

PREPARATION OF ANATOMICAL PIECES AS DIDACTIC RESOURCES FOR NURSING AND BIOLOGICAL SCIENCES UNDERGRADUATE COURSES: THE CHALLENGES OF TEACHING ANATOMY IN THE EXTREME WESTERN BRAZILIAN AMAZON

PREPARAÇÃO DE PEÇAS ANATOMICA COMO RECURSOS DIDÁTICOS PARA OS CURSOS DE GRADUAÇÃO EM ENFERMAGEM E CIÊNCIAS BIOLÓGICAS: OS DESAFIOS DO ENSINO DE ANATOMIA NO EXTREMO OCIDENTAL DA AMAZÔNIA BRASILEIRA

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ABSTRACT

The process of learning anatomy is complex and difficult as far as teaching is concerned, since memorizing structures with complex names makes the task monotonous and discouraging. To arouse interest in learning Anatomy, 10 animal cadaveric parts were produced for the implementation of new teaching-learning methods. These materials were used in classes and practical tests in the course of 02 semesters in the teaching of Human Anatomy and Animal Anatomy, visibly arousing in the students of the Universidade Federal do Acre, *Campus Floresta*, a greater interest in learning, since it replaced anatomical plastic models by the models of animal cadaveric parts. In view of the results, it is possible to observe that the use of the pieces during the classes is an innovative and efficient tool in the anatomy teaching in the extreme Brazilian western Amazon, providing to undergraduate students of Nursing and Biological Sciences to learn with higher quality even in the most remote university *Campus* of the interior of Brazil.

Palavras-chave: Dissecção, miologia, técnicas anatômicas, educação anatômica.

RESUMO

O processo de aprendizagem da Anatomia é complexo e difícil no que diz respeito ao ensino, uma vez que a memorização de estruturas com nomes complexos torna a tarefa monótona e desanimadora. Para despertar interesse no aprendizado da Anatomia, foram produzidas 10 partes de cadáveres de animais para a implementação de novos métodos de ensino-aprendizagem. Estes materiais foram utilizados em aulas e provas práticas no decorrer de 02 semestres no ensino de Anatomia Humana e Anatomia Animal, despertando visivelmente nos alunos da Universidade

Federal do Acre, Campus Floresta, um maior interesse na aprendizagem, uma vez que substituiu modelos anatômicos de plástico por peças cadavéricas animais. Diante dos resultados, é possível observar que o uso das peças durante as aulas é uma ferramenta inovadora e eficiente no ensino de anatomia no extremo Oeste da Amazônia brasileira, proporcionando aos graduandos de Enfermagem e Ciências Biológicas a aprendizagem com maior qualidade no *Campus* universitário mais remoto do interior do Brasil.

Keywords: Dissection, myology, anatomical techniques, anatomical education.

1. INTRODUCTION

The study of Anatomy from the beginning of the formation of Western culture was based on the philosophical and methodological basis for understanding the form, function and origin of man, as well as his relations with the world in his surroundings from the Aristotelian essentialism to the theory of evolution of Charles Darwin [1, 2]. As a basic science Anatomy has become the fundamental framework for the training of the academics of the Biological Sciences and Health Sciences and its teaching has become object of studies and discussions in the contemporary world, mainly because this discipline requires the learning of a nomenclature [3, 4]. Thus, for the learning process be achieved, many contemporary authors reaffirm the need to use corpses and/or cadaveric parts in practical classes [5], considering that currently the most prevalent pedagogy consists of didactic lectures, which discuss the structures and anatomical functions of the body through photographs and computer animations [6].

In the 21st century, the use of corpses of humans or animals became the great paradigm of

anatomy teaching, because access to this important didactic resource was increasingly restricted in Universities and Higher Education and Research Institutions, especially in the face of legal difficulties and ethics in obtaining them [5], the high costs for preparation and maintenance of Anatomy didactic laboratories, but mainly in the absence of human resources capable of teaching and instructing students in the practical classes [8]. This reality is in line with the great effort of contemporary anatomists who systematically test new cadaver preparation techniques for anatomy teaching, signaling the importance of using them in the training and education of future health and biological professionals, as well in prosecution, dissection and research [9-11].

The *Campus* Floresta of the Universidade Federal do Acre (UFAC), located in Cruzeiro do Sul, municipality, interior of Acre state, distant approximately 700 Km from *Campus* Rio Branco, university headquarters, is the most isolated federal superior education unit in Brazil, located in one of the most undeveloped economic and social regions, surrounded by the amazon forest and its traditional communities, that

attends four undergraduate courses that demand in their curriculum the teaching of Human Anatomy and Animal Anatomy.

The Anatomy educators of the UFAC *Campus Floresta* also face the problems concerning the praxis of practical teaching with the vast majority of training centers for health and biological professionals in the world are subject to, as previously discussed: lack of optimum environmental conditions for the teaching of Anatomy, lack of money to produce and maintain the anatomical pieces that will serve the students and researchers, but mainly the lack of human resources able to teach and produce this much needed quality material of teaching. Still in a process of self-criticism and evaluation as educators and trainers of future professionals, it is necessary to reflect in [12] statement that the combination of the increase of students, reduction of the hours of the Anatomy courses and the lack of teachers and technicians who can attend to the graduates lead to a gap in the detailed training in

2. MATERIAL AND METHODS

The cadaveric materials were obtained from different sources, these being domestic and wild animals found dead in garbage bricks and run over in public roads around the municipality of Cruzeiro do Sul, Acre or died of natural causes, donated by popular or collected by the the Laboratório de Anatomia e Fisiologia Comparada of UFAC.

The acquired cadavers were identified at

Anatomy of the future professionals of the biomedical areas, potentially generating questions about their professional capacity. In the specific scenario of the *Campus Floresta* of the Federal University of Acre this reflection is much more severe, since the graduates of the courses that have anatomy in their curriculum are leaving the university with the practical knowledge in human anatomical models of plastic and without any contact with biological cadaver models, which certainly does not reflect the professional reality with which they must deal when inserted in the labor market.

Therefore, it is imperative to introduce new teaching methods and didactic resources to all anatomy courses offered to undergraduates at the *Campus Floresta* of UFAC, so that a complete training with complement of animal cadavers can be offered in classes and tests practices, enabling the formation of critical mass capable of dealing with the challenges in teaching and learning anatomy with quality.

the lowest taxonomic level and then fixed using intramuscular injections of aqueous 10% formaldehyde solution and stored in the same solution for 720 h, then washed in water and transferred to a 70° GL alcohol solution.

After the taxonomic identification process, the anatomical techniques applied were:

- Dissection: for the development of the technique the animals were dissected from the most superficial to the deepest layers, in order to show their superficial musculature and the visualization of organs.

- **Plastination:** the organs were dissected carefully removing all the adipose and connective tissues for better visualization of the structures and immersed in acetone PA for seven days to eliminate adipose tissue, being subsequently immersed in glycerin PA for another seven days. After the previous two steps the materials were removed from the glycerin, drained and cleaned with tissue paper. They were then placed in cloth sacks and disposed of powdered corn starch for seven days, after which they were removed from the product and the remaining powder residues in the pieces were blown with the aid of a hair dryer, modified from [11].

- **Diaphanization:** technique used to prepare skeletons of small specimens, which

3. RESULTS

With the application of anatomical techniques, the present study produced 10 cadaveric anatomical pieces that were used in classes and practical tests during 02 semesters in the teaching of Human Anatomy and Animal Anatomy, visibly arousing the interest of the students of the Universidade Federal do Acre, *Campus Floresta*, who demonstrated ease in learning, since we replaced the previous models. The comparative approach was implemented during the classes, even in Human Anatomy lectures, what allowed, especially to the nursing students a close contact with the cadaver's soft tissues and their structural richness, not available in plastic models, and to recognize the importance of the animal anatomy to understand

consists of the differential staining of bones and cartilages and later diaphanized according to [14], allowing the high contrast visualization of the bones in red and cartilaginous structures in blue on the animal's body.

After these procedures, the anatomical pieces were documented with digital photographs obtained with a DSRL CANON REBEL XTI digital camera for use in practical classes in Human Anatomy and Animal Anatomy. For a greater legality in its execution, the present study had the announcement of the Ethical Commission on Animal Use (CEUA) of the UFAC and the Brazilian Government Environmental Agency SISBIO (CEUA 86/2015 and SISBIO 48632-1 and 47706-1).

the form evolution for both nursing and biological sciences undergraduate students. For the myology study were used *P. palpebrosus*, *L. labyrinthicus*, and *I. iguana* exemplars (Fig. 1), which were dissected allowing the visualization of superficial musculature. The use of viscera of *Sus scrofa* (Fig. 2) and *Canis lupus familiaris* (Fig. 3) contributed to the teaching-learning process of curricular contents: circulatory, respiratory, digestive, urinary and female reproductive systems. Consequently, we perpetuate the diaphanization of the embryos of *Didelphis marsupialis* and it was possible to visualize part of the process of ossification in the embryonic development (Fig. 4). All the didactic exemplars used during this study were listed in table 1.

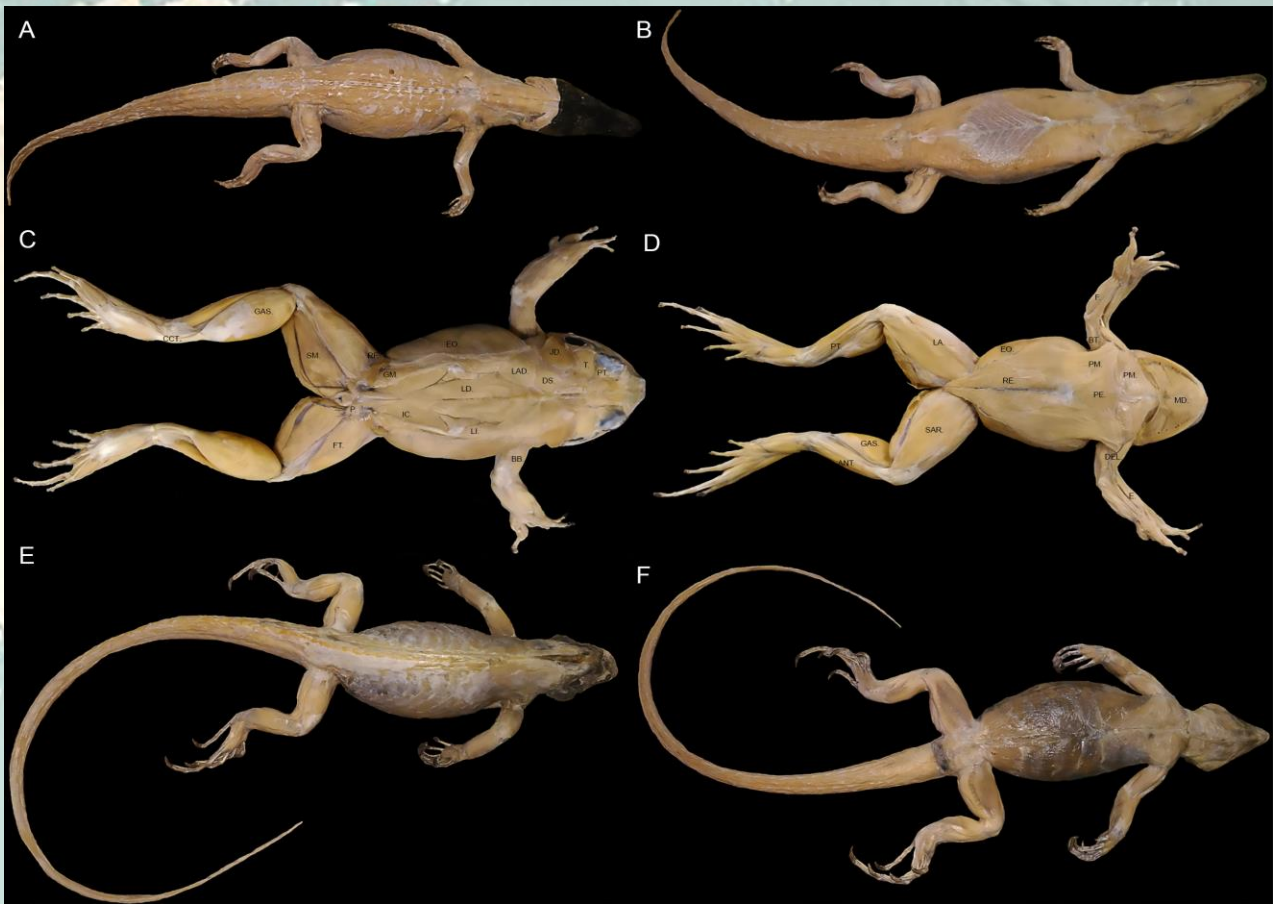


Figure.1. Superficial muscles of *P. palpebrosus*. (A) Dorsal view, (B) Ventral view, *L. labyrinthicus* (C) Dorsal view, (D) Ventral view and *I. iguana* (E) Dorsal view, (F) Ventral view, (PT.) Pterygoid, (T.) Temporal, (JD.) Jaw depressor, (DS.) Dorsal scapular, (LAD.) Large dorsal, (BB.) Biceps brachialis, (LI.) Lumbar ilium, (F.) Flexors, (LD.) Longus dorsal, (EO.) External oblique, (IC.) Iliac coccygeal, (GM.) Gluteus, (RF.) Rectus femoris, (P.) Pisiform, (BT.) Brachial triceps, (FT.) Femoral triceps, (SM.) Semimembranosus, (FT.) Femoral triceps, (GAS.) Gastrocnemius, (Mh.) Mylohyoid, (Del.) Deltoid, (E.) Extensor, (Pe.) Pectoralis external, (PM.) Pectoralis major (Re.) Rectus abdominis, (LA.) Long adductor, (Sar.) Sartorius, (PT.) Posterior tibial, (ANT.) Anterior tibial, (CCT.) Common calcaneal tendon.

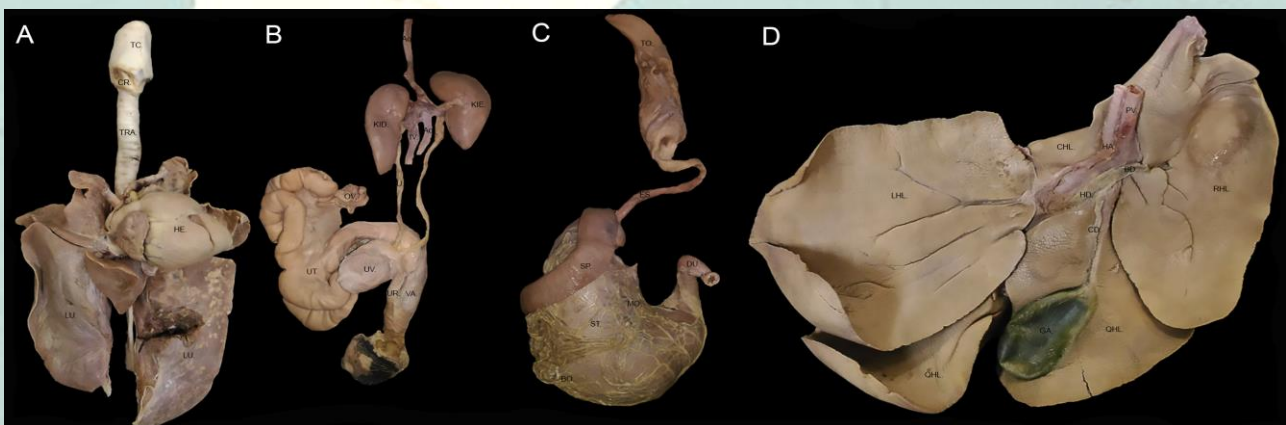


Figure.2. Organs of *Sus scrofa*. (A) Cardiorespiratory, (B) Urogenital apparatus, (C) Part of the digestive tract, (D) Liver, (RHL.) Right hepatic lobe, (QHL.) Medial hepatic lobe, (LHL.) Left hepatic lobe, (CHL.) Caudate hepatic lobe, (HA.) Hepatic artery, (PV.) Portal vein, (BD.) Bile duct, (CD.) Cystic duct, (HD.) Hepatic duct, (GA.) Gallbladder (TO.) Tongue, (ES.) Esophagus, (ST.) Stomach, (MO.) Minor omentum, (BO.) Bigger omentum, (DU.) Duodenum, (SP.) Spleen, (TC.) Thyroid cartilage, (CR.) Cricoid, (TRA.) Trachea, (HE.) Heart, (LU.) Lung, (OV.) Ovary, (UT.) Uterus, (UV.) Urinary vesicle, (UR.) Urethra, (KID.) Kidneys, (AO.) Aorta, (VA.) Vagina, (U.) Ureter, (IV.) Inferior vena cava.

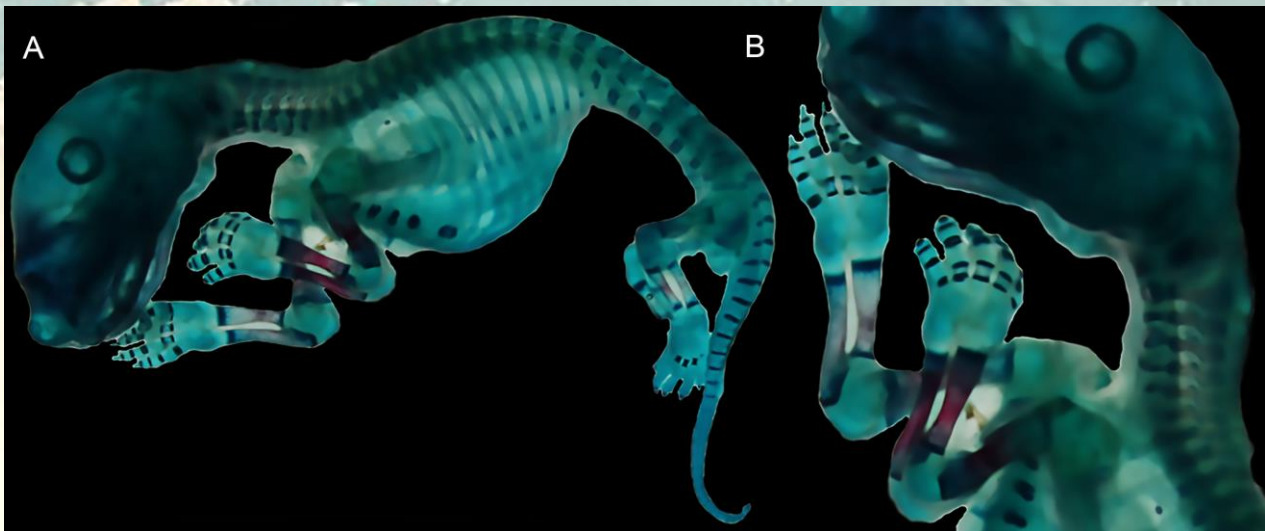


Figure.3. (A) Heart and (B) Lung of *Canis lupus familiaris* platinated, (TRA.) Trachea, (MB.) Main bronchi, (SB.) Segmental brochi, (RL.) Right lung, (LL.) Left lung.

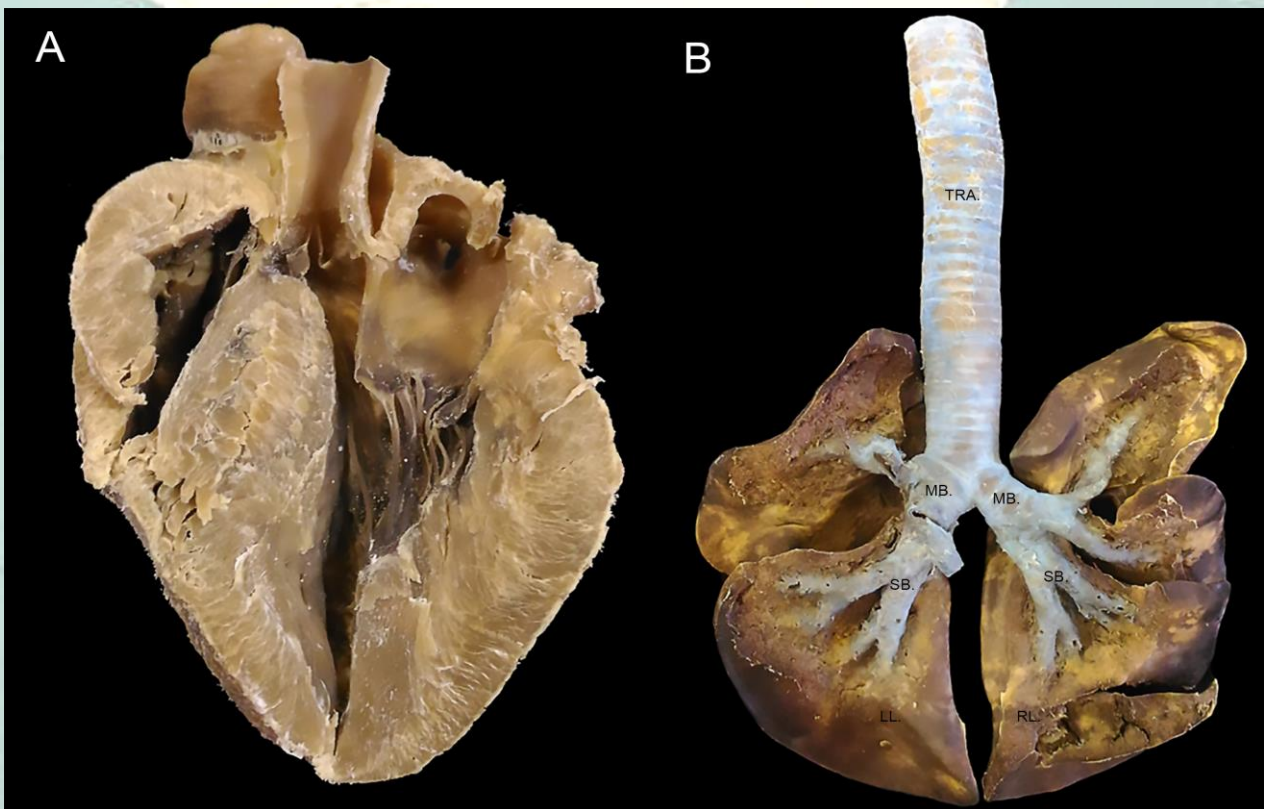


Figure.4. *D. marsupialis* embryos (A) Lateral view, (B) Ossification process of upper members, cartilage (blue) and bone (red).

Table 1. Animal cadavers used to make the anatomical pieces.

RATE	POPULAR	APPLIED ANATOMICAL TECHNIQUES
Crocodylia Alligatoridae <i>Paleosuchus Palpebrosus</i> (Cuvier, 1807)	Alligator	Dissection, expose a superficial musculature
Animalia Chordata Amphibia Anura Leptodactylidae Leptodactylinae <i>Leptodactylus labyrinthicus</i> (Spix, 1824)	Pepper frog	Dissection, expose a superficial musculature
Animalia Chordata Reptilia Squamata Sauria Iguanidae <i>Iguana-iguana</i> (Linnaeus, 1758)	Chameleon	Dissection, expose a superficial musculature
Animalia Chordata Artiodactyla Suidae <i>Sus scrofa domesticus</i> (Erxleben, 1777)	Boar	Dissection of the stomach, cardiorespiratory apparatus and urogenital apparatus
Carnívora Canidae <i>Canis lupus familiaris</i> (Linnaeus, 1758)	Dog	Plastination of the heart and lung
Didelphimorphia Didelphidae Didelphinae <i>Didelphis marsupialis</i> (Linnaeus, 1758)	Opossum	Embryo diaphanization

4. DISCUSSION

Anatomy is the science that studies macroscopically and microscopically, the constitution and development of organized beings [15]. The process of learning anatomy is complex and difficult as far as teaching is concerned, since the memorization of structures and with very complex names makes the task monotonous and discouraging for most students when it is not given in a more participative way [16]. The way in which the teacher approaches the content can reflect positively or negatively in the learning process of the student, being therefore of fundamental importance the search of innovative methods that facilitate the assimilation of the structures and operation by the same ones [17], so several contemporary authors reaffirm the need to use corpses or cadavers in practical classes as a learning tool [5].

The learning epistemologies propose that when the student is stimulated to construct their knowledge, with incentives and orientations of the teachers this knowledge becomes fomented in a more profound and lasting way, thus developing the teaching-learning process [19]. With the use of the cadaveric parts produced during this study, it was possible to increase the effort to study and understand the structures' functioning, increasing their assimilation and recognition. Also through the classes and practical tests given with the pieces, it was possible to provide the academics with a more

realistic view of the function and shape of muscles and viscera, in addition, this study contributed to supply the need for didactic resources for the teaching of Human Anatomy and Animal Anatomy in an isolated university *Campus* in one of the most economic and socially unstable Brazilian regions, thus approaching the theory of practice and reality, as advocated by [20] that the most relevant experiences in learning programs are directed to the intended teaching-learning process that is the innovation of teaching activities, resulting in a true educational praxis articulated to social reality.

This creates opportunities for the theory and practice relationship to occur in students' experiences. It is considered as a priority, in this experience, the search for a synthesis that has the meaning of the construction of the totality - point of departure and arrival of the teacher, which stimulates a more reflexive and critical understanding of reality. When studying cadavers, the students experienced an innovative praxis in Anatomy teaching for the first time in 10 years of existence of the Bachelor's Courses in Nursing and Biological Sciences in the *Campus* Floresta of UFAC, in the extreme Western Brazilian Amazon, since they no longer have to abstract concepts into idealizations of plastic models positively imposed on them, to construct knowledge from realistic experiences from dissected bodies and cadaveric material with which they will have to deal with throughout their professional careers.

5. CONCLUSION

It is concluded that the use of animal cadaveric parts is an innovative and efficient tool in the teaching of Human Anatomy and Animal Anatomy in the UFAC *Campus* Floresta and despite the difficulties presented and discussed by the literature in the teaching-learning process of Anatomy, the use of corpses are efficient didactic resources so that the students can construct the knowledge by means of critical elaborations based on the anatomical experimentation, arousing their interest by this basic science and tool for their academic and professional formation.

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