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SURVEY OF MICROGRAPHS OF THE CARDIOVASCULAR SYSTEM

Ana Beatriz Vieira Vilela
Doctor by: Faculdade de Medicina da Pontifícia Universidade Católica de Goiás, Goiânia – Goiás
http://lattes.cnpq.br/9346310501950325

Julia Faustino Nishi
Doctor by: Faculdade de Medicina da Pontifícia Universidade Católica de Goiás, Goiânia – Goiás
http://lattes.cnpq.br/3468858813266479

Júllia Santana Prudente de Angelis
Doctor by: Faculdade de Medicina da Pontifícia Universidade Católica de Goiás, Goiânia – Goiás
http://lattes.cnpq.br/2494616387333076

Leandro Augusto Rodrigues dos Santos
Doctor by: Faculdade de Medicina da Pontifícia Universidade Católica de Goiás, Goiânia – Goiás
http://lattes.cnpq.br/1615642218772312

Renata Cordeiro dos Santos Rodrigues
Doctor by: Faculdade de Medicina da Pontifícia Universidade Católica de Goiás, Goiânia – Goiás
http://lattes.cnpq.br/4024803227692366

Weiler Ferreira Fonseca
Doctor by: Faculdade de Medicina da Pontifícia Universidade Católica de Goiás, Goiânia – Goiás
http://lattes.cnpq.br/8766475196610992

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Abstract: Introduction: in view of the increasing use of information and communication technologies as a teaching-learning tool, the use of individual microscopes in histology classes has become obsolete due to the space required for storage and techniques for handling them.

Thus, the digitized atlas emerged, aiming to contribute to the training of academics, since it allows a single micrograph to be discussed in a group, presents didactic subtitles, in addition to being available inside and outside the classroom. **Objectives:** Gather micrographs of the cardiovascular system and describe them individually, emphasizing their respective functions in homeostasis. **Methods:** registration of micrographs referring to the cardiovascular system from the slides provided by the School of Medical, Pharmaceutical and Biomedical Sciences of ``Pontifícia Universidade Católica de Goiás``. **Results:** the recorded micrographs were properly described, with the support of a literature review of the cardiovascular system, reaching the proposed objective. **Conclusion:** academics are expected to enjoy this work, and that it is useful for their training.

Keywords: histology, digital atlas, cardiovascular system

INTRODUCTION

The term tissue (from the Latin *texere,* to weave) was introduced around 1800 by the French surgeon and anatomist Marie François Xavier Bichat, considered the father of histology and pathology, and impressed by the different textures found in body parts that he had dissected. The French Revolution, with the practice of executing transgressors by guillotine, provided Bichat with a large number of bodies for his anatomical studies – around 600 a year. As a result, in 1798 he began publishing articles describing the human body as being made up of a variety of different tissues (or textures); he identified 20 "membranes" and their normal and pathological structures, including nervous, vascular, and connective tissue. His two main works that greatly contributed to the advancement of medicine are *Traité des membranes* (1800) and the fifth volume of *Anatomie general* (1801).

The emergence of Histology as a science coincides with the creation of the microscope in 1595, by the Dutch Hans and Zacharias Janssen, manufacturers of glasses (Janssen's microscope). The equipment consisted of two magnifying lenses, and magnified the image between 10 and 30 times, and was improved over time, through the studies of Marcello Malpighi (1628-1694), Antonie van Leeuwenhoek (1632-1723) and Robert Hook (1635-1703), to study insects and plants.

Almost 500 years after the development of the first microscope, Histology is now taught in schools of biological and biomedical sciences around the world. Traditionally, this discipline is taught by viewing slides individually, requiring prior techniques to focus on the equipment, which is expensive and requires large spaces to house them (SANTA-ROSA, 2011). With the advent of technology and the facilities inherent to it, however, this form of teaching has become obsolete.

The use of information and communication technologies as a teaching-learning tool in Higher Education has become a reality. In Histology classes, for example, the adoption of a digitized atlas is already widely seen. By allowing a group of people to view and discuss a single slide at the same time, inside or outside the classroom, which is presented with adequate focus and lighting, and didactic subtitles, classes become more democratic, interesting and dynamic (MIRANDA).

It is worth emphasizing that another benefit of the digitized histology atlas is the guarantee of quality training for students, since the exchange of material between different Universities is a reality, which allows for a collection that is always updated. In addition, this teaching/study method is in keeping with the new generations entering higher education, where learning is no longer unidirectional and based on the teacher, but on the students themselves (UFRGS, 2018) (SILVA).

Bichat, Janssen, Malpighi, Leeuwenhoek and Hook built unshakable pillars for biological and biomedical sciences and, in particular, for histology. On these pillars, it was possible to observe the human body from another perspective, understand the pathologies and propose treatment for them. Undoubtedly, technology provides a unique view of the organism and it must urgently have its facilities enjoyed by as many people as possible. Only then, with the implementation of the Digitized Histology Atlas and with so many other changes, will it be possible to build pillars as consistent as those that were previously built.

METHOD

The contribution to the proposed digital resource, for the improvement of knowledge about histology, was made from the recording of micrographs referring to the Cardiovascular System, obtained from the slides made available by the School of Medical, Pharmaceutical and Biomedical Sciences. Subsequently, all images were carefully analyzed according to their quality, clarity and presence of particular structures of each tissue, as well as their legends. If the records were not judged usable, new micrographs were captured with the aid of the Canon Power Shot G10 Camera, which were improved with the Remote Capture DC and Adobe PhotoShop CS5 programs. In addition, the summary inherent to the Cardiovascular System was prepared based on a thorough literature review, ensuring quality and reliability in the information made available to users of the Virtual Atlas.

The editing of the images and texts that make up the Histology Atlas was carried out at the Morfofunctional Laboratory, located in Area IV - Block K of ``Pontifícia Universidade Católica de Goiás``, due to the availability of technological and literary resources.

RESULTS

ARTERIES AND ARTERIOLES

Arteries are vessels that leave the heart for the organs, in which they branch into smaller diameters, called arterioles.

Blood vessels are formed by layers or tunics. The tunica intima is the endothelium and subendothelial connective tissue of the vessel, being easily observed on the luminal surface of the vessels. Then, the tunica media is observed, basically composed of smooth muscle and fibers, which, in the case of elastic arteries, there is a predominance of elastic fibers. Externally, there is the tunica adventitia, where the *vasa vasorum* are present, a network of smaller vessels that nourish the walls of large caliber vessels.

The muscular artery is structurally similar to the elastic one, except for its caliber and the smaller proportion of elastic laminae in relation to smooth muscle.

Arterioles are vessels endowed with a prominent muscular layer when compared to their size, but follow the same structure as arteries, being formed by the three layers.

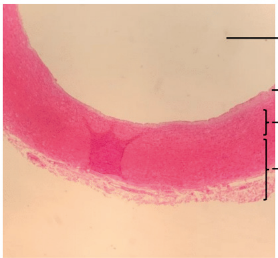

Figure 1 - *Artery in cross-section.*
Staining: Hematoxylin and Eosin.
Small magnification (40x).

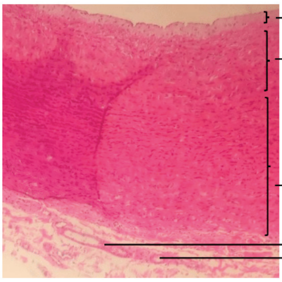

Figure 2 - Artery in cross-section.
Staining: Hematoxylin and Eosin.
Medium magnification (100x).

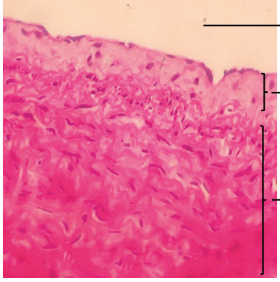

Figure 3 - *Artery in cross-section.*
Staining: Hematoxylin and Eosin.
Big magnification (400x).

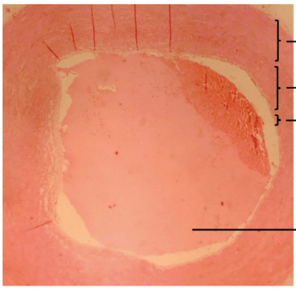

Figure 4 - *Aorta artery in cross-section.*
Staining: Hematoxylin and Eosin.
Small magnification (40x).

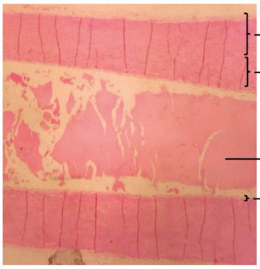

Figure 5 - *Aorta artery in longitudinal section.*
Staining: Hematoxylin and Eosin.
Small magnification (40x).

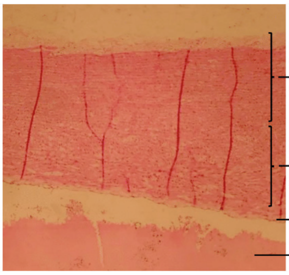

Figure 6 - *Aorta artery in longitudinal section.*
Staining: Hematoxylin and Eosin.
Medium magnification (100x).

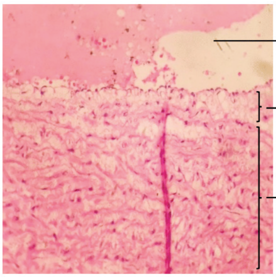

Figure 7 - *Aorta artery in longitudinal section.*
Staining: Hematoxylin and Eosin.
Big magnification (400x).

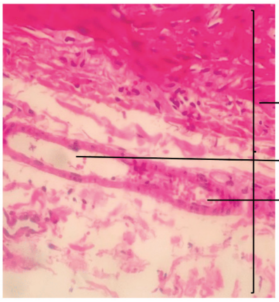

Figure 8 – *Artery in cross-section.*
Staining: Hematoxylin and Eosin.
Big magnification (400x)

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VEINS AND VENULES

The main characteristic of the venous system is the thinness of its walls in relation to the arterial system, in view of the lower pressure suffered by the veins, in addition to presenting a wider lumen. In general, veins and venules are irregularly shaped vessels.

The veins, in view of their greater caliber, present three well-defined tunics, with a thinner tunica media and a more prominent tunica adventitia. They have valves (folds of the tunica intima).

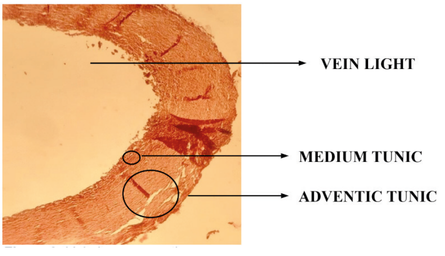

Figure 9 *- Vein in cross-section.*

Staining: Hematoxylin and Eosin.

Small magnification (40x).

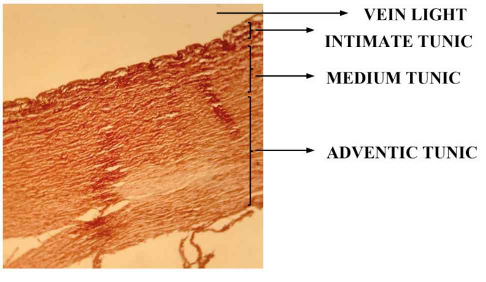

Figure 10 *- Vein in cross-section.*

Staining: Hematoxylin and Eosin.

Medium magnification (100x).

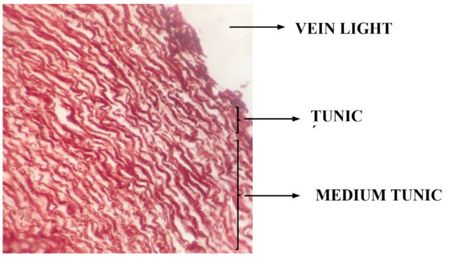

Figure 11 *- Vein in cross-section.*

Staining: Hematoxylin and Eosin.

Big magnification (400x).

BLOOD AND LYMPH CAPILLARIES

Capillaries are blood vessels formed by highly permeable endothelium and the basal lamina, and may contain pericytes, cells that have contractile proteins in the cytoskeleton and are considered mesenchymal stem cells.

The lymphatic vessels converge and form progressively larger lymphatic vessels. The lymph contained in this network of lymphatic vessels passes through the lymph nodes where it is exposed to cells of the immune system.

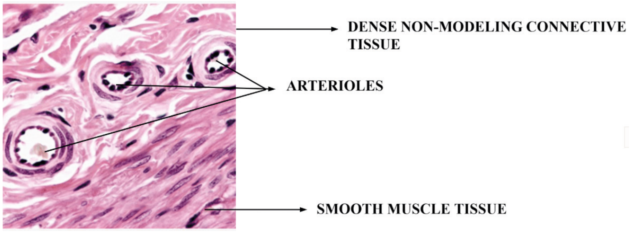

Figure 12 *- Microcirculation.*

Staining: Hematoxylin and Eosin.

Medium magnification (100x).

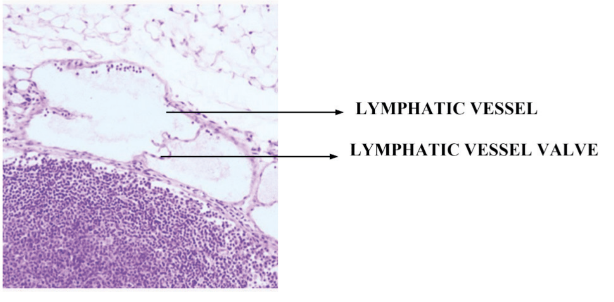

Figure 13 *- Lymphatic vessel.*

Staining: Hematoxylin and Eosin.

Small magnification (40x).

HEART

The endocardium is formed by a simple squamous epithelial tissue (endothelium) associated with a connective tissue (subendocardium). Sometimes it will be possible to observe the formation of heart valves, which are projections of the endocardium formed by a central axis of connective tissue and endothelial lining on both sides. The outer surface of the heart is covered by a serosa - the visceral layer of serous pericardium, called the epicardium.

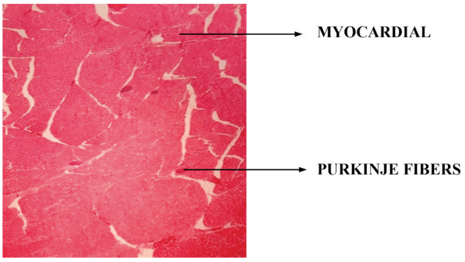

***Figure 14** - Myocardium.*

Staining: Hematoxylin and Eosin.

Small magnification (40x).

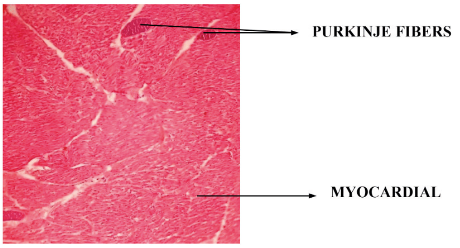

***Figure 15** - Myocardium.*

Staining: Hematoxylin and Eosin.

Medium magnification (100x).

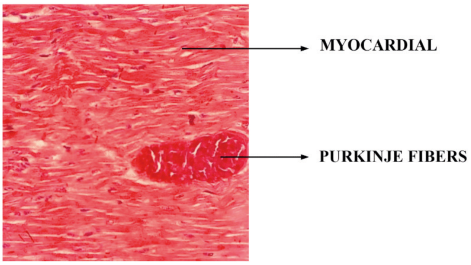

***Figure 16** - Myocardium.*

Staining: Hematoxylin and Eosin.

Big magnification (400x).

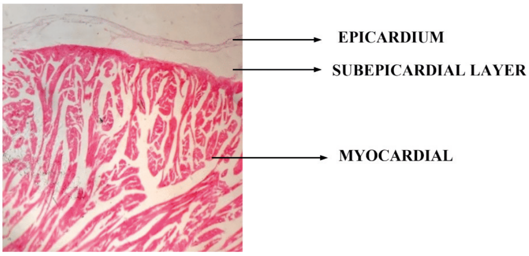

***Figure 17** - Heart.*

Staining: Hematoxylin and Eosin.

Small magnification (40x).

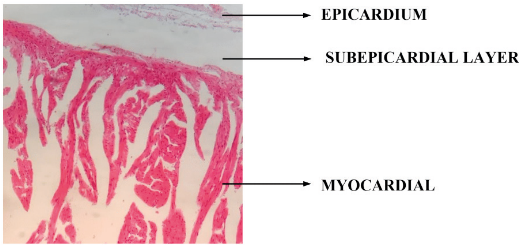

*Figure **18 - SEQ Figure * ARABIC** Heart.*

Staining: Hematoxylin and Eosin.

Medium magnification (100x).

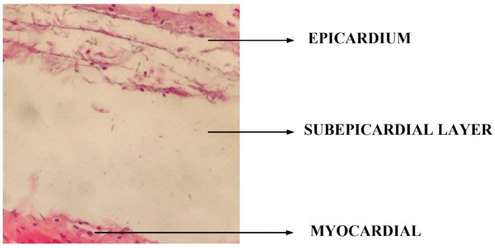

Figure 19 - Heart.

Staining: Hematoxylin and Eosin.

Big magnification (400x).

DISCUSSION

The construction of a digitized histology atlas meets the new teaching reality, in which technology allows a group of people to view and discuss a single slide simultaneously, a fact that is not possible when having individual microscopes. In addition, the digitized atlas helps ensure that the collection is always up to date, as the exchange of materials between different Universities becomes easy and recurrent.

The limitations of this work are justified by the slides of the cardiovascular system available in the laboratory of the School of Medical, Pharmaceutical and Biomedical Sciences at PUC Goiás. There was not a wide variety of blades and, among those available, many had their sharpness compromised. Even so, this work is complete and of great value to university students.

The images were subtitled in accordance with the existing literature, highlighting the authors Carlos Junqueira and José Carneiro

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(JUNQUEIRA, 2018).

The work in question instigates the creation of atlases of histology of other systems of the human body and the exchange of this material with other Universities so that, as previously mentioned, it contributes to the training of professionals in the health area.

CONCLUSION

Based on a literature review on the cardiovascular system, the recorded images were described individually, emphasizing their histological components and respective functions in homeostasis. All proposed objectives were achieved. Finally, it is hoped that academics will enjoy this work, and that it will be useful for their training.

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