A brief visit to William Harvey
Michael Hunze
# Table of Contents

1. Introduction.................................................................................................................................3
2. Sources .........................................................................................................................................3
3. Biographical information.............................................................................................................3
   3.1 Childhood, youth and education.............................................................................................3
   3.2 Padua .......................................................................................................................................4
   3.3 Return to England ..................................................................................................................5
   3.4 Marriage ..............................................................................................................................6
   3.5 Harvey's role at the Royal College of Physicians.................................................................7
   3.6 Harvey as a lecturer..............................................................................................................9
   3.7 Physician at court ..................................................................................................................10
   3.8 Harvey personally ................................................................................................................10
   3.9 Civil Wars ............................................................................................................................12
   3.10 Old age and death ..............................................................................................................13
4. Portraiture of William Harvey ....................................................................................................15
5. Scientific work.............................................................................................................................19
   5.1 De motu cordis ......................................................................................................................20
   5.2 The direct impact of De motu ..............................................................................................26
   5.3 Competitors ........................................................................................................................28
   5.4 Harvey's fields of interest - besides the circulation............................................................28
6. Influences - what made Harvey Harvey? ..................................................................................30
7. Bibliography ...............................................................................................................................32
8. References ....................................................................................................................................33
9. List of illustrations .......................................................................................................................33
1. Introduction
One of the most eminent characters in the history of medicine is the English physician William Harvey, who is first and foremost remembered for being the first scientist of the occident to describe the circulation of the blood.

Much has been written about William Harvey, his work and the changes he has brought about in science and medicine. This small piece is an attempt to highlight a few of these observations in order to give a brief summary of William Harvey's life and work. It starts with a biographical outline of Harvey's life, in which some thought is also given to Harvey's personality. As an afterthought, some observations made by Geoffrey Keynes about the portraiture of William Harvey have been summarized. We proceed to look at Harvey's scientific work and finish with some speculations on how this work came about.

2. Sources
Most of the biographical facts are based on The life of William Harvey by Geoffrey Keynes (Oxford 1966), which has been regarded the definitive biography since its publication. Further experts on William Harvey are Jerome Bylebyl, Walter Pagel, and Erna Lesky, in whose works much information about Harvey can be found. It is also worthwhile to read Harvey's original works, especially De motu cordis, of which translations have been made by Gweneth Whitteridge and Kenneth Franklin.

3. Biographical information

3.1 Childhood, youth and education
William Harvey was born in Folkestone, Kent, England, on April 1st, 1578\(^2\). He died on June 3rd, 1657, aged 79 years, either in London, or at Roehampton, Surrey, England.

He was the eldest son of one Joan Halke, of whom little is known, and Thomas Harvey, yeoman farmer and landowner, who later engaged in commerce and raised to the gentry\(^3\). Five of William Harvey's younger brothers enjoyed even greater success than their father as London merchants. A sixth was employed about the court of James I without achieving any great eminence. Harvey had also got two sisters. How it came about that in the first-

---

1 Geoffrey Keynes (1887 - 1982): Surgeon and author. Hunterian professor of the Royal College of Surgeons. Keynes is an authority concerning the life and work of William Harvey, having written the definitive biography (cf. Keynes 1966), for which he received the James Tate Black memorial prize.  
2 Keynes 1966, 6  
3 Keynes 1966, 1-5
born, William, developed so odd an interest as to become a medical pioneer and scholar, makes the wonder grow in our mind. William alone of the seven sons was notorious for his lack of interest in financial affairs and his total inability to strike an advantageous bargain. He did not die a poor man because his most prosperous brother, Eliab, managed his affairs for him, but he might as well have ended in poverty for all we know.

After receiving what was probably a rudimentary education by itinerant schoolmasters, Harvey went to the King's School, Canterbury. As he left this school at the age of 15, little is recorded about his doings there. After that, he was sent to Gonville and Caius College, Cambridge, where he studied arts and medicine from 1593 till 1599. The fact that his commercially-minded father sent him to Caius College may show that there has been even at this early point a scientific or even medical bent in young William's character, for Caius had an anatomical bias: It had been existent as Gonville Hall and was refounded in 1567 as Gonville and Caius College by Dr. John Caius, who was an eminent scholar, physician, and anatomist. Else, Harvey's interest in anatomy might have been founded at Caius.

In 1597, after four years at Caius, Harvey took his B.A. degree. During the following years, Harvey was absent from the college for long periods of time. The records at Caius show that he was dismissed from the college for months at a time between 1596 and 1599 for being ill. The nature of his illness is not recorded, but it is quite probable that it was malaria, quite a common condition around the Cambridge fens at the time. The last time Harvey excused himself from the college was October 30th, 1599.

3.2 Padua

Harvey was meant to return to Caius on January 30th the following year, but went instead directly to Padua, then one of the leading medical schools in Europe, famous both for anatomical and clinical teaching. It is assumed that the fame that Padua attained through

---

4 Keynes 1949, 9
5 Keynes 1966, 6-7
6 Keynes 1966, 9
7 Keynes 1966, 17-19
the work of Andreas Vesalius\textsuperscript{8} and Fabricius of Aquapendente\textsuperscript{9} attracted Harvey, postulating that Harvey had a strong interest in anatomy then already.

It is reported by various biographers that Harvey, during his years in Padua, had close relations to his teacher Fabricius. If this is true, Harvey must have been an excellent pupil, for Fabricius, as the most eminent anatomist in Europe at that time, would not have bestowed a friendship on any young man\textsuperscript{10}.

Another hint that Harvey was an exceptional personality even in his early twenties is that he was elected a \textit{Consiliarius} in 1600 and again in the next two years. The \textit{Consiliarii} were undergraduate students, each nation that was present at the college electing one or two from their midst, who formed the executive body of the college together with the Rectors. Thus, the undergraduates themselves exercised control over their courses and instruction and elected their own teachers, making Padua a "Student University"\textsuperscript{11}.

In April 1602, Harvey received his doctor of medicine, and in this is described in such fulsome terms that it seems almost too good to be true\textsuperscript{12}. This has in the past been taken as a sign that Harvey was a student of extraordinary brilliance, which he may well have been, but the terms in the diploma were conventional and convey nothing more than that the examiners thought him worthy to receive his degree\textsuperscript{13}.

### 3.3 Return to England

After receiving his doctor in medicine, he returned to England to be a practitioner in London. In theory, his diploma from Padua enabled him to practice medicine anywhere in Europe, but in fact it was necessary to gain entry into the Royal College of Physicians to be allowed to practise in London. An Act of King Henry VIII decreed in 1511 that no one was allowed to practise medicine in the City of London without having been examined -

\textsuperscript{8} Andreas Vesalius (1514 - 1564): Physician, revolutionized the study of biology and the practice of medicine by his careful description of the anatomy of the human body. He wrote and illustrated the first comprehensive textbook of anatomy (\textit{De humani corporis fabrica libri septem or Fabrica}, Padua 1543). Vesalius was the first to overthrow the tradition of relying on Galen and began to make his own observations and thorough observations instead, thereby making anatomy a scientific discipline.

\textsuperscript{9} Fabricius ab Aquapendente (1537-1619): Also known as Geronimo Fabricius or Girolamo Fabrici, this surgeon helped to found modern embryology. He delivered the first detailed description of the placenta in \textit{De formatu foetu} in 1600 and was engaged in comparative embryology. He spent most of his life at Padua university, where he followed Fabricius to the Chair of surgery and anatomy. He made the first ever descriptions of the valves of the veins in the human body in \textit{De venarum ostiolis} in 1603.

\textsuperscript{10} Keynes 1966, 27

\textsuperscript{11} Keynes 1966, 22-23

\textsuperscript{12} By a happy chance Harvey's diploma has survived. J.F. Payne, Harveian Librarian, edited a facsimile reproduction of the document together with a translation in 1908. (Keynes 1966, 32)

\textsuperscript{13} Keynes 1966, 32
this was because the number of untrained doctors or quacks had risen so much that they were regarded a public danger. The Act was followed by similar ones from the following rulers, and they were enforced through fines and imprisonment.

Harvey first appeared for examination at the Royal College on May 4th, 1603. On this occasion, the College Annals record that "his replies to all questions were entirely satisfactory when he was examined. Nevertheless he was put off until another time, with our tacit permission to practice."\(^{14}\) It remains somewhat nebulous why Harvey was refused entry to the Royal College in spite of being "entirely satisfactory", and in what way a "tacit" permission is tacit when it is recorded in the College Annals. There followed two more examinations, one in April 1604 and one in May, in both of which Harvey gained the approval of the examiners. After these, fees had to be paid and oaths to be sworn, and finally, on the 5th of October, 1604, Harvey became a \textit{permissus} and was free to practise medicine under the jurisdiction of the Royal College of Physicians\(^ {15}\).

### 3.4 Marriage

On November 24th, 1604, Harvey married one Elizabeth Browne, daughter of Lancelot Browne, a prominent London physician. Little is known of Elizabeth Browne, apart from the often-told story of her tame parrot\(^ {16}\). As far as it is known, the marriage did not yield any children, and consequently we do not know a lot about the Harveys's domestic life. It is not even sure when Mrs Harvey died. She must have been alive in 1645, when she

\(^{14}\) cit. according to Keynes 1966, 39

\(^{15}\) Keynes 1966, 35-40

\(^{16}\) The story about the parrot has no historical significance whatsoever. It is nevertheless charming and provides food for thought concerning Harvey's personality. That is why it is included here as a footnote. Mrs Harvey possessed a very accomplished and supposedly male parrot. It is interesting that William Harvey made use of this bird in his treatise on generation (\textit{De generatione animalium}, 1651), although it would be rash to assume that the childless couple used the parrot to substitute what they missed. Harvey himself wrote of the parrot:

"A parrot, a handsome bird and a famous talker, had long been a pet of my wife's. It was so tame that it wandered freely through the house, called for its mistress when she was abroad, greeted her cheerfully when it found her, answered her call, flew to her, and, aiding himself with beak and claws, climbed up her dress to her shoulder, whence it walked down her arm and often settled upon her hand. When ordered to sing or talk, it did as it was bidden even at night and in the dark. Playful and impudent, it would often sit itself in my wife's lap to have its head scratched and its back stroked, whilst a gentle movement of its wings and a soft murmur witnessed to the pleasure of its soul. I believed all this to proceed from its usual familiarity and love of being noticed, for I always looked upon the creature as a male on account of its skill in talking and singing (for amongst birds the females rarely sing or challenge one another by their notes, and the males alone solace their mates by their tuneful warblings) [...] until not long after the caressings mentioned, the parrot, which had lived for so many years in health, fell sick, and by and by being seized with repeated attacks of convulsions, died, to our great sorrow, in its mistress's lap, where it had so often loved to lie. On making a post-mortem examination to discover the cause of death I found an almost complete egg in its oviduct, but it was addled."

cit. acc. to Keynes 1949, 13-14
received a £100 legacy from her brother-in-law, John Harvey, and she must have been
dead in 1652, when Harvey wrote in his first will of "my dear deceased loving wife". Probably she died before 1647, as Harvey started to live at his brothers's residencies at that time. There used to be a portrait of Mrs Harvey, together with the famous parrot - sadly, this was destroyed in a fire in 1907.
Knowledge about Harvey's wife, marriage, and family life remains meagre after all17.

3.5 Harvey's role at the Royal College of Physicians

It might strike you as odd that the Royal College of Physicians, who were so reluctant to let Harvey practice, elected him as Fellow already in 160718. Shortly after that, in 1609, he secured the eminent position of Physician to St Bartholomew's Hospital, a position he held for thirty-six years. His duty at St Bartholomew's was to come in at least once a week to see all the patients that were considered in need of the advice of a physician, and to prescribe their medicines. He was also supervisor to a number of surgeons who operated on the patients19. Harvey took an active part in the political activities of the Royal College of Physicians for the rest of his life. Those activities consisted at that time largely of enforcing action against empirics and apothecaries who dealt out medicine without prescription, and against surgeons who trespassed to internal medicine20. The quarrel with the apothecaries was especially bitter and was never resolved during Harvey's lifetime21. The animosity between the Royal College and the medical semi-professionals was reciprocal: There was an occurrence in 1632 when the Apothecaries Society accused Harvey to be responsible for the death of a patient at St Bartholomew's Hospital. Another time, in 1635, the Company of Barber-Surgeons accused Harvey of having overlooked a skull fracture in a patient, instead treating her for "foulenesse of the stomacke" - both treatment and accusation were to no avail as far as we know22.

17 Keynes 1966, 43-48
18 Keynes 1966, 42
19 Keynes 1966, 51-54
20 Webster, 4-5
21 Keynes 1966, 81-83
22 Keynes 1966, 65
These were the positions Harvey held at the Royal College:

- **1615 - 1656**: Lumleian lecturer of surgery and anatomy; he also held anatomical demonstrations. Much of what we know of Harvey today springs from his lecture notes, which date from around 1616 and are lucky to have survived. They were, alas, not written for posterity: the handwriting is terrible, the spelling is inconsistent, the notes are an almost casual mixture of Latin and English, and thus incredibly difficult to understand and interpret. Only in 1964, a translation was made by Dr Gweneth Whitteridge.

- In 1613, Harvey was appointed Censor at the uncommonly early age of thirty-five, an important office because it involved safeguarding the practice of medicine in London against the quacks and empirics.

- In 1627, he became one of the eight Elect of the College. These formed the board that decided who was allowed to practice medicine.

- In 1628, Harvey was made Treasurer to the College. He could then only advance one step higher in the hierarchy by becoming president, an office which he never actually attained, probably due to the troubled times and his constant attachment to the person of the King. The office was offered to him in 1654, but he gracefully declined owing to his advanced age.

- After 1630, his duties as royal physician somewhat curtailed his participation in the business of the college.

- In 1651, Harvey donated a congregation and library building to the College. The building was completed in 1654 and destroyed in the Great Fire of 1666.

- In 1656, Harvey made an endowment for the wages of a librarian and an annual oration, that is held to this day. In making this gift, Harvey intended that there should be an annual feast at which a Latin oration should be spoken in order to commemorate the benefactors of the College and to encourage the Fellows to study and search out the secrets of nature by way of experiment. This is most significant, for it goes to show that Harvey was much in favor of the new empirical science.

---

23 The position of Lumleian lecturer, incidentally, was founded by John Lumley, the sixth Lord Lumley, in 1582, because he feared the abuse of the good name of surgery by quacks, and wanted a good and regular lecture established. Harvey succeeded Thomas Davies in this position.


25 Keynes 1949, 23

26 Keynes 1949, 37

27 Payne, 158
3.6 Harvey as a lecturer

We have reason to assume that Harvey was an avid and a good lecturer. In his notes, he sets himself eleven principles for lecturing. Some of them were:

To supply only by speech what cannot be shown on your own credit and by authority.

To cut up as much as may be in the sight of the audience.

To enforce the right opinion by remarks drawn from far and near, and to illustrate man by the structure of animals according to the Socratic rule.

To bring in points beyond mere anatomy in relation to the causes of diseases and the general study of nature, with the object of correcting mistakes and of elucidating the use and actions of parts; for the use of anatomy to the physician is to explain what should be done in disease.

Not to praise or dispraise other anatomists, for all did well, and there was some excuse even for those who are in error.

To state things briefly and plainly, yet not letting anything pass unmentioned which can be seen.

To serve in their three courses according to the glass (i.e. the hour-glass). In the first day's lectures the abdomen, nasty, yet recompensed by its infinite variety. In the second day's lecture the parlour (i.e. the thorax). In the third day's lecture the divine banquet of the brain\textsuperscript{28}.

Even from a modern point of view, we can assume that Harvey, if he followed his own principles, was a brilliant lecturer. To demonstrate much, to discuss the findings with the audience, and to read anatomy with regard to physiology are standards which are important for anatomical lecturers to this day. Harvey even defined anatomy as "that branch of learning which teaches the uses and actions of the parts of the body by ocular

\textsuperscript{28} Keynes 1966, 90-91
inspection and by dissection\(^{29}\), showing clearly his intention to lecture applied anatomy instead of bare topography\(^{30}\).

### 3.7 Physician at court

In 1618, Harvey became physician extraordinary to James I, and in 1625 in due course physician extraordinary to Charles I. This career went on to physician in ordinary in 1631 and to senior physician in ordinary in 1639. Over all these years, Harvey is said to have come to quite close terms with Charles I\(^{31}\).

In 1629, Harvey began a three-year journey in Europe, where he accompanied the Duke of Lennox as a medical officer. This sometimes happened due to his close relations with the court. In 1632, Harvey briefly returned to his medical work in London, only to leave for Scotland in 1633 in company of King Charles. There is no doubt that during the years abroad, much of the work that led to the publication on generation was done. He undoubtedly also worked on his treatise on insects, which was, to Harveys unsurpassable grief, destroyed in the Civil War\(^{32}\).

He accompanied the King on a visit to Scotland not only in 1633, he was with him on his Scottish campaigns in 1639, 1640 and 1641 as well.

### 3.8 Harvey personally

From April 7\(^{th}\) till December 27\(^{th}\), 1636, Harvey travelled to Europe with his friend Thomas Howard\(^{33}\), Earl of Arundel, on a royal embassy to emperor Ferdinand in Regensburg. He made a side trip in Italy to collect paintings for the royal collection.

This journey provides a couple of small insights about Harvey's personality:

- At Nuremberg, Harvey -uncharacteristically- went out of his way to experimentally prove

\(^{29}\) acc. to Keynes 1966, 90: Whitteridge, 5
\(^{30}\) Keynes 1966, 90
\(^{31}\) Keynes 1966, 155
\(^{32}\) Keynes 1949, 28-29
\(^{33}\) Thomas Howard of Arundel (1585 - 1646): Second Earl of Surrey and Norfolk, Thomas Howard is best remembered for his patronage of the arts and for his magnificent collections. He held many high offices during his career. His luck shifted, though, he was more than once imprisoned. Interestingly, Arundel took his residence in Padua later in his life.
his findings about the circulation of the blood to a critic, Caspar Hofmann. Hofmann's belief, however, was not shifted, and it is reported that Harvey angrily stormed out of the theatre.

- Arundel described Harvey in one of his letters as 'the little perpetual mov[ement] called Dr Hervye".

- Wenceslaus Hollar, who was in the party travelling with Lord Arundel, reports: "Dr Harvey would still be making observations of strange trees and plants, earths, etc., and sometimes [he was] like to be lost. So that my Lord Ambassador would be really angry with him, for there was not only a danger of thieves, but also of wild beasts."

One can imagine the scientist wandering off into the forest on his own, maybe in pursuit of some interesting insect, maybe lost in thought.

Another example for Harvey's alleged detachedness and disregard to danger is the famous incident at the battle of Edgehill: Harvey attended to Charles I at this battle and was given the Prince and the Duke of York (probably children by then) to watch, with whom he withdrew under a hedge and read to them from a book, but he went away again when a bullet came buzzing through the bush and grazed the ground very near him. This story is related by John Aubrey, though, and it is thus quite possible that it is completely, utterly made up.

This illustrates how it remains difficult to come to any conclusions regarding the personality of a man who has been dead for nearly 350 years. We can find stories and anecdotes about Harvey which are related by more reliable sources than Aubrey, but even they can only highlight certain aspects of a character like William Harvey at a certain time, and our conclusions are largely guesswork.

Nevertheless, there was an occurrence in 1634 that might be taken as a hint that Harvey was a scientifically minded person. In this year, Harvey was appointed director to a committee of surgeons and midwives who were to investigate about the Lancashire

---

34 Caspar Hofmann (1572 - 1648) was professor for anatomy and botanics in Altendorf in the vicinity of Nuremberg. He was known (notorious?) as "the biting, barking dog from Altdorf", which might explain why the meeting between Harvey and Hofmann did not go all that well. Hofmann is said to have opposed all new ideas in science, sticking to Aristotle and Galen.

35 John Aubrey (1626 - 1697): Writer, best known for his vivid biographical sketches of his contemporaries, allegedly a flamboyant trader of gossip and thus not widely regarded as a reliable source. Aubrey also left an account of Harvey in his "Brief Lives".

36 Keynes 1949, 33
witches, a number of unfortunate women who were supposed to have practised witchcraft, on the strength of an elaborate story concocted by a boy of ten. The committee's task was to find out whether the alleged witches possessed bodyparts to suckle their supposed familiars or sprites. Of course, no such parts were found. Four of the seven accused were pardoned on the receipt of Harvey's report, from which Keynes quotes:

"On the bodies of Jennett Hargreaves, Frances Dicconson and Mary Spencer nothing unnatural nor anything like a teat or mark or any sign that any such thing hath ever been.

On the body of Margaret Johnson we find two things [which] may be called teats. The first in shape like to the teat of a bitch but in our judgement nothing but the skin as it will be drawn out after the application of leeches. The second is like the nipple or teat of a woman's breast, but of the same colour with the rest of the skin without any hollowness or issue for any blood or juice to come from thence."

The brevity and factuality of Harvey's report suggests that his scientific training prevented him from participating in the hysterical superstition that led to the accusations. Another interesting example of Harvey's way with witches and the occult is to be found in the Gentleman's magazine, 1832, pp. 405-410. On this occasion he dissected a familiar which turned out to be a very ordinary toad from the inside as well.

3.9 Civil Wars
From the outbreak of the Civil Wars in 1642, Harvey was in constant attendance to the King. From 1642 till 1646, the King was mainly at Oxford, so Harvey stayed there as well. Therefore, he ceased to be Physician to St Bartholomew's. At that time, he held the position of Warden of Merton College, Oxford, a position that is often overrated. In 1646 and 1647, he got permission from parliament to attend to the captive King in Newcastle. In 1647, the King got handed over to parliament by the receding Scots. Harvey went back to London to resume his medical practice and has probably never seen Charles I, who was

37 A familiar is a witch's attendant given to her by the devil himself or inherited from another witch. This demon appears in the shape of an animal, usually a toad, a dog, an insect, or, of course, a black cat. Sometimes, a familiar would be an amalgam of several beings. "Teats" or teat-like appearances on a woman's skin would often be taken as proof that the woman was a witch, for the familiars were supposed to be suckled by the witch and drink her blood. A sprite is some kind of elf, fairy or cobold.
38 Keynes 1949, 29-30
sentenced to death for tyranny and beheaded in January 1649, again.

3.10 Old age and death
When Harvey returned to London in 1647, aged 69, he spent much time at the various residences of his brothers’s, which has lead to the assumption that he was a widower by then. He resumed his practice on a limited scale. Presumably this was due to his age and afflictions and not to a dwindling clientele, because his royalist sympathies during the wars do not seem to have affected his practice much.

Speaking of his practice, Aubrey reports that Harvey was widely regarded an excellent anatomist, but he "never heard of any that admired his therapeutique way." He adds, "I knew several practisers in London that would not have give 3d. for one of his bills; and that a man could hardly tell by one of his bills what he did aime at." By 'bills', Aubrey means what we now call prescriptions, and here is one of Harvey's to confirm Aubrey's statement - it matches today's prescriptions at least in illegibility.

Fig. 1: A prescription in William Harvey's handwriting. Seeing this example of Harvey's handwriting, the task of translating his lecture notes into intellegible English must be even more admired.
We must take Aubrey's reports cum grano salis, though, for he was known as a trader of gossip and is certainly not the most reliable source, and the fact that the Lord Chancellor Bacon\(^39\) and many other eminent men were Harvey's patients leads to the assumption that he was quite a successful physician and surgeon conducting a lucrative general practice in the metropolis\(^40\).

In his later years, Harvey suffered much from his gout and his kidney stones. It is reported that he was ready to take an overdose of laudanum (Aubrey says: "a mixture of opium and I know not what") to put him out of his pains. Maybe one such suicidal or euthanasial attempt took place in 1652, when Harvey's friend Charles Scarburgh\(^41\) is said to have administered a dose, but to no avail\(^42, 43\).

At this stage, Harvey is said to have developed some small eccentricies. His great-niece related many years later: "He used to walk out in the morning, combing his hair in the fields. [...] His salt-cellar was always filled with sugar which he used to eat instead of salt." Reports by Dr Ent\(^44\), an old friend of Harvey's, suggest that he was not a happy man at this time. Ent visited Harvey in these days and heard him say: "[I] did not find solace in my studies, and a balm for my spirit in the memory of my observations of former years, I should feel little desire for longer life\(^45\)."

On June 3\(^{rd}\), 1657, Harvey died, with the help of a stroke rather than with the help of Scarburgh. Aubrey notes about Harvey's death: "the morning of his death, about 10 a

\(^{39}\) Francis Bacon (1561 -1626) was the lord chancellor of England between 1618 and 1621. He was also a philosopher and a writer, best known for his works on scientific methods an his central postulation that science is inductive.

Harvey once remarked to Aubrey that he had attended to Bacon.

Kennedy 1966, 157

\(^{40}\) Keynes 1949, 15-16

\(^{41}\) Charles Scarburgh [also spelled Scarborough] (1616 - 1694) was a physician who attended Caius College, just like Harvey did. He was expelled from Caius, though, for somewhat obscure reasons (presumably for his royalist sympathies), and went to Merton college in Oxford, where he met William Harvey. The two men became friends, staying this way until Harvey's death. Harvey bestowed on him not only his velvet doctor's gown, but also his surgical instruments. Scarburgh later attained quite some eminence as a doctor and anatomist. He was knighted in 1669. He also served as a physician at court and became a fellow of the Royal College of Physicians, following Harvey as Lumleian lecturer. He was even one of the original fellows of the Royal Society.

\(^{42}\) Scarburgh returned the next morning and found his friend, presumably to their mutual surprise, not dead but living and in fact much better.

\(^{43}\) Keynes 1966, 370.

\(^{44}\) George Ent (1604 - 1689) was a physician who had studied at Padua. He was, like Harvey and Scarburgh, a fellow of the Royal College of Physicians and was one of the original fellows of the Royal Society.

\(^{45}\) Keynes 1966, 330
clock, he went to speake and found he had the dead palsey in his Tongue; then he saw what was to become of him, he knew there was then no hopes of his recovery; [...] made signe to [...] Sambroke, his Apothecary (in Black-Fryars), to lett him blood on the tongue, which did little or no good, and so he ended his dayes 46.”

Eliab Harvey placed a chapel in the parish church at Hempstead, Essex. To this chapel, or rather into the vault beneath, was Harvey's body transferred on 26 June 1657, Aubrey and Scarburgh being two of the pall-bearers 47.

4. Portraiture of William Harvey 48
When looking at someone biographically, one might become interested in what they looked like. With Harvey, this turns out to be rather difficult, for it was quite common in these days that great personalities were painted only after their deaths. The reasons for this can only be speculated about. In Harvey's case, it is assumed that his fame grew a lot even after his death, and that thus a craving for his image developed. By the end of the 17th century, any set of worthies decorating a gentleman's library included a portrait of Harvey. Thus it came about that today there are between thirty or forty reputed pictures of Harvey, virtually none of which is assumed to have been painted during his lifetime. Most are posthumous paintings, replicas, replicas of replicas, people other than Harvey to which his name was attributed, or plain forgeries.

An interesting example for this phenomenon is figure 2, showing a reputed image of Harvey which has enjoyed too much attention since it was bought for the Royal College of...
Physicians in 1909. It has no previous history, which is not surprising since it is clearly a modern forgery, bearing little resemblance to what Harvey looked like. It is still at the Royal College of Physicians, though. Figure 3 shows another of the many pictures that are said to be Harvey. Interestingly enough, this picture is the only one Cambridge produces when asked about Harvey portraits, and it is exceptional only in one respect: It is exceptionally certain that the man in the picture is not Harvey. The portrait belongs to Caius College.

Figure 4 shows, at last, a genuine Portrait of Harvey which has been rescued from a derelict house of Eliab Harvey’s descendants. It has been found and identified only in 1949 by Geoffrey Keynes, and is at least thirty years earlier than any other portrait hitherto known. It was found together with the portrait of Thomas Harvey and portraits of five of his seven sons (two others had supposedly been stolen by intruders), and dates from between 1620 and 1630, as the sons wear falling ruffs, a fashion that died about that time. The pictures are at the National Portrait Gallery.
From this picture, we get an idea what Harvey looked like when he was in his forties: dark hair and eyes, heavy moustache, small, peaked beard, slight lift of the left eyebrow. Another, though rather unreliable source that tells us something about Harvey's outer appearance, is Aubrey again: "He was not tall, but of the lowest stature, round faced, olivaster complexion, little eie, round, very black, full of spirit; his haire, black as a raven, but quite white 20 years before he died ... he was, as all the rest of the [Harvey] brothers, very cholerique and in his young days wore a dagger; but the Dr would be too apt to draw out his dagger upon every slight occasion."

To get an idea what Harvey really looked like, we must take as a reference the picture with the best pedigree. The picture that fulfils this expectation best is the one which has hung in the library of the Royal College of Physicians, even since before the Great Fire of 1666 (Fig. 5). It is, artistically, quite a good picture, and was almost certainly painted from life. The pose is standard, except for the peculiar position of the right hand which may plainly be the result of an injury to the canvas with clumsy repainting in 1711, when the picture was sent for repair according to the Journal of the Royal College of Physicians. The position of the hand suggests that it might have held a scroll of paper before the repair. The left hand is slim, beautifully shaped with long delicate fingers, but that might as well be the fashion of the time rather than the real look. The face is suspected to have been smoothed somewhat by the painter, who was clearly aware that he was making a ceremonial picture. Note the lift of the eyebrow, which is taken by experts as a guide for the authenticity of Harvey pictures.
Another picture that probably provides a rather realistic aspect of Harvey is now at Ditchingham Hall in Norfork (Fig. 6). It has been argued whether this picture was painted from life or posthumous, but it certainly has a long pedigree as a family portrait.

A picture that has a fully known pedigree has been for nearly 200 years in the collections made by William Hunter, an anatomist and obstetrician, and is now the property of Glasgow University (Fig. 7). It was first acquired by one Dr Mead at the beginning of the 17th century. Mead was famous and knew all the famous men of his time, including some that had known Harvey. Mead’s collection was sold in 1754, and it was then Hunter had the picture bought for him. This portrait is much less formal than the ceremonial picture at the Royal College - Harvey looks his age, and he does not look a happy man, which we have reason to assume he was not. He is fingering a book showing engravings by Vesalius, and through the window in the background, we get a view of Rome (S. Maria de Loreto and Trajan’s Column), a place Harvey liked and from where he got some inspiration for the library he had built for the Royal College. The book is the Works of Spigelius, 1645, containing a reprint of De motu cordis, and it serves to remind us that Harvey was a general anatomist, not merely the demonstrator of the circulation of the blood. The picture is very probably authentic and painted from life.

Fig. 6

Fig. 7
5. Scientific work

The earliest evidence of Harvey's scientific activities are his anatomical lecture notes, which were started in about 1616 and of course modified and amended later. They relied largely on Theatrum anatomicum by Gaspard Bauhin\(^{49}\), sometimes copied verbatim, and other authorities, although Harvey was known to be critical and often impatient in the judging of earlier authorities\(^{50}\).

From the notes we know that Harvey lectured functional anatomy to a great extend, as was usual in those days.

From the notes, it is also clear that Harvey had already begun the original investigations of the motions of the heart, respiration, locomotion, generation, comparative anatomy and pathological anatomy that formed the base of his publications. In fact, we can assume he contemplated publications on all of these subjects, but if that ever happened, we do not know, because many of Harvey's notes, books, and other possessions were lost in 1642, when his rooms at Whitehall were raided by a mob in the outbreak of the Civil Wars. In his Harveian Oration of 1662, Charles Scarburgh mentions as lost papers regarding *De Vegetatione ac vita, De Respiratione vitae proxima, De Pulmone, De Cerebro*, among others\(^{51}\). The notes that were meant to form the base for his treatise on the generation of insects were also destroyed, and this was a hard loss for Harvey\(^{52}\). More was lost in the Great Fire of London, which happened in September 2\(^{nd}\) - 5\(^{th}\), 1666, and destroyed, among many important structures and 13,000 homes, the Harveian Library at the Royal College of Physicians, probably taking much of Harvey's work with it. Besides the lecture notes, which are lucky to have survived, and his two works in print, we have only got a number of letters Harvey wrote. But there is also evidence that Harvey considered more publications, as rough drafts exist for two treatises called *De musculis* and *De motu locali animalium*.

---

49 Gaspard Bauhin (1560 - 1624) was a Swiss physician, anatomist and botanist. Bauhin studied at Padua as well, under Fabricius. Later, he became professor of greek, anatomy, botany and medicine, interdisciplinarity meaning something in those days. Bauhin's *Theatrum anatomicum* appeared in 1605 and was then considered the finest comprehensive textbook in anatomy.

50 Keynes 1966, 94

51 Payne, 163

52 Keynes 1966, 162
5.1 De motu cordis

One of the publications Harvey did make, of course, was *Exercitatio anatomica de motu cordis et sanguinis in animalium*, which was published in 1628, and was the first publication ever to postulate the circulation of the blood.

This was revolutionary, because since antiquity, physiological thought had largely been based on assumptions on how materials flow through the body. Harvey's dramatic discovery in this field inspired a whole new generation of anatomists who tried to emulate his methods of observation and comparative anatomy. This is one of the strands of great influence Harvey had on science in the second half of the seventeenth century. But, in spite of being revolutionary, Harvey's general outlook was quite traditional. He was critical towards chemical and mechanical philosophies that captured many of his contemporaries.\(^5^3\)

Harvey's work shows a symbiosis between functional study by vivisection, structural considerations by anatomical preparation, and exceptionally deep theoretical considerations. It is true that Harvey observed more, quantitatively and qualitatively, than his predecessors, but obviously, he also spent much time in deep thought on his observations.

Besides, Harvey is said to have had a broad interest in arts and literature as well as medicine and philosophy. He was friends or at least acquainted with Francis Bacon\(^5^4\), Robert Fludd\(^5^5\), George Ent\(^5^6\), Charles Scarburgh\(^5^7\), John Selden, Thomas Hobbes, and John Aubrey\(^5^8\).

We shall now try to retrace the steps that led to the development and publication of *De motu cordis*.

\(^5^3\) Pagel 1969, 17
\(^5^4\) Francis Bacon: see footnote on page 14
\(^5^5\) Robert Fludd (1574-1637): London physician, member of Paracelsus' Rosicrucian Order. Fludd published a variety of works, partly medical, partly mystical, showing a great interest in everything odd and unorthodox. Among other things, Fludd defended the view that the pope was Antichrist. He was an eminent physician, though, and was elected a Fellow of the Royal College of Physicians. Fludd was presumably on rather close terms with Harvey and was among the first to acknowledge Harvey's views on the circulation in print. Keynes 1966, 133-136
\(^5^6\) George Ent: see footnote on page 14
\(^5^7\) Charles Scarburgh: see footnote on page 14
\(^5^8\) John Aubrey: see footnote on page 11
Since the early sixteenth century, a conflict in medical science had evolved. The philosophers supported largely Aristotelian\textsuperscript{59} views, while the academic physicians rather supported Galen\textsuperscript{60}. Harvey was an exception to this rule, as he is said to have had Aristotelian views\textsuperscript{61}. It is not quite clear where he got those from. Sources say Padua was Aristotelian\textsuperscript{62}, and that Paduan Aristotelianism must have had a deep and everlasting impression on Harvey in his formative years, personified as it was in his admired teacher, Fabricius\textsuperscript{63}.

Harvey was Aristotleian especially in his monistic view of living substance\textsuperscript{64}. This implies that the soul is not separate from the body matter and acts upon it, but is the form, or tendency to perfection, of the body. Thus, there is only one living thing, that has both material and immaterial qualities. And thus, vital powers inhabit all parts of the body, in contrast to the view that the activities of most parts of the body are the manifestation of separable spirits that flow from one central source\textsuperscript{65}.

Starting from this monistic point of view, Harvey developed a doctrine on the primacy of blood, which he obviously had already started when he wrote the lecture notes, and which he himself seemed to have regarded higher than \textit{De motu cordis} later. In this doctrine, he states that animal life is first and foremost a property of blood, and that the soul inheres in the blood\textsuperscript{66}. Experiments with chicken embryos had made him assume that the first rudiment of an embryo is drop of blood that starts to pulsate, and all the other organs develop from this\textsuperscript{67}.

This explains a great deal his interest in blood. His interest in the movement of the heart

\textsuperscript{59} Aristotle (384-322 BC): Eminent ancient Greek philosopher and scientiest whose thoughts dominated western culture and science until the end of the 17th century.

\textsuperscript{60} Galen of Pergamum (AD 129-216): Greek physician, writer and philosopher, whose writings exercised a dominant influence on medical theory and practice in Europe, from their first publication in the beginning of the Middle Ages until the 16th and 17th century, when men like Vesal and Harvey came along to prove him wrong. Galen spent some years in Rome (about 162 - 166), where he attracted fame by making public anatomical presentations, using pigs, apes, sheep and goats. Considering anatomy the basis for medical knowledge, he vivisected as well. He could not vivisect humans, though, and even the dissection of human corpses was not an option, due to the rules of the time. Galen ended up making inferences about the human anatomy by his observations in animals, which had of course to be erroneous frequently.

\textsuperscript{61} Lesky, 291-292
\textsuperscript{62} Fuchs, 22
\textsuperscript{63} Pagel 1969, 5
\textsuperscript{64} Pagel 1969, 7
\textsuperscript{65} Fuchs, 22
\textsuperscript{66} Lesky, 293
\textsuperscript{67} Pagel 1969, 13
Kritische Biographien ärztlicher Persönlichkeiten - A brief visit to William Harvey

and the blood was then triggered by a hot dispute on whether the arteries pulsate on their own or as a consequence of the heartbeat, a dispute Harvey wanted to solve.

In Galenic view, which had stood nearly unaltered for fourteen centuries before Harvey, there was a separation between two vascular systems: the heart and the arteries on the one hand, and the liver and the veins on the other hand.

The left ventricle and the arteries were supposed to ventilate vital spirit and natural heat through the body, while the liver supplies the body with nutrients by way of the veins. This was deduced from the clear fact that nutrients passed from the gut, the mesenterical veins, through the portal system into the liver. It was then thought that the liver distributed this blood through the body by means of the veins. At its destination, it was then to be used up as a nutrient or to be transformed into flesh. The venous valves, which had been studied by Fabricius, where thought to direct the flow of this blood upwards, so not all the blood would trickle down because of gravity. The question why we need the right heart, though, remained unanswered first. This was one of the flaws of this theory, and it lead to a wide-spread criticism at the time, and Harvey's work is a progression of this criticism.

The Galenic view was somewhat modified when Matteo Realdo Colombo postulated – correctly- in 1559 that blood is passing from the vena cava to the aorta by way of right ventricle, lungs and left ventricle. It was then thought that this blood was tempered with the fresh air that goes into the lungs. But still, the veins were thought to serve nutrification while the arteries were there for the vivification. In 1616, Harvey seems to adhere to this view, too, according to his lecture notes.

68 Keynes 1966, 169-170
69 Matteo Realdo Colombo (1516?-1559): A notable anatomist and surgeon, Colombo studied at Padua under Vesal, succeeded as professor of surgery in 1543, became the first professor of anatomy in Pisa in 1546; he published De re anatomica in 1559, in this book, he gives detailed accounts on the pleura, the peritoneum, and the mediastinum.
70 Michael Servetus (1511? - 1553), Spanish theologian and physician, actually described the lesser circulation in 1553, but his book Christianismi restitutio was primarily theological and is not thought to have had any great influence on anatomical science. In fact, he makes only a passing note on the discovery of pulmonary circulation when discussing the relation between spirit and regeneration. This leaves us with the question, though, if the lesser circulation had been properly discovered early, and had come to Servetus' knowledge maybe via a publication that is lost to posterity.
Servetus, incidentally, was condemned as a heretic by both Protestants and Roman catholics, later to be burned alive by Calvinists, which shows a fiery oecumenicalism that is uncharacteristic of the time.
An altogether unconfirmed writing by an Arabian physician, Ibn an-Nafis, is said to have postulated the lesser circulation even earlier, in the 13th century.
Keynes 1966, 107 / 170
71 Keynes 1966, 107
Colombo was also the first to describe the two phases of the heartbeat. Remarkably, he used the term "constriction" for what we today call systole, and he used "systole" for the diastole. This puzzled Harvey, since "systole" literally also means constriction. So Harvey made his own vivisections and observations and went on to call the systole the "erection" (as the apex of the heart lifts during the systole) and the diastole the "relaxation". This implies that the systole is the active part of the heartbeat, while the diastole is all passive. This had never been described before. Harvey was also the first to describe the contraction of the auricles, saying that "the auricles arouse the somnolent heart", an accurate observation as we know today\textsuperscript{72}.

From his observations of the heartbeat, and from his structural anatomical studies, Harvey deduced that the heart is for contracting and expelling blood, not for dilating and contracting. It follows, then, that the arteries must dilate when the heart contracts. If they contracted simultaneously, blood could not flow from the heart to the arteries. So Harvey stated that the arteries dilate as a consequence of the blood being pushed in them by the heart, in the way a glove inflates when you breathe in it. And with this splendid analogy, he found his answer to the question whether the arteries pulsate on their own\textsuperscript{73}.

From his structural observations, Harvey concluded that blood flows centripetally to the heart from the veins, and centrifugally from the heart through the arteries. On its way from the veins to the arteries, the blood passes through the lungs. Having said this, Harvey saw an enormous problem, an absurdity that threatened to destroy his model: if it really worked that way, all the veins would soon be drained and the arteries would be bursting. When he realized this, he first tried to estimate the amount of blood that the heart drains from the veins with every beat. He concluded that it must be quite a lot, because the heart and the great vessels are so large, and "mother nature does nothing purposelessly". He found that the food we eat could not possibly provide that much blood.

Incidentally, Harvey was not the only one who thought about this problem. In 1623, Emilio Parigiano\textsuperscript{74} writes that there must be a significant reflux from the aorta to the left ventricle, otherwise it would drain and the aorta would burst. It is not clear if Harvey knew about

\textsuperscript{72} Fuchs, 57
\textsuperscript{73} Pagel 1970, 3
\textsuperscript{74} Emilio Parigiano had also studied at Padua. As a physician, he does not seem to have achieved any great eminence. In 1635, he published an extensive critique to De motu cordis.
Parigiano, whose publication might have triggered his thoughts. Anyway, he came to the all-important conclusion that somehow, blood must get back into the veins from the arteries. In *De motu cordis*, chapter eight, Harvey says:

"When I had thus considered how large the amount of transmitted blood would be, and in how short a time the transmission would take place, I noticed that the juice of the ingested aliment could not supply this amount without our having the veins emptied and completely drained on the one hand, and the arteries disrupted by the excessive intrusion of blood on the other, unless the blood somehow permeates from the arteries back into the veins and returns to the right ventricle of the heart. I began to consider whether [the blood] might have a kind of motion, as it were, in a circle, and this afterward found to be true."

This is the core of *De motu cordis*. It is remarkable that the first half of the book, right up to this point, consists of theoretical considerations that ultimately lead up to the all-important conclusion, while in the second half, Harvey proceeds to give evidence and to verify his statement. It is important to see that this reflects the process by which Harvey arrived at his bold statement. He did not at all open up a body and saw the circulation, he thought\(^{75}\) that there must be one and later proved it by observation. This is most remarkable and in the light of this, Harvey's achievement rates even higher\(^{76}\).

Let us now consider some of the evidence Harvey gives in the second half of *De motu cordis* to prove that he is right about the circulation:

- The transmission of blood from the vena cava to the aorta is too large to be supplied by nourishment alone. The veins must be replenished with blood from the arteries in some way. He makes quite careful calculations to prove this. To calculate the transmitted volume, he takes very low figures (for example, he supposes an ejection fraction that is as low as 12.5%) and goes on to show that even with the lowest estimated figures, the transmission volume would be too great to be supplied by food alone.
- If you puncture the aorta, nearly all the blood from the body drains very fast - the veins also empty. Thus, veins and arteries must be interconnected.

\(^{75}\) "meditated", as Pagel put it
\(^{76}\) Pagel 1969, 2-3
• If you pinch the vena cava, the heart drains, if you pinch the aorta, the heart swells. So the flow of the blood must be unidirectional. (All of the above: Chapter 9 and 10)

• It is very improbable that the blood goes from the vena cava to aorta through little pores in the septum. For one thing, the septum is very tough and dense compared to other tissues, and will let nothing pass in experiments. Furthermore, in the embryo, there is the foramen ovale that serves to interconnect the two sides of the heart. If blood was to carry on passing the septum, why should the foramen ovale close?

• Harvey did experiments with ligatures. If you put a tourniquet around your arm, it will go white and cool, the veins will not be visible. If you loosen it a bit, then, the veins will swell right up to the ligature. So he deduced, correctly, that blood flows into the arm through the arteries, whose pressure is high enough to surpass that of the medium-tight ligature, but cannot leave the arm because the low-pressure veins are squeezed. (Chapter 11, 12)

• He observed the same in blood-letting. It was already known that a medium-tight ligature made the veins below swell up, thus making it easier to perform phlebotomy, and causing more blood to spurt out upon incision. This wouldn't make sense if the blood went into the veins from the proximal side of the ligature. (Chapter 12)

• The orientation of the venous valves is inward, not upward, as his predecessors always said. Harvey states that this cannot be true, because in the jugular vein it can be clearly seen that the valves open downward. He used a probe to show the direction of the valves. He also states that dogs and oxen have venous valves in the horizontal vessels, e.g. the iliacal veins, where there is no danger of blood trickling downwards because of gravity. So the whole purpose of the veins is to make blood flow to the heart and to prevent it from flowing outward to the extremities. (Chapter 13)

• The circulation of the blood would explain how a local affliction, such as a snakebite or the bite of a mad dog, or venereal diseases, can spread through all of the body so quickly. (Chapter 16)

Thus, Harvey had arrived at and proved the discovery that he is remembered for today. This discovery, of course, gave rise to an important question: What is the use of the circulation?

While Harvey's predecessors thought that the heart was the source of the life-giving heat, Harvey notes as early as 1616 that, in his opinion, the blood itself is the source of the
body heat, and the heart merely serves to push the blood around. This was a shame, because the other theory would fit nicely into the circulation theory: the blood circulates, it cools down, and needs to return to the heart to be reheated. This consideration first led Harvey to change his mind and to assume that the reason for the blood to circulate is indeed the necessity to pick up heat in the heart. But in the mid-thirties Harvey returned to the his original view and stated that his failure to show its purpose was no valid reason to deny the existence of the circulation. Later, he combined the two theories and said that the body heat is created by fermentation of the blood, which could for somewhat obscure reasons only take place in the vena cava and the heart, necessitating its return to the center of the body.

Another incidence when Harvey gave up, unknowingly, a correct theory in favour of a wrong one was when he gave up his notion that the heartbeat is induced by the beat of the auricles and boldly if wrongly stated that the heartbeat is initiated by a self-induced swelling of the blood in the cava, which irritates the heart and makes it beat.

5.2 The direct impact of De motu

After the publication of De motu cordis, a discussion ensued that lasted for at least twenty years. In this discussion, Harvey received much support, but was of course also criticized.

Given the nature of humans at all times and places, not everyone who took a stand in this discussion chose his point of view purely on a factual basis. For instance, the first person to cite Harvey and acknowledge his view on the circulation in print is Robert Fludd who cites Harvey in his work on the pulse. As said above, Fludd was presumably a close friend to Harvey. On the other hand, the first massive antagonism to Harvey that appears in print is published by James Primerose, likewise in 1630. Primerose had earlier struggled to be elected Fellow of the Royal College of Practitioners, but was refused. So his attack on Harvey may have been reasonable, but it might have just as well been because of Primerose's grudge against the Royal College.

It is probable that Harvey did not take part in the discussion much, for when De motu
cordis was published, Harvey failed to respond to any public attack on his views, however virulent those attacks were. There are only two reported incidents when Harvey showed some reaction towards his critics. One was when he met Caspar Hofmann in Nuremberg in 1636 and tried to demonstrate his findings (cf. chapter 3.8), and the other was when he published a brief supplementary statement in 1649, ostensibly in answer to a famous French physician, Jean Riolan. The statement was called "Exercitatio Anatomica De Circulatione Sanguinis. Ad Joannem Riolanum filium Parisiensem.", and contained more evidence gathered in further anatomical experiments.

Harvey also remarks in his preface to De motu cordis that "these views, as usual, pleased some more, others less: some chid and calumniated me and laid it to me a crime that I had dared to depart from the precepts and opinions of all anatomists: others desired further explanation of the novelties which they said were both worthy of consideration, and might perchance be found of signal use."

This could mean he just shrugged criticism off, but maybe not reacting was more something of a defence. At least, what he says in De motu cordis might lead to the assumption that he was not immune to criticism after all: Harvey notes that he had known about the circulation of the blood for nine years before publishing, and spent those nine years explaining his views to his colleagues and showing them his experiments for critical evaluation before he hazarded publication. Even then, "publishing took place yielding to the repeated desire of all and the pressing request of some"80. He also says he would have been afraid of being charged with "overpresumptousness"81. He mentions those fears one more time in chapter 8, just before coming to the main point, saying "I not only fear that I may suffer from the ill-will of a few, but dread lest all men turn against me. To such an extend is it virtually second nature for all to follow accepted usage and teaching which, since its first implanting, has become deep-rooted; to such extend are men swayed by a pardonable respect for the ancient authors"82.

Incidentally, De motu cordis was published in Frankfurt because William Fitzer, an Englishman who had emigrated to Frankfurt, agreed not to charge Harvey to print the book, like an English printer would have done. But we can assume that Harvey regretted this step afterwards, because he obviously had no chance to proof-read and the first

80 Harvey 1628, 6
81 Harvey 1628, 5
82 Harvey 1628, 57
edition made a list of 126 errata necessary. Besides, the quality of the paper was so poor that only about 55 pieces of the original edition survive to this day, and those that did survive are in a bad state.

5.3 Competitors
Harvey might have had competitors, and it is quite possible that it was sheer luck that he was the first to describe the circulation of the blood. One possible competitor was Walter Warner\textsuperscript{83}. In his writings, we find quite a few points similar to \textit{De motu cordis}. The statement that Warner was actually the first to discover the circulation of the blood, and that a mutual acquaintance tipped Harvey off about this, is considered a rumour\textsuperscript{84}.

Another exact contemporary of Harvey who also worked on the movement of the heart and the blood was Adriaan van den Spieghel\textsuperscript{85}. He was born in Brussels in 1578 and studied at Padua. We do not know if Harvey and van den Spieghel met, but it is altogether possible. Van den Spieghel vivisected, he looked at the heart and the vessels, he conducted ligature experiments, and he found that the arterial pulsation pushes along the blood in the veins. Maybe the only thing that prevented him from finding out about the circulation of the blood first was his untimely death in 1625\textsuperscript{86}.

5.4 Harvey's fields of interest - besides the circulation
In 1627, Harvey started working on a treatise that was supposed to be called \textit{De motu locali animalium}. This treatise was, alas, never finished, but the drafts contain important insights and go to show that in this field, too, Harvey was capable of revolutionary work. An example for this is the fact that while his predecessors regarded the sensitive faculty to be sent out from the brain, Harvey postulated –correctly- that perception starts with the object, passes through the sense organ and the nerve, and ends up in the brain. So the use of a (sensitive) nerve, Harvey correctly assumed, is to communicate something sensible to the brain, for a judgement to be made. In the same way, Harvey had revolutionary views about locomotion and the motoric nerves. While his predecessors thought that all the energy for locomotion is supplied by the brain and sent out to the muscles, Harvey described the brain –again, with astounding accuracy from today's point of view- as a \textit{maestro del coro}, directing and coordinating the movements. This he

\begin{itemize}
  \item \textsuperscript{83} Walter Warner: mathematician and philosopher.
  \item \textsuperscript{84} Webster, 21
  \item \textsuperscript{85} Adriaan van den Spieghel (1578 - 1625) was a physician at Brussels, Leiden and Padua.
  \item \textsuperscript{86} Bylebly 1979, 62-64
\end{itemize}
deduced from the fact that a beheaded cock can still move—the muscles still contain energy-, but the movements are uncoordinated and do not make sense\textsuperscript{87}.

Another field of interest that Harvey worked on was the generation of animals. He might have caught that virus from Fabricius. In this field, he made his second publication, \textit{De generatione}. The work for this treatise had already begun in 1616 and was mostly finished in 1638, even though the actual publication took place only in 1651. The book is large, it consists of 72 exercises and contains a wealth of observations on all aspects of generation in a variety of species. He primarily observed deer as an example of vivipara and domestic fowl as ovipara. His studies of the day-to-day development of the chick embryo were more accurate than anything that had been done in this field before. Another unprecedented achievement were his observations regarding viviparous generation: he dissected the uteri of hinds and does during all stages of pregnancy and used his observations to evaluate and correct the theories of Aristotle, Galen, and Fabricius. Aristotle had written that the fetus develops from a mixture of the male semen and the menstrual blood, while Galen thought that male and female semen came together in the uterus to form the fetus, which the menstrual blood nourished (not altogether inaccurate as we know today). Harvey, though, lacking a microscope\textsuperscript{88}, found that the uterus was completely empty after conception—no semen whatsoever, no menstrual blood—, but miraculously, a fetus develops in this empty uterus. He was never able to explain that properly, so \textit{De generatione} is altogether more speculative than \textit{De motu cordis}. A fundamental trait of his speculations, though, is that an egg is the primordium of all animals. His postulation was \textit{ovum esse primordium commune omnibus animalibus}, shortly \textit{omne vivum ex ovo}. This was new; Harvey was the first to regard oviparous generation as the more fundamental model\textsuperscript{89}.

Thus, we can see that William Harvey was a man with multiple interests and abilities. We know that he had great anatomical knowledge and he was interested in comparative anatomy, his studies ranging from insects through every part of the animal kingdom up to some sixty kinds of mammals besides man. He even had interests reaching far beyond medicine, which is illustrated rather nicely by the fact that he went on an excursion to

\textsuperscript{87} Keynes 1966, 163-166
\textsuperscript{88} He used magnifying lenses, though.
\textsuperscript{89} Lesky, 304-308
Stonehenge in 1620 and actually took part in archaeological excavations. This is hardly known, which proves the point that his discovery of the blood circulation with its overwhelming consequences has overshadowed the great range of Harvey's other work, and that the greatness of his mind has seldom been given due recognition.

6. Influences - what made Harvey Harvey?

It is not an easy task to find out what influenced and formed a man that has lived so long ago. Of course, the question "what made Harvey Harvey?", viz., how did this genius come about in a man, has been tried to answer in many different ways.

Webster speculated what influences apart from direct medico-science made Harvey what he was. For one thing Jacobean London was a social and medical mess. It had 200,000 inhabitants, while no other town in Great Britain had more than 15,000, and it was growing steadily and quickly. Of course, the density of population led to disease. There were great plague epidemics in 1603, 1625 and in 1630. Those last two epidemics claimed 80,000 victims. Other diseases spread, morbidity and mortality were terrifying, and physicians were largely unable to help. This effected a great anxiety about health in the first half of the 17th century, so the need and the potential for discourse and innovation was great. There was a stirred-up atmosphere, making it easier to become separate from traditional views. This may have contributed to the way Harvey worked and how his work was received.

At Harvey's time, the Royal College, too, sported an innovative spirit that may have boosted Harvey. William Gilbert, president of the Royal College, asked his fellows not to be impoverished by sticking to closely to the works of Aristotle and Galen.

Another thing that probably helped to make Harvey the way he was was the fact that Padua was not only the leading medical school in Europe, but also full of innovation. Galileo worked there at the time, though nothing suggests that Harvey has ever met him. In fact, Keele notes that it is an astonishing fact concerning historical personal contacts

---

90 Keynes 1966, 125-127
91 Webster, 1
92 William Gilbert (1544-1603): Most known for his pioneer research into magnetism. Educated as a physician, he practised in London. Besides, he was a philosopher and one philosophical work, De mundo nostro sublunari philosophia nova, was published posthumously in 1651.
93 Webster, 15
that Harvey does not seem to have been influenced by Galileo. Another author, the Lord Birkenhead of Cohen, states that the University of Padua was of all the universities in Europe the one least bound by authority. In 1404, it had come under the rule of Venice, which at that time and for long after was the most anticlerical state in Europe. Padua fostered the spirit of independent inquiry and condemned the unquestioning acceptance of authority.

The significance of the time Harvey lived in must not be underestimated. The 17th century was a time of turning tides, of beginning opposition between the scholastic bookworms and the observing and experimenting empirist. It was a climate that sprouted new ways of thinking, that permitted new ways of acquiring wisdom. The Royal Society was founded in 1662, the Académie des Sciences in 1666, short after Harvey's death. These occurrences bear witness to the fact that in Harvey's lifetime, it became possible to think anew. Harvey himself wrote that Aristole's authority had so much weight for him that one should not differ from it without giving it lots of thought. This does signify some adherence to Aristotleianism, yes, but it also signifies that Harvey saw the distinct possibility, or even necessity, to differ from Aristotleianism - and that is just what he did, saying:

"Nothing is older than nature, and nothing a bigger authority."

One might assume that there was a conflict between the two ways of thought, that of Aristotle whom Harvey himself acknowledged as his master, and that of modern science which he helped to invent. Though those to might appear to be a contradiction in today's view, it was not a contradiction at all in Harvey's time - it was possible to unify in one mind respect for the authorities and excitement at new findings. Harvey is today often portraied as a prototype for the modern scientist, a view which overlooks Harvey's Aristotlean side.

Hopefully, it has become clear that William Harvey is a thoroughly interesting and fascinating character, scientifically, philosophically and personally, and even though much has been written about him, it is still worth considering this man from new points of view.

94 Keele, 21
95 Cohen, 103
96 Lesky, 293-294
97 Pagel 1969, 1; Fuchs 37
7. Bibliography

A. original works
   1. *Exercitatio anatomica de motu cordis et sanguinis in animalibus*. Frankfurt am Main 1628
   2. *Exercitatio anatomica de circulatione sanguinis*. Cambridge 1649
   4. A transcription of the lecture notes has been published as *Prelandes anatomiæ universalis*. London 1886

B. standard translations
   1. *Opera omnia: A collegio medicorum Londinensi edita*. London 1766
   6. Whitteridge, Gweneth: *De motu locali animalium*. Cambridge 1959
   7. For other editions and translations, see Keynes, Geoffrey: *A Bibliography of the Writings of Dr. William Harvey*. Cambridge 1953


D. secondary literature (selection)
   2. Keele, Kenneth D.: *William Harvey, the Man, the Physician, and the Scientist*. London 1965
19. Fuchs, Thomas: Harvey und Descartes (Diss.). München 1990

8. References

Keele, Kenneth D.: William Harvey, the Man, the Physician, and the Scientist. London 1965

9. List of illustrations

- all illustrations taken from Keynes, 1949 -