

## REVIEW ARTICLE

# LESSONS FROM THE HEART: REVISITING THE PSYCHOCARDIOLOGICAL THEORIES OF ARISTOTLE IN THE 21<sup>ST</sup> CENTURY

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## ABSTRACT

**The aim:** To provide an overview of the psychocardiological theories of Aristotle and discuss their implications in contemporary research and clinical practice

**Materials and methods:** Specific keywords (brain, heart, cardiology, psychiatry, psychocardiology, Aristotle, cardiocentric) were subjected to list down and analyze the literature in PubMed and Google Scholar. All types of articles, including original research, systematic reviews, and meta-analyses, along with gray literature dating back to 1950. We excluded studies reporting a significant conflict of interest and findings dispersed through popular media instead of peer-reviewed journals. Out of all articles, as per inclusion criteria and readings, we selected 26 for further analysis and narrative to build.

**Conclusions:** Although this knowledge is currently outdated, revisiting his findings and methods is a source of lessons and inspirations for modern researchers and practitioners.

**KEY WORDS:** cardiology, psychiatry, Aristotle, psychocardiology, psyche

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## INTRODUCTION

Psychocardiology is a complex term generated by the need to understand, conduct research and improve clinical practice based on the heart – brain interaction. Humanity has known these interactions since the era of Hippocrates. A wealth of medical, erudite and non – erudite sources have emphasized the connection of cardiovascular and mental health and the devastating impact of mental health conditions on the heart. Harvey, the first anatomist to accurately describe the circulatory system has stated that “*Every affection of the mind that is attended with either pain or pleasure, hope or fear, is the cause of an agitation whose influence extends to the heart*”[1].

The 21<sup>st</sup> century has marked a new era of investigating the heart – brain interaction from the ground up, including its epidemiological and pathophysiological characteristics. Evidence indicates that cardiovascular and psychiatric conditions have a bidirectional association. Genetic, epigenetic, social and environmental factors contribute to a “coalition” of mental stress with unhealthy nutrition and lack of physical exercise paving the way to the co-occurrence of dyslipidemia, hypertension and coronary heart disease with depression, sleep disorders and anxiety disorders. Frequently, a feedback loop is detected between these co-

morbidities with sleep disorders aggravating hypertension [2] and, conversely and emotional instability precipitating arrhythmias [3]. Psychiatric comorbidities can increase the length of hospitalization of patients with heart failure to up to 9 days[4]. While the prevalence of simultaneous mental and cardiovascular morbidity is highly variable, both of them account for increased global rates of morbidity, mortality, social burden of disease and healthcare associated costs [5]. Both fields would benefit from relevant – and if possible joint – health promotion, prevention and early diagnosis strategies. In recognition of the aforementioned, terms and concepts such as “psychocardiology” and “heart – brain connection” or “axis” have emerged.

Nevertheless, global funding for cardiology exceeds funding for psychiatry, which equals to a mere 0.3% of the total development assistance for health [6]. Although stigmatization can contribute to the development of cardiovascular diseases, individuals with hypertension or atrial fibrillation are less likely to face discrimination than individuals with bipolar disorder and schizophrenia [7]. In response to these disparities between the two fields, it is pivotal to raise more awareness about the heart – brain connection and encourage relevant research and evidence based interventions at clinical and community level.

History of Medicine and medical humanities have a record of contributing to spreading awareness about important public health and clinical issues. Historical and philosophical perspectives can shed light to unseen aspects of the brain – health axis, inform practitioners about relevant popular perceptions and their roots, and set ethical boundaries and even fuel novel concepts [8]. In particular, revisiting the work of Aristotle, an influential philosopher leading the cardiocentric school of thought highlights the long-term perception of the health – brain connection and helps conceptualize psychocardiology in the 21<sup>st</sup> century.

**THE AIM**

To present the philosophical theories of Aristotle about the heart – brain connection and discuss their practical implications in contemporary psychocardiology research and practice.

**MATERIALS AND METHODS**

Specific keywords (brain, heart, cardiology, psychiatry, psychocardiology, Aristotle, cardiocentric) were subjected to list down and analyze the literature in PubMed and Google Scholar. All types of articles, including original research, systematic reviews, and meta-analyses, along with gray literature dating back to 1950. We excluded studies reporting a significant conflict of interest and findings dispersed through popular media instead of peer-reviewed journals. Out of all articles, as per inclusion criteria and readings, we selected 26 for further analysis and narrative to build.

**REVIEW AND DISCUSSION**

**ARISTOTLE IN HISTORY**

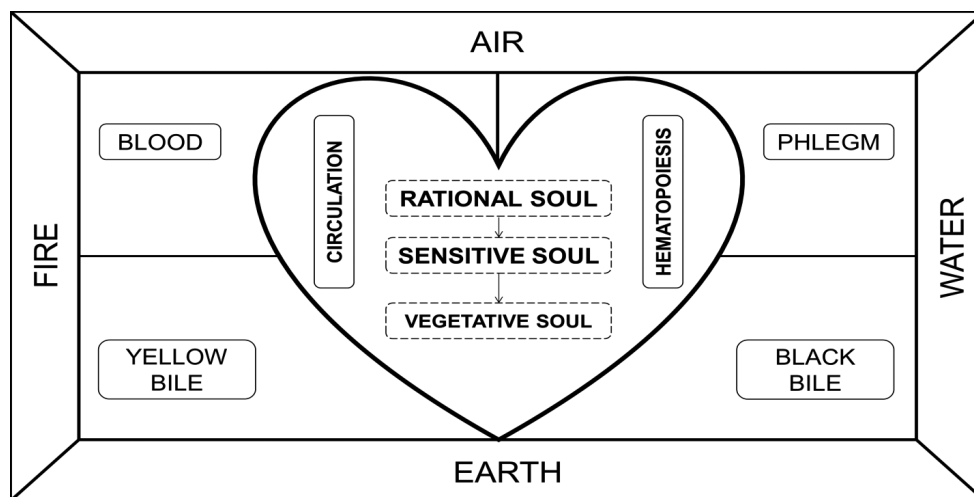
Aristotle was born in 384 BC in Stagira, Chalkidiki, Greece. The son of a physician, who grew up among his father’s medical writings, was introduced to philosophy by the prominent Plato (c. 428 – 348 BC). After the demise of his teacher he founded the peripatetic school of philosophy in Athens and served as the tutor of Alexander the Great

(356-323 BC). He spent his last days in Chalcis, Euboea Greece and died in the waters of the Euboea gulf while studying the peculiarities of the local stream. Aristotle’s work is astonishingly diverse covering several major areas of human inquiry, from art, ethics, rhetoric, and politics to physics, biology, and even metaphysics. Being familiar with human health and disease since his early years, he paid special attention to biology, physiology and medicine. His relationship with Alexander helped him obtain and study animals and specimens found all the way from Egypt to India. Aristotle authored nine anatomy books and two treatises on medicine, which have not been preserved. His philosophical theories and observations related to biology, anatomy, physiology and reproduction can be traced in History of Animals (Historia animalium), Movement of Animals (De motu Animalium) and Generation of Animals (De generatione animalium) [9].

**CARDIOCENTRIC PHILOSOPHY – THE HEART AS THE HABITAT OF THE PSYCHE**

Aristotle considered the heart as the most prominent organ of the body. According to him, cognition, motion, and sensation were anatomically and physiologically based on the heart, while the brain served as a pump and a cooler supporting the circulation of blood [10]. The whereabouts of this model dated back to ancient Egypt and Mesopotamia. This perception has been “sang” in Homeric sagas and was endorsed by philosophers such as Empedocles, physicians such as Philistion of Lokri or even medical communities of the era such as the School of Knidos in Asia Minor. Ibn Sina, the father of Arab Medicine incorporated the psychocardiological theories of Aristotle to his work and practice. Variants of the theory survived until Renaissance in erudite medicine and even until the 19<sup>th</sup> century in folk medicine textbooks [11, 12].

Aristotle has epitomized the cardiocentric (heart – centered) model and attempted to provide biological evidence for this by means of embryology, comparative anatomy and physiology. He elaborated on the embryology of the heart in the second book of Generation of Animals (De Generatione Animalium) indicating the heart as the first



**Fig. 1.** The tripartite soul (psyche) located in the heart and combined with the four humors and the cosmic elements according to Aristotle and the ancient Greek medical, philosophical and cosmological paradigm.

organ to form in the body of the fetus. Aristotle used to dissect fetuses of several species – but not humans as it was prohibited by religious norms of the era – and justified the primacy of the heart because of the need of heartbeat for the development of the fetus. He also assumed that the heart served as the source of sensation [13].

In the third book of the History of Animals (Historia animalium)[14], Aristotle introduced the concept of cardiac cavities and described the heart as a triventricular structure. He was unable to detect the fourth cavity due to the way he strangled animals before dissection. Being unaware of the connection between arterial and venous circulation, he dedicated one ventricle to each leg of (his understanding of) the circulation and associated the remaining third ventricle with metaphysical purposes. This was in accordance to hylomorphism, a central doctrine of Aristotle's natural philosophy suggesting that every natural bodies host two intrinsic principles, one potential and one actual[15]. In this frame it was possible for the heart to regulate the circulation while hosting the rational soul, the highest intellectual component of the human being[16]. An overview of the soul (psyche) in the philosophy of Aristotle is presented in Figure 1 [17, 18].

The cardiac neurophysiology of Aristotle is presented in On Youth, Old Age, Life and Death, and Respiration (De Juventute et Senectute, De Vita et Morte, De Respiratione) and in Parts of Animals (Partibus animalium). According to Aristotle, pulsation derives from the inmost warmth, a metaphysical vital force of the psyche residing in the heart. Blood, one of the four vital humors, was supposed to be generated in the heart, transport the vital force of sensation, movement and cognition throughout the body and then evaporate. Despite its metaphysical connotations, the blood evaporation theory was based on Aristotle's observations of the arterioles, whose connection to trichoids, venules and veins could not be visualized in the dissections performed by the philosopher [19, 20]. It becomes evident that Aristotle considered cognitive, affective functions and mental wellbeing tightly joined with physiological cardiovascular function. Aristotle's cardiovascular physiology could be rephrased as "*I have a heartbeat and therefore I am*".

## ARISTOTLE'S PSYCHOCARDIOLOGY IN THE 21ST CENTURY

The perception of human physiology has changed a lot since the era of Aristotle. In spite of his metaphysical bias and the moral restrictions of the era, Aristotle worked hard to discover the biological evidence of the heart – brain connection. Nowadays, revisiting his work can provide researchers, clinicians and intellectuals with a number of lessons.

Biological evidence is important and its sources should be as diverse as possible. However, its results can be misinterpreted and should be reconsidered in the light of new evidence. Aristotle dissected a great variety of animals at different stages of their development, seeking anatomical and physiological evidence for his theories about the soul

and the heart. Due to the lack of equipment and techniques, he misinterpreted some of his research, failed to describe the circulation and was led to faulty conclusions. Nevertheless, Aristotle made a paradigm shift in an era, when most intellectuals would only develop theoretical concepts and argue over them. His approach to biology and medicine inclined towards observation and experiment, as suggested by Hippocrates and his disciples [21]. Contemporary intellectuals can benefit from a deeper understanding and even involvement in life and natural sciences [22].

Vaguely interpreted, the hylomorphic perception of Aristotle affirms that each organ has hidden cultural and social representations. Nowadays, the heart is regarded as a vital organ with a prominent role in circulation and homeostasis, an innate system of electrophysiology and a diverse spectrum of pathologies. Nevertheless, the heart is still considered as a residence or a host of sentiment and affection in popular beliefs. In religious context, the heart remains connected to the soul and psyche. Modern medicine can take into account these beliefs in its efforts to raise awareness about cardiovascular and psychiatric diseases and comorbidity among lay people. Pastoral care can help, those who freely seek it as a complement to evidence based medicine, understand and even relieve their own cardiovascular and mental risk factors. Evidence has highlighted spiritual and social perceptions as a determinant of coherence and mental wellbeing in rural populations with (usually) limited access to health [23-25] aimed at exploring an association between spirituality, religiousness, and sense of coherence in a population group residing in a rural area of Crete, Greece. STUDY DESIGN AND METHODS: The study was conducted during the period 2007-2009. Subjects aged 65 years and older (n = 118). In this context, psychocardiology is an ideal field for compassionate biopsychosocial human centered interventions and related research [26].

Multidisciplinarity is an equally important lesson from Aristotle's psychocardiology. Modern medicine can be enriched with philosophy, particularly when it comes to ethical boundaries and considerations and communication with patients. Beyond erudite philosophical treatises, art, proverbs, fiction and literature can help physicians and researchers understand risk and stigmatization factors and decode the hesitancy of the public to seek medical attention. Acquiring this knowledge – without neglecting continuous medical education – has also been shown to help physician and healthcare practitioners become more resilient and mindful [27].

## CONCLUSIONS

Health promotion, prevention and early diagnosis constitute a shared goal by healthcare professionals in cardiovascular and psychiatric wards, which can be enhanced by cooperation between them. Revisiting the work of Aristotle provides methods and principles to advance psychocardiology research and practice in a biopsychosocial and human – centered context.

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