leads us to consider Descartes in a continuous line in the development of anatomy from Vesalius onwards. The coherence of the Cartesian sources in science should be noted, because Descartes, in medicine as in physics, in L’Homme as well as in Le Monde, wanted to draw information from the most recent sources: from Copernicus to Galileo in physics, from Vesalius to Bauhin and Harvey in medicine.

Let us turn to medicine. In the remarkable year 1543, Copernicus published his De Revolutionibus Orbium Coelestium in Nuremberg, and Vesalius, from Brussels, had his De Humani Corporis Fabrica Libri Septem published. At that time Vesalius was teaching anatomy at Padua, ‘the most famous school in the universe’, as he wrote in the Preface of his treatise. It was in Padua, when he was not yet thirty, that Vesalius had written the final version of his treatise in seven books on the fabric of the human body, before sending it for publication at Oporinus, in Basel. Vesalius’ aim in his treatise is to show the ‘fabric of the human body’ and to reverse the decline of anatomy. The preface of the treatise denounces the ‘loss’ of anatomy, and contains information about Vesalius’ medical studies. Vesalius argues against the bookish teaching he received in Paris and wants to restore the ‘lost knowledge of the human body’. He also writes about his conception of man. He mentions the ‘charm’ of studying the organism which is ‘the most perfect among all the creatures’, and of examining with attention what is ‘the refuge and the instrument of our immortal soul, that the Ancients, thanks to the remarkable correspondence with the world, had rightly named microcosm (microcosmus)’. These ideas, one dealing with the perfection of the human being that is shown in Vesalius’ book, the other associated with the definition of man as a microcosm and with the theme of Nature creating this noteworthy, remarkable work of art, will be of great importance in medical treatises after Vesalius,
even in Harvey’s treatise on the movement of the heart and the blood, as we shall see below. In 1555, Vesalius published a revised edition of the *Fabrica*, in which he showed himself more concerned with embryology and vivisection.

When Descartes mentions the name of Vesalius in his correspondence, he also refers to the ‘others’ – Vesalius opened the way, and other anatomists had followed his example. Such was the case in the Low Countries, where in the first third of the seventeenth century there was a revival of interest in Vesalius, as can be shown from the editions directly inspired by him. In 1633 a new edition of Vesalius’ *Epitome Anatomica* was published in Amsterdam, with commentaries by P. Paaw. The full title of this small book, first published in Leyden in 1616, is *Andreae Vesalii Bruxellensis Epitome anatomica, Opus Redivivum*. The anatomical aspect of medical life is also shown in Rembrandt’s famous painting *The Anatomy of Dr Tulp* (Figure 15.1), painted in 1632 in Amsterdam, that is, in the city and at the moment when Descartes was preparing *L’Homme*. This historical painting depicts the only public anatomical demonstration in Amsterdam in 1632, performed by Dr Tulp on a condemned criminal, who had been hanged the day before the dissection began. This painting is also a group portrait (the members of the anatomical guild), and a painting belonging to the history of medicine and ideas, because what is shown is an anatomical demonstration beginning with the explanation of the *musculi digitos moventes* of the lower left arm and hand. This fact is important, because Renaissance anatomies began with the *venter inferior* (the lower belly), as can be seen from the title page of the *Fabrica* by Vesalius, published in 1543 and 1555 (Figure 15.2). In the seventeenth century, as in the sixteenth, no anatomy would begin with the arm, so Dr Tulp must have asked Rembrandt to portray him in this way. And if Tulp asked Rembrandt to show him dissecting the muscles of the forearm that allow the fingers to move, it was because Tulp wanted to be painted in a Vesalian light. Tulp wanted to be seen, to be acknowledged, as a ‘new Vesalius’, as ‘The risen Vesalius’, ‘Vesalius redivivus’ – because Vesalius’ large woodcut portrait, which is found at the beginning of the *Fabrica*, 1543 edition (Figure 15.3), and which was reprinted many times, shows Vesalius dissecting a lower arm. Rembrandt’s painting thus established a link between Vesalius and Tulp (Paaw’s pupil), showing the Vesalian Renaissance in the Low Countries in 1632.

During this period, many books in Europe were printed in the Vesalian style. This allows us to make precise the Cartesian reference to ‘the others’, the other anatomists after Vesalius. In *Le Principe de Vie chez Descartes*, I argued that Caspar Bauhin, who taught medicine in Basel after having studied in Padua, was the most important among the ‘other anatomists’ Descartes was alluding to in his letter to Mersenne. In 1590 Bauhin published a treatise directly inspired by Vesalius, including the title *De Corporis Humani Fabrica*. In one of his other treatises, the most
famous, very well known in the Low Countries, Bauhin used the anatomical drawings found in Vesalius’ books, and he entitled his treatise – published in Frankfurt in 1605, then reprinted and enlarged in 1620–21 – *Theatrum Anatomicum*, ‘Anatomical Theatre’. These anatomical drawings helped Descartes from the moment he began to practice his anatomical experiments. In 1629, Descartes lived in Kalverstraat (Street of the Calves) and, ten years later, he reported to Mersenne: ‘During one winter in Amsterdam, I used to go nearly every day to a butcher’s, to see him slaughter animals, and to have brought to my house the parts of the animals I wanted to anatomise at leisure.’ During the winter of 1632, Descartes wrote to Mersenne:

My discussion of man in *Le Monde* will be a little fuller than I had intended, for I have undertaken to explain all the main functions in man. I have already written of the vital functions, such as the digestion
of food, the heart beat, the distribution of nourishment, etc., and the five senses. I am now dissecting the heads of various animals, so that I can explain what imagination, memory, etc., consist in.30

In L’Homme, Descartes located the seat of imagination and common sense in a gland in the brain. In this treatise, Descartes did not mention the name of the gland – the name pineal gland or conarium is to be found in some letters in 164031 – but referred to it by using the letter ‘H’. This apparently indicates that Descartes was referring to an anatomical plate dealing with the internal structure of the brain, found in Bauhin’s treatise Theatrum Anatomicum, where the pineal gland or conarium is identified with the letter ‘H’ (Figure 15.4). In the Excerpta Anatomica, Descartes’ notes about his anatomical experiments, he refers twice to Bauhin. Bauhin’s Theatrum Anatomicum is indeed an important book when one is interested in Descartes’ biology, and in my edition of L’Homme, I quoted the Theatrum Anatomicum to explain Descartes ‘in context’, and reproduced anatomical plates from the Theatrum Anatomicum. Bauhin was indeed a ‘learned anatomist’ whom Descartes wanted his readers to refer to in L’Homme.32

This anatomical theatre also recalled Bauhin’s studies at Padua, where he was taught anatomy by Fabricius of Aquapendente, the founder of the famous permanent wooden anatomical theatre. Bauhin directly alluded to one of the dissections performed in Padua by Fabricius when, in book four of the 1605 edition, he refers to the public anatomical demonstration of the existence of the valves in the veins. At the end of the book, Bauhin gives, in a slightly different form, some of Fabricius’ plates from the De Venarum Ostiolis (1603). So Bauhin updated Vesalius’ plates – such is the case with the valves of the veins, a very important anatomical discovery, about which both Harvey and Descartes thought deeply (Figure 15.5). This plate will be shown in Harvey’s De Motu Cordis et Sanguinis, together with Harvey’s experiments on the ligated arm to demonstrate the circulation of the blood and explain the function of these valves (Figure 15.6).

Bauhin’s Theatrum Anatomicum gave Descartes the opportunity to see in a smaller size than in Vesalius’ books, very good anatomical plates, and read a less controversial text than the Historia Anatomica by Laurentius, where each chapter is followed by questions and controversies. If nowadays we have forgotten Bauhin’s name, we should remember that Bauhin was quoted with praise by Harvey in his De Motu Cordis,33 and that the Theatrum Anatomicum was the reference book when Harvey was giving his anatomical Lectures in London from 1616.34

Descartes’ knowledge of anatomy comes from Vesalius and Bauhin, while his knowledge of embryology comes from Fabricius of Aquapendente, and from his own experiments, as can be seen from a letter to Mersenne, of 2 November 1646.35

When Descartes refers to Fabricius, he once more acknowledges his
Figure 15.4
LIBRI QUARTI.

VALVULAE IN VENIS.

Figure 15.5
Cartesian physiology

Figure 15.6
debt to Renaissance medicine. Descartes read the two embryological treatises of Fabricius, *De Ovi Pulli* (The Formation of the Egg and Chick) and *De Formato Foetu* (The Formed Foetus), very carefully. These books have magnificent engraved plates showing the formation of the chick, the formation of the human foetus, the formation of the foetus of the sheep, the cow and the horse, plates which helped Descartes in his practice of embryological dissections. In these experiments, Descartes was interested in the order in which the organs form during development or gestation. But he also owes to his reading of the *De Motu Cordis et Sanguinis* his considerations on the heart in the embryo representing the beginning of life.

When quoting the embryological treatises of Fabricius, Descartes was referring to a very famous teacher of anatomy at Padua. Fabricius had taught anatomy and surgery at Padua for half a century. When Harvey went to Padua, Fabricius was teaching anatomy and surgery, performing anatomical demonstrations and dissections. Fabricius had a great influence on Harvey. His ambitious programme of research was to prepare a *Totius Animalis Fabricae Theatrum*, which he planned to illustrate with coloured life-size plates, each to be accompanied by an engraving in black and white. His first book was the *De Visione, Voce, Auditu* (On Sight, the Voice and the Ear), published in 1600, with plates. Then, in 1603, were published the *De Locutione et eius Instrumentis* (About Speech and its Instruments), and the *De Venarum Ostiolis* (the famous treatise on the Valves in
Annie Bitbol-Hespériès

the Veins), and De Brutorum Loquela (On the Speech of Animals). Then came the embryological treatises and the De Respiratione et eius Instrumentis in 1615, and later on the new edition of the surgical works (Opera Chirurgica).

A study of Descartes’ medical sources – Vesalius, Bauhin and Fabricius – leads us to note two important points. The first is that Descartes’ readings in medicine were far from the Parva Naturalia of the scholastics and from Fernel’s treatises (sources that Gilson gave too great an importance in his famous paper ‘Descartes, Harvey et la scolastique’). The second is that Descartes’ acknowledged sources – Vesalius, Bauhin, and Fabricius – sources that are genuine, as can be seen from reading Descartes’ medical writings, are the same as Harvey’s reference books in anatomy and embryology. And, of course, Descartes also refers to Harvey himself in his writings. This agreement on reference books and on the importance of experiments is all the more fascinating when we note that Descartes had studied medicine by himself.

Descartes’ medical study of the nature of man and his reading of Harvey’s De Motu Cordis et Sanguinis

The Cartesian challenge was all the more important as Descartes had studied the medical tradition in carrying out his ambitious research programme dealing with ‘the nature of man’, to which he had devoted himself from June 1632. When referring to ‘the nature of man’ – in a letter to Mersenne explaining how fundamental this study became in Le Monde, and later in quoting this expression in the Sixth Meditation, the Principia, and the Passions de l’Âme – Descartes is making use of a phrase that had become popular in medical texts. The reason for this was that ‘The Nature of Man’ was the title of one of the works assigned to Hippocrates, then commented upon by Galen, and usually quoted in medical and anatomical treatises of the Renaissance and the seventeenth century. This treatise, which sets out a theory of physical human nature, was nonetheless mentioned in a context where man fits into the macrocosm.

This question, dealing with the nature of man as linked with the status of Nature, is studied in these medical treatises and is alluded to in Harvey’s book on the movement of the heart and the blood. And I think that it is in the context of this question that we can clearly understand the new way in which Descartes wrote about medicine. The pages Descartes devoted to medicine in the Discours and in the Dioptrique show that Descartes separated philosophical themes or metaphysical problems (such as the role played by the Creator or by God, the status of Nature, of the soul) from the medical question of the study of the body, in which the investigation about the movement of the heart is a pre-eminent example.

These questions are linked with the Descartes–Harvey debate on the movement of the heart, as can be seen from study of the controversy. Coming to the nub of the controversy between Descartes and Harvey, we
find that its study reveals several important aspects of the Cartesian conception of physiological problems. The first is the rejection of the macrocosm–microcosm comparison, a rejection grounded on Cartesian physics (the Discours was written after Le Monde, which contains L’Homme), and evidenced by the fact that Descartes says nothing either about the heart–sun metaphor, or about the microcosmic analogy, while Harvey not only quotes these analogies, but also makes use of them at important places in his book.

From Le Monde and L’Homme on, Descartes invoked the ‘laws of Nature’. If this expression can be found in medical treatises, for instance in Du Laurens’ Historia Anatomica, it means regular and prefixed movements, certain and well-determined laws, but something unknown to human beings. In contrast, the laws of Nature in Descartes’ new system of the world are the laws of motion explained in Le Monde and derived from the immutability of God. And the body about which Descartes writes in L’Homme and Part V of the Discours, like the material world in general, is ruled by the laws of Nature ‘established’ by God, and by the circulatory pattern that is shown in the world, as in man with the circulation of the ‘animal spirits’ – i.e. the most subtle particles of blood – which is like the circulation of the blood. Descartes’ embryology is also like a ‘sort of living whirlpool’. It is obvious then that for Descartes, the link between the world and man is totally different from the descriptions of the similarities between macrocosm and microcosm that were very common in medical treatises. In his Preface to the Fabrica, Vesalius asserted that ‘the Ancients’ named man ‘microcosm (microcosmus)’ because of all the close connections with the world. This theme of man as a microcosm can be found in most of the medical treatises of the seventeenth century and is associated with the parallel between the sun and the heart that was a widespread theme in the Renaissance, not to mention in Agrippa’s De Occulta Philosophia. These themes can also be found in the works of Robert Fludd, and Descartes would have read them in the writings of Fernel, Kepler, and Harvey. The parallel between the sun, necessary for all life, and the heart, ‘principal’ organ in the body, was indeed very common in medical books, and was also linked with the Paracelsian influence on medicine, as can be seen from Fludd’s writings, and from the influence of astrology in medicine. Physicians who wrote about the parallel between the sun and the heart generally called upon ‘the Ancients’, as can be seen from Laurentius, and maintained the traditional geocentric universe, even Fludd, whose system of the world was centred around the sun, and who rejected the work of Copernicus. When explaining that the heart is the principle of heat and life, Anatomists also frequently called the heat in the heart ‘divine’. If Descartes does not retain this link between the sun and the heart, it is because he rejects the explanation that underlies such a connection, namely that the principle of life originated from the heavens, or that such a link between the sun and the heart lends support
for a cosmology derived from the Greek legacy. Descartes rejects these ideas connected with a tradition Harvey is not opposed to. We must not lose sight of the fact that in Harvey’s use of the metaphor of the heart being like the sun, there is no influence of Copernicus or Galileo. Harvey, when in Padua, attended Fabricius’ lectures and anatomical demonstrations, but there is no evidence that Harvey attended Galileo’s lectures. Though it has been suggested that in Padua he was influenced by Galileo’s teaching in astronomy, it should be remembered that while Harvey was a student in Padua, Galileo was not teaching the Copernican system, but the works of Euclid and the *Book of the Spheres*. It was Descartes who followed the theses of the ‘new astronomers’ – Copernicus and Galileo in *Le Monde*; the condemnation of Galileo’s *Dialogue on the Two Chief World Systems* by the Congregation of Cardinals, established to censor books, resulted in his not publishing a book with ‘the proscribed movement’.

If Descartes did not agree with Harvey on the question of the cause of the movement of the heart, it is because his own chronology of the phases of the cardiac cycle is in accordance with the explanation of the origin of heat conceived as the principle of life. If the expulsion of blood occurs during systole, namely during the phase of contraction of the heart and thereby during its diminution in volume (as Harvey says), there must be something in the heart that is the cause of its contraction. In his *Description du Corps Humain* (published in 1664 with *L’Homme*), Descartes explained: ‘Now if we suppose that the heart moves in the way Harvey describes, we must imagine some faculty which causes this movement; yet the nature of this faculty is much harder to conceive of than whatever Harvey purports to explain by invoking it.’

Descartes wished to avoid calling upon a ‘vis pulsifica’ in the heart, or, as Harvey did, upon the expansive and contractive action of the heart itself, which cannot be accounted for. So Descartes explained the expulsion of the blood from the ventricles as a kind of natural phenomenon occurring in the blood itself, a process like ebullition, or fermentation, the result of the production of heat taking place in the heart. Therefore the expulsion of the blood must coincide with the expansion and not with the contraction of the heart, and this is explained in the *Discourse*, as well as in the *Description*.56

When Harvey describes blood ‘that is warmer, perfected, vaporous, full of spirit, and so to speak, alimentative’, and the heart ‘as a fountain or inmost shrine or the body’, his ideas on the blood and on the heart are directly derived from Aristotle’s writings; this is paradoxical given the importance of Harvey’s discovery in the history of medicine, and it explains why the first recognition of Harvey’s discovery in print came from Robert Fludd’s *Medicina Catholica* of 1629. Fludd was a mystic physician who called Harvey ‘his friend, colleague and compatriot well versed not only in anatomy but also the deepest mysteries of philosophy’.58
So it can be said that Descartes gives the Harveian theses a shift of emphasis, because Descartes separates the experimental proofs given by the English physician from the philosophical background on which Harvey was still dependent. The treatise on the movement of the heart and the blood illustrates that its author was indeed a brilliant and an inspired experimenter, but the book also reveals a physician dependent on the philosophical tradition that was taught to medical students at Padua. Descartes, on the other hand, questioned the conceptual framework in which Harvey fitted his brilliant discovery.

If the *Discours* accepts the circulation of the blood, it should be noted that Descartes only quotes with approval the Harveian experimental proofs, and that he does not mention the Aristotelian reference that gave birth, according to Harvey himself in ch. 8 of *De Motu Cordis et Sanguinis*, to the definition of the circular movement of the blood in animals. When Harvey writes that ‘we may call this motion circular in the same way in which Aristotle says that the air and the rain imitate the circular motion of the heavens’, this is not merely rhetorical. Harvey believes in the analogies between the world as cosmos and man. Harvey, indeed, accepts one of the major principles of Aristotelian cosmology, which Descartes rejects – that phenomena in the sublunar world are seen as imitations of the celestial pattern. As W. Pagel writes, ‘circular motion serves the preservation and maintenance of both these worlds’. By referring to Aristotle in order to define the circular motion of the blood, Harvey shows the importance of his studies in Padua through the deep influence on him of the Aristotelian philosophy taught by Cremonini, who in 1590 filled the vacant chair of the famous Paduan Aristotelian philosopher Giacomo Zabarella. The persisting Aristotelian influence in Harvey’s writings can also be seen in his *De Generatione Animalium*, published in 1651, where Harvey himself acknowledges several times his debt to both Aristotle and Fabricius.

It therefore becomes clear that the presentation of Harveian views in the *Discours* is accompanied by a shift of emphasis, Descartes revealing (except on systole) a much more ‘modern’ Harvey than the one that can be found by reading the treatise of 1628. This judgement is confirmed by Descartes’ emphasis in the Harveian demonstration on the assumption of the existence of ‘many small passages’ (the anastomosis) at the extremities between the arteries and the veins, that Harvey himself – who was writing as was Descartes, before the invention of the microscope – was unable to see. This example illustrates the Cartesian method of explaining the visible actions of visible organs in terms of the invisible actions of structures too small to be seen at that time. Here Descartes is anticipating the use of magnifying lenses in the advancement of biological knowledge and expects many benefits from it, as can be seen from the *Dioptrique*, Discourse 10.

Descartes follows Harvey in asking ‘anyone unversed in anatomy to take the trouble . . . to have the heart of some large animal with lungs dissected
Harvey indeed insisted on these precise observations. But Descartes, in describing the structure of the heart, parts from Harvey when, considering the cardiac valves (‘the eleven little membranes’), he writes ‘there is no need to seek any reason for the number of these membranes . . . beyond’ mechanical reasons due to their structure and their distribution in the heart. Thus Descartes discards the respectful attitude towards the skill of Nature that can still be found in Harvey’s treatise. In ch. 8 of *De Motu Cordis*, for instance, Harvey expresses his admiration in considering the ‘carefully balanced and exquisite contrivance of the valves and fibres and from the rest of the fabric of the heart’. Harvey is here following ideas expressed by, for example, Bauhin and Laurentius and grounded in Vesalius’ famous treatise, *De Humani Corporis Fabrica Libri Septem*. Such is the case with the part played by ‘Nature’ and by admiration. It should be noted that in Vesalius’ title the word ‘fabrica’ does not stand for the word ‘structure’, as it is generally translated, and does not just mean the study of the human body that stands on the bony structure of the body that is shown, in the first book, by the famous skeletons miming animation or meditation. The word ‘fabrica’, preferred in the title to the word ‘structura’, which appears in the treatise, deals with a conception of the body as a remarkable piece of work made by an ‘Opifex’ or by Nature (Natura), which is frequently associated with Providence. The word ‘Opifex’, too, means the remarkable piece of work made by the Creator, who, for instance, thanks to his ‘ingenuity’ (industria), has associated muscles and nerves. In this respect Vesalius is inspired by the praises that Galen gave to the Creator. But the illustrations in Vesalius’ treatise emphasise the aspect of the human body as a masterpiece, a genuine work of art. When publishing his treatise about the valves in the veins (*De Venarum Ostiolis*), Fabricius explained that the eight anatomical plates illustrating his discovery prove ‘admirabilem naturae industriam’ (the wonderful work of nature). Bauhin echoed this in his *Theatrum Anatomicum*, and Harvey writes about the ‘skill’ of Nature.

Compared to this medical tradition, Descartes’ assertions about nature, as well as his explanations of the functions of the bodies, are original. Descartes tells us that ‘by nature I do not mean some goddess or any other sort of imaginary power . . . but matter itself’. In order to explain the organic functions of the human body Descartes refers to mechanical models instead of praising Nature or the ‘skill of Nature’. These mechanical models are found in Descartes’ writings from *L’Homme* onwards in order to explain physiological functions. They are often derived from Descartes’ reading, but used in a different context, that of the Cartesian systematisation of mechanism. The *Discours* refers to the unpublished treatise of *Le Monde* including *L’Homme*, uses the term ‘automaton’ and makes public the hypothesis of ‘animal-machines’, with the comparison of a ‘clock consisting only of wheels and springs’ that measures time ‘more accurately than we can with all our wisdom’.
These mechanical comparisons as explanations of physiological functions common to both humans and ‘animals lacking reason’ are also original because they are linked with the Cartesian use of the expression ‘there is no wonder (ce n’est pas merveille)’, for instance in L’Homme, in the Description, and in his correspondence. The reason is that Descartes considered medicine as a scientific explanation not requiring the traditional praises to the human body, leading to praise of God or the Creator, or creating the devotional atmosphere of medical treatises of the Renaissance and of the first half of the seventeenth century.

Looking more closely at the account of Harvey’s discovery in the fifth part of Descartes’ Discours leads the reader to realise that Descartes intends to reject some important theses of the medical tradition, including those regarding Nature and its teleological assumptions, assumptions that Harvey still makes in his treatise. We shall return to this point below. What the Harvey–Descartes controversy shows above all, however, is that the Cartesian explanation of the motion of the heart does not reduce to trying merely to give a coherent description of vascular phenomena, a task that Harvey, the specialist, performed so brilliantly. Descartes is not such a specialist, and has wider issues and a greater challenge to face. In Descartes’ project, L’Homme is a part of Le Monde, and in the Discours, where the unpublished treatise is alluded to, Descartes chooses the motion of the heart as a model for the explanation of all the movements in the body. Such an attempt is a challenge to traditional medical theories linked to a cosmology derived from the Greek legacy, and opens the way to a new physiology rejecting both the traditional interpretations in terms of ‘faculties’ derived from the Galenic tradition, and the Aristotelian legacy in medicine that was so important in medical writings, and that Harvey’s work bears witness to.

The Harvey–Descartes debate on the cause of the motion of the heart is also significant because of the contrast of two personalities with different backgrounds, and different purposes in publishing their ideas. Harvey was a doctor of medicine, but Descartes’ work, although published anonymously, reveals its author at once as a polymath who had written a ‘Discourse on the method of directing one’s reason and seeking truth in the sciences’.

In this Discours, Descartes explicitly raised the question about man in a medical context, while going against medical tradition. This is the case when Descartes presents an explanation of biological functions derived ‘only from the disposition of their organs’, from the Discours to the Passions and the Description. To explain the disjunction between the soul and vital phenomena which features in Cartesian mechanistic biology, the Discours asserts, summarising L’Homme: ‘So I contented myself with supposing that God formed the body of a man exactly like our own . . . without placing, in the beginning, any rational soul or any other thing to serve as a vegetative or sensitive soul’. In such a body, without any Aristotelian or
scholastic souls, Descartes places the famous ‘fire without light’. This life principle, defined as the heat of the heart, excludes any vitalism (long before the term existed), because this is a fire whose nature is in no way different ‘from that of the fire which heats hay when it has been stored before it is dry, or which causes new wine to seethe when it is left to ferment from the crushed grapes’.79 This fermentation model, reduced to ‘mere motion’, is important in Descartes’ biology both to explain the heat in the heart and the formation of the various organs in embryology.

The elimination of the non-intellectual functions of the soul, together with the rejection of the definition of man as a microcosm (still the prevailing view80) constitutes the philosophical motif of Cartesian physiology, from \textit{L'Homme} to the \textit{Passions}, not to mention the \textit{Discours} and the Sixth Meditation.

\textbf{Descartes’ new anthropology}

It can be said without anachronism that Descartes defines a new ‘anthropology’, for this notion can be found in 1618 in the \textit{Anthropographia} of Riolan the Younger (translated into French in 1629), and it is the first word of the \textit{proema} in the anatomy treatises of Caspar Bartholin the elder in 1632, and his son Thomas in 1677;\textsuperscript{81} Dionis also makes use of this notion.\textsuperscript{82} The originality of Descartes’ anthropological ideas results from his assertion of the singularity of the rational soul, or a human mind ‘better known than the body’,\textsuperscript{83} whose union with the body defines a ‘real man’,\textsuperscript{84} and also from his assertion of a body that functions thanks to the ‘disposition of the organs’, and which is given life by the heat in the heart. As the soul is no longer either a principle of life or a principle of movement, and as death ‘never occurs through the absence of the soul’,\textsuperscript{85} the body, though it is not ‘our better part’,\textsuperscript{86} becomes for Descartes a major subject of investigation.

The body, about which Descartes writes in \textit{L'Homme} and the fifth part of the \textit{Discours}, is ruled by ‘the laws of mechanics, which are identical with the laws of nature’.\textsuperscript{87} These Cartesian texts, which offer a new definition of nature, also propose a new relation between man and nature, in which the study of the ‘eyes of the onlookers (\textit{les yeux des regardants})’\textsuperscript{88} is very important. Descartes’ deep interest in the physiology of vision and his strikingly novel way of dealing with its problems, already considered in \textit{L'Homme}, appear in the sixth Discourse of the \textit{Dioptrique}, which deals with vision in an original and extensive way in order to define a fundamental aspect of the relation between man and the world.

The \textit{Dioptrique} was the first book Descartes wanted to publish after he decided not to have \textit{Le Monde} published because of Galileo’s condemnation. This text, published in 1637, is of paramount importance in Descartes’ philosophy, because it establishes the Cartesian theory of knowledge by setting out a new explanation of both the bodily and the mental
conditions of visual experience, namely that there is no resemblance between ideas and things. The fourth Discourse in the *Dioptrique*, on ‘the senses in general’, as well as the opening of *Le Monde*, later explained by the long account of eyesight in *L’Homme*, demonstrate that our sensible representation (our perception) is not like the object that stimulates it. This argument relies on anatomical arguments: witness the fact that, when explaining his theory of vision (*Dioptrique*, Discourses V and VI, and *L’Homme*), Descartes’ originality lies in his emphasising the function of the nerves. Compared with other explanations of vision written in the period immediately preceding his own, the boldness of the Cartesian text, and the illustration of the eye and the point of insertion of the optic nerve, is again worth noting. Descartes’ originality can be confirmed by looking at treatises published just before the *Dioptrique* and *L’Homme*, the *Historia Anatomica* of Laurentius, as well as the *Œuvres Anatomiques* of Jean Riolan the Younger, show how puzzled these physicians were when considering the optic nerves, their precise location, their point of origin, their connections and their precise function. Moreover Descartes’ contributions to the theory of vision are far more innovative than those of Kepler, who was his ‘*premier maître en optique*’, and from whom he borrowed his explanations of the crystalline humour and the title of his *Essai* dealing with optics (*La Dioptrique*). Descartes’ strong insistence on the function of the optic nerves in the explanation of the sense of sight, also stated in the *Principia* (IV, art. 195), is undoubtedly the new element that enables him to refute the Aristotelian theory of a resemblance between our sensory perception and the things that produce them.

So Descartes’ anatomical and physiological research, particularly on the nerves, on the inner region of the brain, and on the heart, are definitely linked with his philosophy. These texts from the *Discours* and the *Dioptrique*, and their links with the unpublished treatise, prove both the coherence of the Cartesian project of rebuilding the system of the sciences, born of the famous dreams of November 1619, and the depth and scope of Cartesian thinking about medical questions. They illustrate Descartes’ development from 18 December 1629, when he wrote to Mersenne that he was going to ‘begin studying anatomy’. This was a genuine beginning, for there is no hint that Descartes was interested in medicine before 1629. Moreover, I reject the idea that the famous dreams of 1619 could have given Descartes an inclination to become a physician, and that Rosicrucian doctrines could have influenced Descartes’ medical ideas.

Descartes, therefore, was indeed really interested in medicine, had read many books and performed many experiments. If he was wrong in his explanation of the movement of the heart, as was shown by Harvey in 1649 and confirmed by Richard Lower in 1669, Descartes supported Harvey’s discovery of the circulation of the blood and put it into a new conceptual framework. Descartes placed Harvey’s discovery of the circular motion of the blood in a mechanical context; this ‘modern’ Cartesian
framework will emerge as the only one likely to make progress in medicine, and will replace Harvey’s own Aristotelian and vitalistic ideas. Descartes also opened the way to new lines of investigation, as with his study of the nerves, in *L’Homme* and the *Dioptrique*.

In this way Descartes demonstrated his aim of systematising the field of medicine. This is apparent, for example, at the end of the fifth Discourse of the *Dioptrique*, where he gives mechanical explanations for the transmission of images through the human body, in order to explain birthmarks that ‘excite so much the admiration of all the Learned (Doctes)’. In this Discourse, dealing with ‘the images that are formed on the back of the eye’, Descartes invokes a ‘small gland’ located in the middle of the concavities in the brain, where the ‘common sense’ is located. Here the *Dioptrique* is complementary to the *Discours*, in not naming this gland – although any reader familiar with controversies in cerebral anatomy can identify it from these two texts as the pineal gland or conarium. This example demonstrates that Descartes was willing to declare himself on complex and controversial topics in medical treatises, regarding to the possibility of locating within one single centre in the brain the mental faculties (the famous internal senses) of memory, imagination and reason. The expression used by Descartes at the very beginning of the *Discours* – ‘some other difficulties pertaining to medicine’ – is to be understood in the context of these controversies, which relate to theological debates. The anatomical indications of brain structure alluded to in the *Discours*, and more precisely in the *Dioptrique*, illustrate Descartes’ wish to clarify and explain some ‘difficulties’ in medicine. The same holds for the passage, at the end of the third Discourse of the *Dioptrique*, in which he rejects ‘the peculiarities (…) with which anatomists usually thicken their books’. This critical statement which appears after a remark about the ‘six or seven muscles which are attached to the eye’, suggests that Descartes has in mind the lack of agreement among his immediate predecessors and contemporaries as to the number of oculomotor muscles, the statements made about their evocative names, and, above all, the views about man, who contemplates the sky and has six eye muscles, whereas the beasts, which always look down, have a seventh one which keeps the eye from falling out of its orbit.

The pages which Descartes devotes to medicine show what is at stake with the publication of the *Discourse* and the *Dioptrics*. The deliberations on man, based on a profound study and redistribution of topics already approached in the unpublished treatise, centre on the transformation of both the status of medical discourse and of the place occupied by physiology and medicine in the field of knowledge. Descartes’ medical explanations, grounded in the laws of physics (which includes physiology), and the comparisons he draws in order to explain the motion of the heart, as well as the sense of sight, represent a new way of considering medical questions. Rejected from the traditional treatises is not only the idea of
man as a microcosm, but also the conception of man as the ‘end of all created things’. Descartes rejects the search for final causes, as can be seen from his rewriting of Harvey’s description of the valves of the heart, as we have already noticed, and from his reply to Gassendi, who raised objections to Descartes’ rejection of final causes in physics in the Fourth Meditation. Gassendi clearly reintroduced the concept of finality when he wrote to Descartes that ‘we know that certain great thinkers have been led by a study of anatomy not just to achieve a knowledge of God but also to sing thankful hymns to him for having organized all the parts and harmonized their functions in such a way as to deserve the highest praise for his care and providence’. Gassendi followed traditional medical discourse in admiring the ‘superb’ functioning of the valves in the heart and praising ‘the ineffable Providence which has so appositely designed the valves for this function’. In his reply, Descartes writes that ‘we cannot guess from this what purpose God had in creating any given thing’. Descartes contrasts physics where ‘such conjectures are futile’ with ethics ‘where we may often legitimately employ conjectures’ and where ‘it may admittedly be pious on occasion to try to guess what purpose God may have had in mind in his direction of the universe’.

Reasoning thus, Descartes prescribes a totally new way of approaching the question of man in medicine. At the beginning of his study of anatomy, and later on in the Description, he quotes the ancient injunction ‘gnôthi seauton (Know thyself)’, which had a medical application from the sixteenth century onwards, in order to justify the study of the human body – but at the same time he rejects the interpretations that had been linked to it. This injunction is inseparable from a consideration of the place of man in the universe, as justified by the microcosm-macrocosm parallel, and its significance is revealed by the context in which it is quoted, either in the context of praising God, or in the moralising context of pointing out the certainty of the body’s ending as dust. Knowledge about the body is characterised in Descartes’ works by a mechanistic explanation of its functions, which justifies the use of the expression ‘there is no wonder’ and is evidence of the rejection of the devotional perspective of praise of the Creator in medicine. The latter, especially among Christian physicians, entails giving due praise to God, and entails the thesis that knowing oneself is knowing God, ‘cognitio sui-cognitio Dei’. The Historia Anatomica of Laurentius opens with a demonstration of ‘the dignity of man, the excellence of anatomy’, the affirmation that ‘there is nothing accidental (fortuitous) in the structure of the body’, and continues with chapters entitled ‘How profitable anatomy is to the knowledge of man’s self’ and ‘How profitable anatomy is to the knowledge of God’. Caspar Bauhin also invokes the maxim ‘Know thyself’ in his Theatrum Anatomicum. His aim is to convince the reader both that it is noble to practice dissection, and that the body is as worthy of study as the soul. The invocation of the Delphic precept with its double meaning – on the one hand, the
praise due to God, who created such a wonder as the human body, and, on the other hand, the statement of man as a microcosm – is not inconsistent with Galen’s works, or with the texts coming out of the Galenic tradition, which marvel at the admirable structure of the human body in order to reveal ‘the wisdom, the power and the goodness of the Creator’.105 These texts concur in the ontological dignity of man asserted in neo-Platonist humanism, and all these themes can be found in the works of Bauhin, which Descartes had read. In such a context, the dissociation that Descartes establishes between reasoning about medicine and teleological or theological considerations is clear, as can be shown from the study of the motion of the heart (already mentioned), and from the study of vision. Descartes’ works contain no judgments about ‘the excellence of the eyes’ such as open the study of vision in the Historia Anatomica of Laurentius (‘As sight is admirable in its action, so the organ of sight is beyond any wonder.’106)

Descartes also rejects the other anatomical application of the Socratic maxim ‘Know thyself’, as it relates to the ephemeral nature of human life. The most notable illustration of this, in terms of a pessimism strongly impregnated with gruesome moralising, is to be found in the inscriptions on the banners held by the images of skeletons standing around the galleries of the famous anatomical theatre at Leiden (Figure 15.7), a university that was a centre of Calvinist asceticism.107 During the first third of the seventeenth century, in both Protestant and Catholic countries, death in its most sordid aspects was omnipresent – and not only in medical treatises. One consequence of Cartesian dualism was to banish speculation about the mysteries of the separation of soul and body which was given such prominence, and to explain in terms of mechanics the extraordinary feats sometimes performed by parts of corpses, to which in those days sensitivity was commonly attributed (as shown in the Discours108).

The originality of Descartes’ biological ideas is also seen in another consequence of the affirmation of dualism: specifically, the statement, in the fifth part of the Discours, of the difference between man and the beasts. In establishing this difference with respect to the rational soul and language, Descartes is once again attacking the medical tradition. In their search for what determines the peculiar dignity of man, physicians had disputed about human reason and the human hand, echoing Aristotle, and emphasising, after Galen, the function of the hand. Rembrandt’s famous painting ‘The Anatomy of Dr Tulp’ (see Figure 15.1) reveals the importance attached to the human hand. If Tulp suggested that Rembrandt should portray him dissecting the muscles moving the fingers of the human hand, this was because the scene had to be associated with the exceptional significance of the hand in medical texts. These books refer to Aristotle directly by quoting the passage about the hand as ‘organum organorum’ or, indirectly, via Galen and the many pages he devoted to the hand in the De Usu Partium,109 in relation to Aristotle and finalism.
Descartes introduces further innovations with his analysis, in the Sixth Meditation, of the phantom-limb syndrome, which in no way affects the unity of the soul, and then with the description, in his Principia (Part IV, art. 196) of a young girl who complained of various pains in her fingers when bandages were placed on the arm from which the hand had been amputated. According to Descartes, this case proves that ‘pain in the hand is felt by the soul not because it is present in the hand, but because it is present in the brain’. It also entails the rejection of the traditional ‘qualitatem dolorificam’ (the so-called ‘quality’ of pain) that Fromondus put forward in objecting to Descartes’ argument. Extending the analysis of sensation given in the Dioptrique (Discourse IV), this example echoes the correspondence with Descartes on the Discours and the Essais.

Descartes’ influence in medicine: mechanism and the circulation of the blood

After the publication of the Discourse and the Essais, it was Cartesian anthropology, grounded in a mechanistic definition of life, that gave rise to reactions among the first readers. The objections of Fromondus and
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Plempius in the autumn and winter of 1637–8 demonstrate the repercussions of the fifth part of the Discours, and of some pages in the Dioptrique. When the Discours was published Fromondus was teaching philosophy at Louvain, and Plempius, who had begun as a physician in Amsterdam, where he had undertaken dissections with Descartes, was teaching medicine at Louvain. It should be noted that although the Discours had been published anonymously, Descartes’ name, in Latin, was quoted in September 1638 in a treatise on medicine: in his Fundamenta Medicinae Plempius published, although not in their entirety, the answers Descartes had given to his objections about the cause of the motion of the heart.

Soon after the exchange with Plempius and, indirectly, with Fromondus, the immediate result of the medical issues discussed in the Discours and the Dioptrique also became evident in the case of the physician Henri de Roy, known as Regius. Regius was appointed professor of medicine at Utrecht in 1638, due to his success in giving private lectures in physiology in which he applied the principles of the Discours and the Essais. After an exchange of letters, Regius decided to submit to Descartes the medical theses he was formulating in order to have them defended by his students at Utrecht. Thus Regius, a teacher of medicine, was behaving as though he was a student of Descartes, as can be seen from the letters he wrote to him, as well as from Descartes’ answers, from 24 May 1640 onwards, when Descartes pointed out the modifications that Regius should make to his theses. I have shown elsewhere, that Descartes’ contribution to the writing of these theses was so important that in 1641 he was in fact the co-author (who wished to remain hidden) of a great part of the corpus known under the title Physiologia. Regius later borrowed many passages from this material in his published books, particularly in his Fundamenta Physices of 1646. Thus Descartes’ influence on Regius’ Physiologia is to be found far beyond the three explicit references to Cartesian writings. The Physiologia borrows from the Discours the ‘fire without light’ (ignis non lucidus) in the heart, the explanation of the circulation of the blood and of the motion of the heart, and the references to ‘clocks and other automata’, and from the Dioptrique the affirmation that it is ‘the soul that has sensory perceptions and not the body’.

The Physiologia fits perfectly in this critical moment in the history of medicine: without giving up the traditional content and enumerations in medical treatises, it introduces major innovations, such as mechanical explanations derived from the Discours, and the circulation of the blood. It should be noted however that the passages concerning the circulation of the blood do not mention the name of Harvey, its inspired discoverer. The reason is that these passages summarise not Harvey’s book, but, with one minor difference (in the order of presentation), the proofs given to demonstrate the circulation of the blood in the Discours. Since Regius is following Descartes, and not Harvey directly, there is no mention in the Physiologia of the reference to Aristotle in the definition of the circulation
of the blood. Descartes’ influence is also felt in Regius’ discussion of diastole and systole in their traditional meaning, which Descartes still retains instead of the new definitions given by Harvey. Following Descartes, Regius argues that the heat in the heart is a fermentation comparable to the heat ‘in damp hay (in foeno humido)’.

As the publication of the Discours had already done, Descartes’ contribution to the writing of these medical theses played a part in propagating the discovery of the circulation of the blood. Descartes’ acceptance of the circulation of the blood, his disagreement with Harvey on the cause of the motion of the heart, both in the Discours and in his long epistolary discussion with the physician Plempius, his precise description of the physiology of vision in the Dioptrique, the ‘correspondence course’ given by Descartes to Regius, all lead us to regard Descartes, from 1637 onwards, as a privileged participant in medical discussion, and to acknowledge his important role in medicine in the first half of the seventeenth century. Harvey himself acknowledged the importance of the Cartesian analysis of the motion of the heart, when he discussed it in his second Reply to Jean Riolan the Younger in 1649, which contains the famous address to Descartes.117

Descartes’ ideas on medicine were important not only during his lifetime, as shown by the letters to the physicians Meyssonnier, in 1640, on the conarium, and to Vorstius, in 1643, on the animal spirits, but their influence continued after his death, with the posthumous publication of L’Homme and the Description. When publishing these texts in 1664, the latter with the subtitle ‘On the Formation of the Fœtus’ (a title corresponding in part to Descartes’ text), Clerselier draws attention to the Cartesian ideas on embryological questions, or, in seventeenth-century terms, on the generation of animals.118 The complementary nature of these two texts is clear; although Descartes had given up trying to explain reproduction and embryogenesis in L’Homme,119 he was to return to this question many times, which required ‘free time and the convenience of practising some experiments’.120 Thus his failure to complete the Principia should be reconsidered, especially since one must add to these texts the unpublished papers reporting and explaining Descartes’ anatomical experiments, and many pages of his correspondence, which confirm the philosopher’s exceptional interest in the human body, and in the most complex questions of anatomy, physiology and embryology. In his Primae Cogitationes circa Generationem Animalium, Descartes reflected on the causes of the generation of monsters, and, in an important passage, evoked the laws of Nature which he had discussed in Le Monde. He asks: ‘But, really, what more important causes can we have than the eternal laws of Nature? Is it that we would have these causes resort to some Mind? But to what Mind? Or immediately to God himself? Why are there sometimes monsters?’122 Without trying to represent Descartes as one of Darwin’s forerunners, as Fouillée tried to do in 1893,123 the novelty of this
statement is noteworthy, and all the more remarkable when contrasted with the theological or astronomical-astrological explanations, appeals to variations in the seed, and imagination found in traditional medical treatises.124

Descartes’ attempt to rid the medical field of the difficulties and controversies he had to deal with had a lasting influence upon physicians. The reason for this is that Descartes, despite certain errors, had given a spur to experimental research, and had played a part in the vast task of founding a ‘renovated’ anatomy and a physiology based on new and more fruitful concepts.

Descartes’ influence was felt throughout Europe. In Germany, it was apparent both in philosophy and in medicine, for instance in the teaching and writings of Johannes Clauberg, from 1651. In Paris, a Treatise on the Fevers was published in 1664, based on Descartes’ principles, as well as Le Monde de Mr. Descartes.125 The Cartesian mechanistic view, linked to the discovery of the circulation of the blood, became the prevailing view in France in demonstrating human anatomy thanks to the teaching and writings of Dionis, from 1673. Dionis also borrowed from Descartes ‘the fire without light in the heart’, some mechanical comparisons to explain the functions of the body, and the structure of the nerves.126 This Cartesian influence persisted. In 1776 for instance, P. Fabre’s Recherches sur la Nature de l’Homme, published in Paris quotes Harvey’s (written Harvée) discovery of the circulation of the blood in the section devoted to the ‘Observations on the circulation of the blood’; in the same sentence, this discovery is said to entail that the body is to be considered merely as a hydraulic automaton.127 Although Descartes is not directly quoted in this section, linking the discovery of the circulation of the blood to automata was a Cartesian notion.

Descartes is also numbered among major new physicians in Thomas Bartholin’s treatise Anatome quartum Renovata, published in Lyons in 1677. With its division into four books, followed by four booklets linked with each of the books, the whole book proves how difficult it was to write a coherent anatomical treatise after the discoveries of the circulation of the blood and the lacteal veins. For instance, Descartes’ medical ideas are quoted on the movement of the heart, on the fire without light, on the pineal gland (where the common sense and imagination are located), on the function of the crystalline humour, and on the nerves. But Bartholin also writes that no anatomist has been able to see the valves which Descartes supposed to exist in the nerves.128

The Italians Borelli and Baglivi borrow from Descartes the comparison of the vessels with hydraulic automata, and Malpighi considers Descartes as a genuine innovator in medicine, the first to give mechanical explanations of vital phenomena.129

Richard Lower, in his Tractatus de Corde (published in 1669, twenty years after Harvey’s letters to Riolan), clearly quotes Descartes, but mainly
to refute his theories about the motion of the heart. As for the chemist Robert Boyle, in his Christian Virtuoso,\textsuperscript{130} he refers to Descartes among ‘writers of dioptricks’ for the study of the different parts in the eye. In 1694, the part of L’Homme dealing with the eye is quoted by Nicolas Hartsoeker in chs. 6 and 7 of the Essay de Dioptrique, published in Paris. Descartes’ medical thoughts also had a complex influence on many authors of the eighteenth century, of whom Buffon is a prime example.\textsuperscript{131}

But since Descartes’ biological writings are inseparable from his reflections on what he considers metaphysics, the influence of his medical thinking was not restricted to the field of medicine. During Descartes’ lifetime, the philosophical writings of Henry More question the Cartesian definition of life as something without any connection with the soul, as well as some aspects of Descartes’ dualism\textsuperscript{132}: that dualism which would also be extensively discussed, for instance, by Malebranche, who was converted to philosophy by reading L’Homme.

Notes

1 Some of the material used in this paper was first read at the Conference in the honour of Marjorie Grene, held at the University of Dijon in May 1995 (forthcoming publication by Jean Gayon and Richard M. Burian), and another part was read at the ‘Descartes and the Renaissance’ conference held at the University of Tours in March 1996 Descartes et la Renaissance, ed. Emmanuel Faye (Paris, H. Champion), 323–47. I referred to some parts of these two French papers in my Introduction to Descartes: Le Monde et L’Homme (Paris, 1996), as I also did in October 1996, when I was invited to Oxford University (Philosophical Society and Department for Continuing Education) to lecture on ‘Descartes, Harvey and Renaissance Medicine’, in the course organised by Michael Lockwood on ‘Descartes: Philosopher-Scientist’. Marjorie Grene and Michael Lockwood are warmly thanked for their fruitful observations on a preliminary version of this paper. Many thanks to Theo Verbeek for his help in obtaining copies of Rembrandt’s painting and of the anatomical theatre at Leyden, and to the librarians in the Réserve of the Bibliothèque Interuniversitaire de Médecine (BIUM) in Paris especially to Bernadette Molitor. I am deeply indebted to Stephen Gaukroger for many linguistic emendations. The remaining mistakes are mine.

2 Cf. AT vi. 1.

3 AT vi. 46 (line 26) to 55 (line 3), the fifth part beginning page 40 (line 21), and ending page 60 (line 3).

4 In his writings Descartes generally uses the word ‘médecine’. His use of this term also refers to our present conception of physiology. Descartes only made use of the term ‘physiologie’, ‘physiologia’ in his correspondence (cf. AT iii. 95, and iv. 240), dealing with Regius, a Dutch physician. And it was to discuss the medical theses reorganised under the heading ‘physiology’ that Regius consulted Descartes. These theses were called Physiologia, and referred to the traditional parts of medicine, which were: anatomy, physiology – which in those days meant the study of the natural and healthy parts of man (Physiologia sive cognitio sanitatis’ is the complete title of these theses) – and pathologia. We shall speak of these theses later in this paper.

5 AT vi. 50.
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6 Kepler’s name is not quoted in the *Dioptrique*, though this title refers to Kepler’s *Dioptrice*.

7 For instance, the ‘venous artery’ corresponds to what we now identify as the pulmonary veins, and the ‘arterious vein’ corresponds to what is now known as the pulmonary artery. For more details, see Annie Bitbol-Hespériès, *Le Principe de Vie chez Descartes* (Paris, 1990), 57–63.


10 AT vi. 46.

11 See *Le Principe de Vie chez Descartes*, op. cit.

12 See to Beverwick, 5 July 1643, AT iv. 4; To Newcastle, April 1645, AT iv. 189.

13 See Part I, art. 7.

14 AT xi. 239.


16 AT i. 102.

17 For Descartes as an ‘amateur’ in medicine, see for instance, Lindeboom, *Descartes and Medicine* (Amsterdam, 1979), 70 and 81. Taking an opposite view to Lindeboom’s statement is Stephen Gaukroger’s, in *his Descartes, an Intellectual Biography* (Oxford, 1995), where Gaukroger notes that Descartes’ ‘extensive anatomical investigation … shows him to have been a thorough and careful observer’ (270).

18 For instance Plempius, Regius, and Vorstius, who taught medicine in the Low Countries, and Meyssonnier, a French physician.


20 AT i. 137.

21 AT ii. 525.

22 *De Humani Corporis Fabrica* (Brussels, 1543), Foreword.

23 Ibid., Foreword, ‘… emortuam humani corporis partium scientiam’.


26 Tulp (1593–1674), whose actual name is Claes Pieterszoon, or Nicolaus Petreus. This public anatomical demonstration is the second one in Tulp’s career.


28 Cf. Latin and German editions of the *Epitome*.

29 Cf. letter to Mersenne, 13 November 1639, AT ii. 621.

30 AT i. 263.

31 Letter to Meyssonnier, 29 January 1640, AT iii. 19–20; and to Mersenne, 1 April 1640, AT iii. 47–8.

32 AT xi. 120.

33 Ch 4, pp. 25–6 of first edition.

34 Cf. *Prelectiones Anatomiae Universalis*. 
35 AT iv. 555.
36 See my notes to the second volume of the forthcoming Pléiade edition of
Descartes’ Primae Cogitationes circa Generationem Animalium.
37 For further details, see Le Principe de Vie chez Descartes, op. cit., p. 91–4.
38 See H.B. Adelmann, The Embryological Treatises of Hieronymus Fabricius (Ithaca,
39 Cf. Études sur le Rôle de la Pensée Médiévale dans la Formation du Système Cartésien
40 AT i. 254.
42 Cf. AT vi. 41, Le Monde, AT xi. 3.
43 See Le Monde, ch. 4, Principia, II, art. 33, and IV, 65, and Météores Disc I and II
on subtle matter.
44 Jacques Roger, Les Sciences de la Vie dans la Pensée Française au XVIIIe Siècle
45 De Occulta Philosophia libri tres, 1533, lib. II, cap. XXVII, pages CIII, and CV.
46 Fludd, Utriusque cosmi, II (De microcosmo interno), 1619, Tractatus I, lib. VIII,
48 Cf. Paralipomena ad Vitellionem, cap. I, prop. XXXII, and Astronomia Nova,
ch. XXXIII.
51 For instance by L. Chauvois, W. Harvey (Paris, 1957), 64–5 and 184.
52 Cf. AT i. 322.
53 De Motu Cordis, ch. 2.
54 AT xi. 243.
56 Cf. Part V, and letter to Plempius, 15 February 1638, AT i. 527 and AT xi.
241–5. For further details, see Le Principe de Vie chez Descartes, op. cit., 68–71.
57 Cf. first edn., 42. The English translations are from the Whitteridge ed.
58 Cf. Fludd, Medicina Catholica, 1619. Walter Pagel was the first to draw attention
to Fludd with reference to Harvey’s discovery: W. Pagel, ‘Religious motives in the medical biology of the XVIIth Century’, Bulletin of the History of
Medicine, vol. 3 (1935), 277. Cf. W. Pagel, William Harvey’s Biological Ideas
59 W. Pagel, William Harvey’s Biological Ideas, op. cit., 113.
60 AT vi. 47.
61 AT vi. 48.
62 Cf. De Motu Cordis, cap. 6, 8, 17.
63 Cf. C.D. O’Malley, Andreas Vesalius of Brussels (Berkeley, 1964), 139.
64 Cf. 1543 edition, for instance in the foreword, and Bk I, cap. IV, p. 11, cap. V,
p. 17 (‘capitis structura’).
65 The word ‘admiratio’ and words derivating from it can be frequently found,
66 Ibid., 26 ‘... rerum Opifex’, 58, passim.
68 Ibid., ‘... Naturae providentiam in digitorum articulis contemplari ...’ (123).
70 Ibid., lib. II, cap. II on the muscles in the hand, p. 219.
71 Vesalius wanted his treatise to be useful both to physicians and to artists. But
the influence of his treatise went far beyond and showed the connection
between things medical and ecclesiastical. In 1550, Henry Bullinger, the Swiss
reformer, dedicated sermons to King Edward VI, the English sovereign. God, wrote Bullinger, is known by his works, ‘... and the workmanship or making of man, which Lactantius and Andreas Vesalius have passingly painted out for all men to see ...’ Cf. M.H. Fisch, ‘Vesalius in English State Papers’, Bulletin of the Medical Library Association, vol. 33 (1945), 253, n. 54. After his reading of Vesalius’ treatise, Philip Melanchthon, Luther’s close colleague and the main reformer of teaching in Protestant Universities, wrote in 1552, in a copy of the Fabrica, a poem about cosmology, anatomy and theology. In the twenty-eight lines of his poem, he wrote about God who ‘shaped’, ‘maintains and fashionings everything in logical design’ in the world, and about the human body: ‘... the body’s several parts/Came not together aimlessly as if devised by chance:/With purpose God assigned to each its own allotted task/And ordered that man’s body be a temple to Himself/So Holy Wisdom casts its rays within our human minds/And sways our thoughts with light divine emitted from His word...’. Cf. Philippus Melanchthon, De Consideratione Humani Corporis, Flyleaf prefixed to the Fabrica now in the USA Army Medical Library, quoted in D.M. Schullian, ‘Old Volumes Shake Their Vellum Heads’, Bulletin of the Medical Library Association, vol. 33 (1945), 440. The same idea of the human body as a temple appears in Melanchthon’s Oratio de Arte Medica, in Encomia Medicinae Des. Erasmi Roterodami, Hieronymi Cardani, Philippi Melanchthonis (Rotterdam, 1645), 130–1.

72 Cf. De Motu Cordis, chs. 6, 8 (on the final cause of the movement of the heart p. 42), and ch. 17.
73 AT xi. 36–7.
74 See, for instance Salomon de Caus, Les Raisons des Forces Mouvantes avec Diverses Machines tant Utiles que Plaisantes auxquelles sont adjoints plusieurs Dessins de Grottes et Fontaines (Frankfurt, 1615).
75 AT vi. 59.
76 Cf. AT xi. 153, 268, AT iii. 262.
77 AT vi. 57.
78 AT vi. 45–6.
79 AT vi. 46.
81 Institutiones Anatomicae (1632), Anatome quartum renovata (1677).
83 Meditationes, AT ixA, 19, and vii. 24.
84 Cf. Discourse, AT vi. 59, and end of sixth Meditation.
85 Cf. Passions, art. 2 and 6, Description, Foreword.
86 Passions, art. 139.
87 AT vi. 54.
88 Le Monde, AT xi. 107, 109 and 110.
90 Letter of 31 March 1638, AT ii. 86.
92 AT i. 102.
95 AT vi. 129.
97 AT vi. 108.
99 Cf. Laurentius, L’Histoire Anatomique, Book I, beginning of the first chapter; see also C. Bauhin, Theatrum Anatomicum (1621 edn.), praefatio, p. 2, about the theme of man ‘alii vero rerum omnium finem’.
100 AT vii. 55; AT vii. 309. Descartes will also discuss the conception of man as ‘the end of creation’ later: cf. to Chanut, 6 June 1647, AT v. 53–54, and Principia, III, arts. 2–3.
101 AT vi. 375.
102 Cf. letter to Mersenne, 15 April 1630, AT i. 144, and Description, AT xi. 223. On this point, see my ‘Connaissance de l’Homme, Connaissance de Dieu’, op. cit.
104 See Theatrum Anatomicum, where the ‘know thyself’ is quoted in Greek. Cf. Epistola deductoria, p. 4 (verso) in 1605 edn., and p. 2 in 1621 edn.
105 Cf. for instance De Usa Partium, lib. II, cap. X.
107 On these detailed prints of 1609 and 1610, see my ‘Connaissance de l’Homme, Connaissance de Dieu,’ op. cit.
108 AT vi. 55.
110 Letter from Fromondus, 13 September 1637, AT i. 406.
111 Cf. letters from Fromondus to Plempius, 13 September 1637, AT i. 406; from Descartes to Plempius for Fromondus, 3 October 1637, AT i. 420, and Principia, IV, art. 196.
112 Plempius will only publish these letters in their entirety in 1644, in a second edition, after Regius’ criticisms. They will also be republished in 1654.
113 Cf. letter to Mersenne, 23 August 1638, AT ii. 334.
115 AT vi. 109.
116 Nor is Harvey referred to either in Fundamenta Physics or in Philosophia Naturalis.
118 Cf. the editions of 1677, and 1680, and the translations into Latin (a new one for L’Homme, whose first edition appeared in 1662, joined with La Formation du Fœtus), in 1686 et 1692. Cf. also the 1697 Frankfurt edition, Opera philosophica.
119 Letter to Mersenne, June 1632, AT i. 254.
120 Letter to ***, 1648 or 1649, AT v. 261.
121 See Part IV art. 188: AT ixB. 309.
122 AT xi. 524.
123 See his Descartes (Paris, 1893), 67.
125 Its author is Rohault.
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128 Cf. in particular, 364–5, 384, 497, 520, 660–1, and 664.
129 Opera posthuma, 1662, introductory discourse.