

'But we are here not to destroy new therapies', he adds. Getting cardiologists and oncologists to work together in the preclinical phases could increase the possibility of patients using new treatments. Research at the IEO now allows detection of cardiac toxicity in the preclinical phase. When they started their research 17 years ago, it was believed that cardiac toxicity and the subsequent heart failure were not preventable. Some 15 years later, they know how to prevent and treat cardiac toxicity.

At the IEO, before starting chemotherapy they perform a cardiological evaluation of the patient and an echocardiogram. Importantly, they measure troponin and natriuretic peptides at each cycle

of chemotherapy and monitor these markers. If troponin increases, they commence treatment with the angiotensin-converting enzyme inhibitor enalapril, which can prevent the development of cardiac dysfunction in these high-risk patients.

'We previously demonstrated that patients showing an increase in this marker during chemotherapy have a higher risk to develop cardiac dysfunction in the following months'

says Cardinale. 'So with this simple and cheap approach we have the possibility to prevent cardiac dysfunction and associated cardiac events in all [chemotherapy] patients'.

Jennifer Taylor, MPhil

The story of the heartbeat, II

Part II, Heart Rate: a journey from the Egyptians to modern day.

Since the dawn of time, humans have reflected on the mysterious incessant beating of the heart, a vital principle associated with the preservation of life itself.

Egyptians developed a sort of cardiological culture which spread through the entire Mediterranean basin. Although they believed the cardiovascular system to be a domestic vessel, they thought that the heart could increase in weight (hypertrophy) and they linked such an increase with its 'speed' (heart rate). But, the heart was also the seat of the soul, weighed by the Gods at ones final judgement. The purpose of weighing the heart (and therefore the soul) before the underworld tribunal presided by 'Osiris' was to establish whether the deceased deserved the immortality of the blessed, based on their life on earth. A well-known wall painting (Figure 1) from the seventh century BC found in Luxor in the tomb of Pa Nentwy shows 'weighing' the heart of the deceased before Ma'at, the Goddess of truth.¹ On the left of the giant scale depicted in this painting, the heart is put into a vessel. On the right, Ma'at is kneeling with a feather. If the heart weighs more than the feather (hypertrophy and tachycardia), the monkey sitting atop of the scale eats the heart and the soul does not reach eternity. Alternatively, if it weighs less,

the deceased will enter the Kingdom of happy transformation (a belief from 1000 BC). As a consequence of such a unique value, during mummification, the heart was treated with special care and generally left *in situ*, while the other viscera were removed and preserved.

The Aztec and the Mayas sacrificed still-beating hearts from the victim's chest and offered it to the sun. This sacrifice was essential for the preservation of life, which was generated by the heat and the movement of the sun. The sun in turn, could only take energy from a living, beating heart! Therefore, the purpose of human sacrifice to the sun was not to gain favour with the divinity, but to revitalize the divinity's precious resources (Figure 2).

In the Old Testament, the heart is the seat of emotion and also of thought, rationality, and conscience. 'Thinking' is expressed as 'conferring with the heart' and God is the being, possessing 'wisdom of the heart'.

Hippocrates with his school in the fourth and fifth centuries BC developed a complete image of the heart and the heartbeat.



Figure 1 Weighing the soul of the deceased before Ma'at. Wall painting in the tomb of Pa Nentwy, 7th century BC.

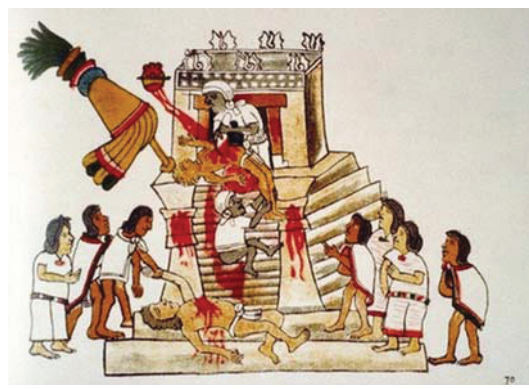


Figure 2 Offering of a human heart to Huitzilopochtli, the god of war, by an Aztec priest. Codex Magliabechiano, 16th century Biblioteca Nazionale, Florence.



Figure 3 The sacred heart of Jesus. Pompeo Batoni (1708–1787) Chiesa del Gesù, Rome.

Heartbeats were caused by the expansive force of an ‘innate fire’ located in the left ventricle, while the lungs cooled the heart through respiration, generating a rhythm that alternated between the heating and cooling. Such was the mechanism of the heart rate! The blood then distributed the heat produced by the heart throughout the body. Later, the Alexandrian school accurately described the heart anatomy and analysed the cardiac pulsation, comparing the working of the heart to that of a pump.

From the thirteenth century onwards, the mysticism of the Benedictine, Franciscan and Dominican Orders gave a huge

impetus to the cult of the heart of Jesus—the seat of faith and the place of the Holy Spirit, challenging artists to exploit its symbolic potential. So, the sacred heart of Jesus was depicted as emitting rays, with straight lines representing light and wavy lines representing heat, but always creating the illusion of a beating heart! (Figure 3).

In 1628 William Harvey demonstrated by simple experiment and incontrovertible calculation that the heart expels in 1 h an amount of blood greater than the weight of a man and that to do so it has to beat at least 60 times/min. The blood is then conserved throughout its passage through the body and cannot be either produced or used up all at once by any organ. It must therefore be moving in a circle.²

Thereafter, modern cardiology has evolved with the development of devices and the heart has lost much of its mystery. Even in this new age, it remains the seat of life and accompanies our emotions through the heart rate.

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