



Scientific progress – or just another day at the office

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Harvey is generally accepted as the patron saint of cardiology. Some shading is not amiss because a medical history canon is by definition an instantaneous photograph. Therefore *De Motu Cordis* is set in a historic perspective and portrayed as the result of genuine scientific progress. Nevertheless Harvey symbolises the watershed between ancient medicine and modern medicine based on observational and experimental research. We too seem to witness a transitional zone between modern medicine and a new *customised* medicine, individualised and integrative, firmly based on a further expanding technology. (*Neth Heart J* 2008;16:143-6.)

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William Harvey (1578-1657) is considered to be one of the great icons of 17th century thinking. His popularity owed everything to one of the great scientific discoveries of the time: that of the circulation of blood. His sensational discovery was made known to the world in 1628 in *De Motu Cordis*. Nowadays it is not so easy to reach stardom in cardiovascular medicine. Tiny consecutive steps in research may lead to an unexpected outcome or even a milestone but then success knows many fathers, toppling over each other and quite willing to accept the credits for their alleged contributions. Were the achievements of William Harvey exceptional according to tradition, using a customary method not so much empirical as resolute-compositive (an expression coined by

Galileo himself), or was he floating on previous waves, not really searching for answers but attempting by guesswork and experiment to find a solution to a puzzle already laid in front of him?

We should remember that he was subject to a new revolutionary 17th century way of thinking, just as we are tributary to the ICT revolution of the second half of the 20th century, and perhaps it is time to bring name and fame back into proportion, looking at historical data and with the help of Foreestus, a talented Dutch physician also learning, writing and practising in those exciting times, so defining for the rationalisation in human affairs and thus the way in which modern day medicine has evolved.

De Motu Cordis and William Harvey

Besides Hippocrates, Galen (129-199 AD) is considered to be one of the most influential physicians in antiquity. His views and writings remained authoritative for more than a thousand years. According to Galen's system three grades of

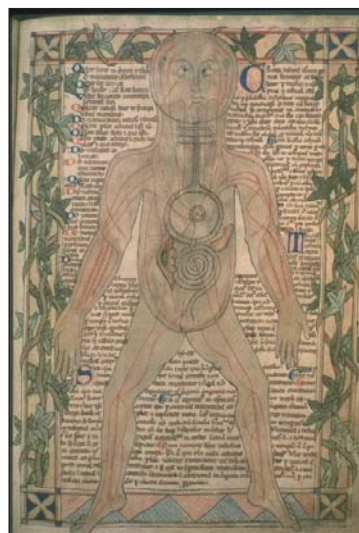


Figure 1. The circulation of blood according to Galen. The 'vein man', part of an English manuscript in the late 13th century, has followed Galen's view. The centre is the heart, which serves to pump blood through the body, generate heat, and store intelligence.

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blood ebbed and flowed through the body. The liver made the blood from food received from the intestines and charged it with 'natural spirit'. Part then passed through the right ventricle into veins; part went through the left ventricle absorbing 'vital spirit' and passed into arteries. Some of this blood reached the brain, absorbing 'animal spirit' and was carried into the nerves, believed to be hollow.

To meet his expectations, Galen conducted a series of experiments, hardly repeatable in centuries to come. In a living animal, for instance, he resected a section of an artery to replace it with a stiff tube and found that the pulse was then lost at the peripheral end.¹

History was to reserve a strange fate for Galen. For the propagator of a scientific method based on experience, he founded a system which was destined to become a clearly defined dogma for many centuries and was going to paralyse the progress of medical research for a long time. Ancient medicine was based on Hellenic humanism which holds out little or no hope for desperate cases and therefore gradually became inflamed by the spirituality of Christian charity, eventually leading to monastic medicine. Scholars of this time attempted to reconcile their own thoughts and observations with the writings of the ancients.

Peter of Spain (in 1276 elected Pope as John XXI) was the leading medical scholar of his time. Being a priest he became a physician at the new university in Siena in 1247, where he probably wrote his '*De Motu Cordis*'. Reasoning quite logically, he described much that was true but then he missed the concept of a circle, a circulation. In his view the movement of the heart was in itself vital to life and the expression of the soul but he understood the heart more as a conduit than a pump.²

Then Michael Servet or Servetus (1511-1553), who studied medicine in Paris and cooperated with Vesalius as prosector, gave an accurate description of the pulmonary circulation based on the observation of multiple connections between veins and arteries. Also the striking size of the pulmonary artery contrasting with the alleged function of nourishing the lungs drew his attention and consequently led to a teleological approach where observation defines the problem.³ At the time few doctors paid attention to his exact description of the lesser circulation until years later two Italian doctors from Padua restated this fact, without even quoting poor Servetus.

Eventually William Harvey would become the great discoverer of the circulation of the blood. He studied in Padua and Cambridge. At the time the dissection of corpses was forbidden in England and therefore he had to rely on vivisection in his meticulously re-tracing of the circulation of blood. In his famous *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus*, he was the first to show that the heart works like a pump and confirmed that no communication exists between the two ventricles, hitherto considered as a fact of life and cornerstone in Galen's doctrine.⁴

One of the best points he made in *De Motu Cordis* is the result of some very simple calculations. Once he realised that the heart was ejecting blood to the periphery, he did a very simple calculation. It had previously been thought that the

blood was consumed in the periphery. Harvey showed that one would be consuming one's own body weight in blood every day if all the blood that was leaving the heart was in fact being consumed. And he also did another simple experiment on his own arm where he found the valves of the veins and then just pressed the blood from the vein. He then lifted his finger and saw the blood filling the vein from below. Science based on experiments designed to answer pre-set questions. The era of modern medicine was about to begin.

The Dutch experience and Pieter van Forest

Although the Galen-Aristotle way of thinking was dominant until the beginning of the 17th century there was something resembling an autopsy practice in the Netherlands as early as 1076 and 1099.⁵ It demonstrates an ongoing process of professionalisation and needs to fill in resting voids in existing knowledge despite the fact that the beginning of a systematic autopsy practice to unravel pathology and anatomy is generally placed in the Renaissance period.

Only at that time was there an open mind for contrary thoughts and exchange of ideas and skills.^{6,7} Old concepts were no longer taken for granted and empiricism fell in disgrace. It was recognised that the old theory of imbalance in bodily 'spirits' as a determinant of disease was no longer tenable in view of finding organ-related pathology at autopsy. Attention was refocused and organ-related medicine then took care of a longstanding separation between 'heart and soul' till this very day. Pieter van Forest or Forestus (1521-1597) was an exponent of this time. He was educated in Leuven and Italy by scholars of name and fame, at that time developing new concepts and ideas such as for instance his fellow-countryman Vesalius, in his anatomical studies continuously challenging the doctrines and authority of Galen. Forestus learned to be open to all new ideas at an early age but he would never gratuitously implicate them without forming an opinion of his own. Returning to the lowlands he worked in Alkmaar and Delft as town physician. During his lifetime he wrote his *Observationes et Curationes Medicinales* based on case histories, winning the sobriquet of the Dutch Hippocrates in his own lifetime.⁸ In his Delft years he became



Figure 2. Pieter van Forest at the age of 64 years, engraved by Goltzius in 1568: the Dutch Hippocrates.

physician to the Prince of Orange and witnessed his traumatic death (10 July 1584) and together with his fellow town physician Cornelis Buysen conducted the autopsy that followed.⁹

In his report Forestus gave ample evidence of his anatomic skill and knowledge. It becomes evident that at that time Forestus had already detached himself from Galen's doctrine and views on life and death and was paying tribute to the new ideas put in place by Vesalius and his experimental research on anatomy.

Discussion

Progress in medicine is nowadays characterised by a 'publish or perish' kind of attitude. Tiny steps and achievements are highlighted in numerous periodicals and the internet and even feints are sometimes put forward as a breakthrough. In other words: it is not easy anymore to sift the grain from the husk.

Contrarily, ancient medicine is characterised by scarce paperwork, not easily accessible and with limited spread. Furthermore medical treatises are often embedded in theological writings because of the close interrelation between medical science, and medieval theology and philosophy. Obviously these circumstances bring about a risk of enlarging available sources beyond original proportions at the same time minimising the possible influence by emphasising their isolated existence and limited access. Such an apparent upgrading and downsizing at the same time in itself harbours a contradiction which hampers interpretation.

Anyway, it is generally believed that Harvey did not know about the work of Servetus, not to say Peter of Spain. In my opinion, however, it is no longer tenable that the eminent scholars of the day lived and worked in 'splendid isolation' because there is ample evidence that they met and greeted each other on a regular basis, learning from each other in Italy, the cradle of medical education (Salerno, from the 9th century on) and universities (from the 12th century onwards). Initially their aim was to reconcile new ideas and observations with ancient medicine but a scientific approach became increasingly visible where intellectual development in itself got the upper hand and autopsy, anatomy and bedside teaching became standard features in medical education and progress.

Looking at the data presented here, is it then farfetched to assume that Harvey had foreknowledge and elaborated on already paved roads to meet expectations of others rather than following his own discernment? A supposition like this would make his *De Motu Cordis* rather a *De Motu Scientiae* but that does not alter the fact that his proclamation of the all time hero in cardiovascular dynamics was more than justified, because he of all would profoundly influence philosophers, first by his experimental method and then by encouraging them to think of the human body as a machine where all human experience can be explained by mechanical laws.¹⁰ It would then take centuries to overcome this view that all science is mechanical.

Like our predecessors who were lucky enough to live and work in the Renaissance period with its revolutionary and experimental practising of science, we too are living in exciting times which in the future will be regarded as one of the watersheds in the course of medicine and science. The Human

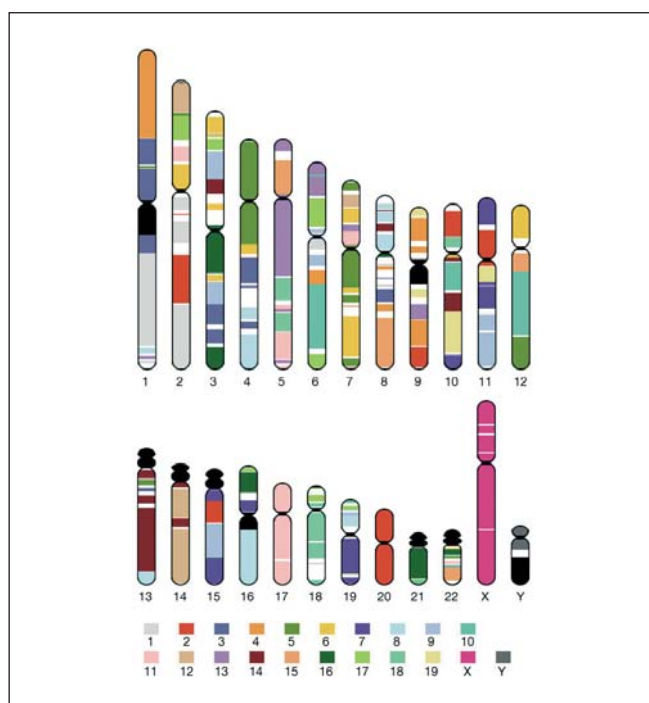


Figure 3. Human chromosomes, with segments containing at least two genes whose order is conserved in the mouse genome as colour blocks. Each colour corresponds to a particular mouse chromosome. Centromeres, subcentromeric heterochromatin of chromosomes 1, 9 and 16, and the repetitive short arms of 13, 14, 15, 21 and 22 are in black (Nature 2001;409:860-921).

Genome Project will mark the end of modern medicine and the beginning of new kind of *customised* medicine, integrative, individual and comprehensive, firmly based on a further expanding technology, hopefully staying within the human context.

For it is the discovery of the human genome that will eventually unite 'heart and soul' again, providing us with a patient-tailored therapy based on synergy in drug action. ■

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