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ANATOMICAL STRUCTURE AND HISTOPHYSIOLOGICAL CHARACTERISTICS OF THE HEART: A MODERN ANALYSIS

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Abstract: This article provides a systematic analysis of the anatomical and histological structure of the heart, as well as its physiological functions. The study aims to evaluate the functional significance of the heart's four-chambered structure, its wall layers (epicardium, myocardium, endocardium), and its conduction system. The research employed methods including anatomical dissection, histological analysis, and systemic vascular-nervous analysis. The results demonstrate that the intercalated discs between cardiomyocytes ensure the rapid transmission of electrical signals, while coronary blood supply and innervation coordinate the heart's inherent automaticity. The conclusion emphasizes that the anatomical and histological integrity of the heart serves as a fundamental basis for its effective pumping function, as well as for understanding and treating cardiological pathologies.

Keywords: Heart, myocardium, cardiomyocyte, conduction system, anatomical nomenclature, coronary circulation.

Introduction

The heart (Latin: *cor*, Greek: *καρδία – sardia*) is a hollow muscular organ, conical in shape, which serves as the central organ of the cardiovascular system. It is responsible for pumping blood to all organs and tissues of the body, and its histological structure is highly complex [1]. It is located in the middle mediastinum of the thoracic cavity [1]. Morphologically, the heart consists of a base (*basis*), directed superiorly and posteriorly, and an apex (*apex*), directed anteriorly, inferiorly, and to the left. The base of the heart is formed by the roots of the major blood vessels. The heart possesses three surfaces: 1) anterior (sternocostal); 2) inferior (diaphragmatic); and 3) posterior (vertebral or pulmonary). The size of the heart is roughly equivalent to the individual's closed fist [2]. In children, the heart rate is higher, and the heart

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appears more globular and horizontally oriented [3]. The origins of major vessels lie on the anterior surface of the heart: the superior vena cava is located to the right and slightly posteriorly, the ascending aorta is located anteriorly and to the left, and the pulmonary trunk is located further to the left [2]. Anatomically, the heart consists of four chambers: two atria and two ventricles. The left atrium and left ventricle constitute the "arterial heart," as they contain oxygenated blood, while the right ventricle and right atrium constitute the "venous heart." The heart rhythmically contracts and relaxes; contraction is termed *systole*, and relaxation is termed *diastole* [1]. The heart beats an average of 70–74 times per minute, with 60–90 beats/min accepted as the medical norm [1].

Physiological and Pathological Context

The four-chambered structure ensures complete separation of arterial and venous blood [4], which is essential for uniform heat distribution across tissues. Unlike other organs, cardiovascular pathologies are the leading cause of death globally [5, 6]. The heart is a "target organ" susceptible to various internal and external negative factors, including brain, kidney, and vascular health. Cardiovascular diseases affect people of all ages, including children. Treatment is directed toward identifying and correcting specific functional impairments using diagnostic tools such as echocardiography and electrocardiography to analyze electrical, acoustic, and mechanical events [7].

Methods

The study utilized the following anatomical and histological investigation methods:

- **Anatomical Dissection:** Examination of the heart's gross structure, chambers, and valvular system.
- **Histological Analysis:** Microscopic evaluation of myocardial cardiomyocytes, conduction system cells (Purkinje fibers), and their intercellular connections.
- **Systemic Analysis:** Investigation of the structural integrity of the heart's blood supply (coronary arteries) and its innervation.

Detailed Breakdown of Methodology

1. **Anatomical Dissection:** Used to study the layered structure and spatial relationships of the heart.
   - *Chamber Analysis:* Comparing the thickness of the septal walls; the thickness of the left ventricular myocardium is analyzed in relation to its functional load.
   - *Valvular System:* Studying the structure of valves and *chordae tendineae* to understand the unidirectional flow mechanism.
2. **Histological Analysis:** Uses staining to reveal cellular structure.
   - *Cardiomyocytes:* Identifying *intercalated discs* and *gap junctions* that facilitate rapid electrical conduction.
   - *Purkinje Fibers:* Examining their glycogen-rich, large-diameter structure which is essential for synchronized ventricular contraction and arrhythmia prevention.
3. **Systemic Analysis (Vascular and Nervous Regulation):**
   - *Coronary Arteries:* Mapping the branching patterns to understand myocardial nutrient delivery, crucial for infarction diagnostics.
   - *Innervation:* Investigating the relationship between autonomic nerves and the myocardium to understand rhythm regulation.

Significance: This triple-method approach transforms the study of the heart from rote memorization to a profound understanding of physiological processes.

Results

The analysis yielded the following critical findings:

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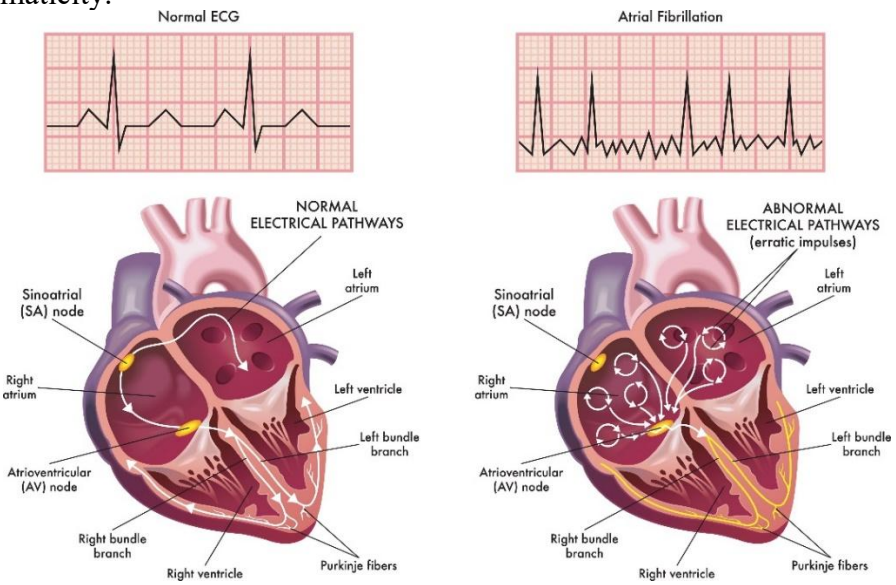
- **Myocardial Layer:** Cardiomyocytes possess a characteristic striated structure, with *intercalated discs* providing rapid electrical signal transmission.
- **Valvular System:** The mitral and tricuspid valves function as a complex fibrous apparatus ensuring unidirectional flow.
- **Conduction System:** The sinoatrial (SA) node (the natural "pacemaker") and the atrioventricular (AV) node were confirmed to generate and distribute impulses based on automaticity.



Summary of Tissues and Regulation:

- **Anatomical Results:** The left ventricular wall thickness is approximately three times that of the right, reflecting its role in systemic high-pressure circulation.
- **Histological Results:** The heart functions as a functional *syncytium* due to intercalated discs, allowing the entire myocardium to act as a single unit.
- **Systemic Results:** Coronary artery branching is perfectly adapted to metabolic demand, and the dense concentration of sympathetic and parasympathetic nerves around the SA and AV nodes allows for dynamic rhythm adjustment.

Discussion

The efficiency of cardiac function depends on the perfect balance between anatomical structure and electrical conductivity. Impairments in myocardial diffusion or coronary circulation lead to clinical pathologies such as myocardial infarction and heart failure. While the heart's intrinsic automaticity allows it to function independently of the central nervous system, the autonomic nervous system fine-tunes this activity to meet the body's physiological needs.

Conclusion

The heart is not merely a pump, but a complex biological machine that regulates hormonal, electrical, and mechanical signals. Its anatomically optimized chambers and systemic conductivity ensure a lifetime of fatigue-free operation. Deep study of these anatomical structures serves as a fundamental basis for accurate diagnosis and effective treatment strategies in cardiology.

References

1. Moore, K. L., Dalley, A. F., & Agur, A. M. R. (2017). *Clinically Oriented Anatomy* (8th ed.). Wolters Kluwer.
2. Ross, M. H., & Pawlina, W. (2018). *Histology: A Text and Atlas*. Wolters Kluwer.

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INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

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3. Guyton, A. C., & Hall, J. E. (2020). *Textbook of Medical Physiology* (14th ed.). Elsevier.
4. Yunusov, A. T. (2020). *Histology, Cytology, and Embryology*. Toshkent: O‘qituvchi.
5. Netter, F. H. (2019). *Atlas of Human Anatomy*. Elsevier.
6. Zipes, D. P., et al. (2018). *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. Elsevier.
7. Mamatqulova, N. X. (2025). *Histology of the Cardiovascular System*. Termiz: TDTU Termez Branch Press.
8. Kurbonovich T. B. et al. (2025). DIGITAL TECHNOLOGIES IN MEDICINE. TELEMEDICINE. *IMRAS*. Vol. 8. No. 12. P. 39-41.
9. Kurbonovich T. B. et al. (2026). PROBLEMS IN MODERN CULTURE: SOCIO-SPIRITUAL ANALYSIS IN THE CONTEXT OF GLOBALIZATION AND DIGITAL TRANSFORMATION. *Global Science Review*. Vol. 18. No. 1. P. 183-188.
10. Panji o‘g‘li C. O. et al. (2026). REGENERATIVE PROPERTIES AND MODERN HISTOLOGICAL ANALYSIS OF CONNECTIVE TISSUE IN THE MORPHOFUNCTIONAL SYSTEM OF THE ORGANISM. *American Journal of Applied Medical Science*. Vol. 4. No. 2. P. 230-235.
11. Turdimuratov B.K. (2022). *Teaching Medical Sciences Using Innovative Methods and ICT*. Tashkent: Uzbekistan Medical Publishing House.
12. Kurbonovich T.B., & Bahodirovich, B.B. (2026). Step-by-step acquisition of practical skills in studying information technologies in medicine. *Global Science Review*, 17(1), 203–209.
13. Kurbonovich T.B., & Nurhayat, M. (2026). Compilation and steps of the medical situational issues algorithm. *American Journal of Applied Medical Science*, 4(2), 59–63.
14. Turdimurodov B.K., et al. The essence of electronic textbooks in medical education. *European Journal of Humanities and Educational Advancements*, 3(4), 48–50.
15. Shoxrullo S., Mirzohid B. (2026). MODERN CARDIAC SURGERY: EVOLUTIONARY MILESTONES AND CLINICAL RELEVANCE. *American Journal of Applied Medical Science*. Vol. 4. No. 3. P. 56-58.