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3-D RECONSTRUCTION OF THE ETHMOIDAL ARTERIES OF THE MEDIAL ORBITAL WALL

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Purpose: The medial wall of the orbit is reported to contain anterior and posterior ethmoidal foramina, through which pass branches of the ophthalmic artery. These arteries are a potential source of bleeding during surgical procedures involving the medial orbital wall. However, recent research has revealed variable numbers of accessory ethmoidal foramina, which have also been shown to transmit vascular structures, making intraorbital surgery unpredictable and potentially hazardous. This study aims to elucidate the branching pattern of the arterial supply of the medial orbital wall, particularly in cases of multiple ethmoidal foramina.

Methods: Orbits were retrieved from cadavers donated for anatomical examination. Red silicone was injected into the ophthalmic artery via the internal carotid. The medial wall was then dissected out and embedded in Biodur® Epoxy E12 resin. Sections of 0.3 mm thickness were cut with a slow speed diamond saw, and then photographed with a Nikon D3100 digital camera. Three-dimensional reconstructions were carried out using WinSURF software.

Results: Using WinSURF, the outlines of the branches of the ethmoidal arteries and the bone lining the medial wall of the orbit were delineated. A three-dimensional model of the pattern of arterial branching was created.

Conclusion: Surgeons operating along the medial wall of the orbit need to be aware that multiple branches of the ethmoidal artery may be encountered. Three-dimensional reconstructions of the branching pattern of the ethmoidal artery give a clearer understanding of the blood supply to the medial wall.

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TOPOGRAPHIC ANATOMY STUDY OF UTERINE HORN AND OVARIAN BITCH BURSA BY MEANS OF ULTRATHIN SLICE PLASTINATION

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Purpose: The ovarian bursa of the bitch is characterized by complex topographic visualization due to the abundant infiltration of fatty tissue and by the relationship between the organs and the adjacent peritoneal dependencies. The objective of this study was the visualization of the topographic details of the ovarian bursa of a bitch by using ultrathin plastinated cross-sectional slices, which are otherwise too difficult to be seen in conventional dissection techniques and slices.

Methods: Ultrathin cross-sectional slices (300µm) were obtained from two plastinated blocks containing the ovarian region of a bitch; these blocks went through the following steps: fixation, dehydration, degreasing, forced impregnation (Epoxy E12, E6, E600, Biodur®) and curing. The slices obtained from the blocks were used to make a casting using E12, E1 for 3 days at 45°C. The slices then were scanned at 300 dpi.

Results: Two ovarian fimbriae were recognized with very good detail. The coalescence between the mesosalpinx, mesovarium and the proper ligament of the ovary were also observed. A hollow structure, corresponding to the epoophoron was indicated in relation with the mesovarium. The ovarian bursa surrounds the ovary completely and is closed ventrally. The mesosalpinx showed an abundant amount of blood vessels and smooth muscle fibers, and its dorsal relationship with the sublumbar muscle, a lateral relationship with the abdominal wall, and a medial relationship with the ovary and mesovarium. A limitation for this study was the impossibility of following the trajectory of the uterine tubes completely.

Conclusion: The ultrathin cross-sections allowed observation of topographic details which have usually been shown as schematic images, like the ovarian fimbriae, the epoophoron and the coalescence between the tissues that form the ovarian bursa.

S10 PLASTINATION OF STAINED SECTIONS OF BRAIN: A NEW STAINING METHOD

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Purpose: In recent years plastination has changed the way in which gross anatomy can be presented to students. Brain slices plastinated by the S10 technique require macroscopic staining to differentiate between the fiber tracts (white matter) and cell bodies (gray matter). The purpose of this work was to compare color fade of brain plastinates stained with Mulligan's method and with our new modification of the Mulligan method.

Materials and methods: Staining procedures were performed after fixation according to Mulligan's method and our new modification of the Mulligan method. Specimen color was measured and compared before and after S10 plastination using ImageJ 10440 (National Health Institute, USA).

Results: Plastination of the unstained brain slices as well as stained sections resulted in dry, clear, odorless and durable specimens. There was a little fade of color in stained slices exposed to light. Since the white matter areas did not react with the stain in this procedure there was satisfactory contrast between gray areas and the unstained white matter. Considering the low costs of the new staining method, these stained brain slices could be used for educational purpose in anatomy courses.

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POLYMERIC EMBALMING IS AN INNOVATIVE METHOD IN TEACHING OF HUMAN ANATOMY AT MEDICAL UNIVERSITY "ASTANA"

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Purpose: The production of anatomical preparations by polymeric embalming produces specimens without toxic effects, without harmful action for professionals and teaching staff and students' health; the specimens are life-like and durable. This method changes all the traditional representations about study of anatomy which are associated with formalin-fixed cadavers.

Methods: Production of anatomical preparations by polymeric embalming consists of the following stages:
1. Fixing of the biological material. For polymeric embalming both fixed and unfixed material can be used. However, preliminary fixing of anatomical preparations is preferable, as the fixing solutions compact the tissues and decrease the shrinkage of anatomical structures during polymeric embalming. The fixative inactivates the tissues' enzymes, which prevents the decomposition of the tissues, and does not prevent the polymerization of silicone.
2. The production of anatomical teaching specimens by dissection. This is the traditional manual production of preparations by standard techniques with removal of fat, connective tissue and display of the necessary structures. It is very difficult work but an important stage in the production of polymeric materials.
3. Dehydration and defatting. At these stages there is replacement of water by the intermediate solvent, and dissolution of fat tissues. In the capacity of dehydrating agent one can use such organic solvents as acetone or ethanol. As the degreasing agent we also use acetone which dissolves fat tissues very well at temperatures above 15 C
4. Impregnation by silicone. At this stage there is replacement of the intermediate solvent by liquid silicone in the organs and tissues. The process is carried out in the vacuum chamber at gradually reduced pressure and at room temperature.
5. Polymerization. At this stage under the action of temperature and a polymerizing agent, consolidation of silicone composition occurs in the organs and tissues. Before finishing polymerization the preparations are placed in the necessary position.

Conclusion: All these above listed facts determine the great future for technology in polymeric embalming and promote its wider introduction in the educational process.
The silicone preparations are ideal for exhibiting in anatomical museums and for practical lessons of medical students. At present anatomical silicone preparations are very widely used for the study anatomy not only in the Medical University "Astana" but in other medical schools and universities of Kazakhstan.

HOW TO SET UP A LABORATORY OF PLASTINATION

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Purpose: The establishment of a plastination lab requires more than just planning for space allocation and equipment but more importantly special attention to handling hazardous materials, waste generation and safety issues. The requirements for creating a laboratory of plastination will be discussed with reference to materials, equipment, waste management, hazardous material, safety issues and today's other essentials for a modern plastination lab.

Methods: The first thing to consider when planning for a plastination lab is to think big but start small. Consider your initial budget. Make sure safety issues are the first to be addressed. You will not be able to get everything you want so establish priorities. If you are not experienced with plastination, start with the Silicone technique. It is easier and more reliable for the novice plastinator. Identify your limitations and confront them from the start so you can plan ahead. Involve the administration (Chair and Dean) in the process. Motivate them and they will help you. Basic instruments and materials for plastination are available through many vendors. Biodur® offers a complete set of plastination kits available in different sizes to beginners. Each kit contains a plastination Kettle (vacuum chamber), vacuum pump, silicone S10/S3/S6 and other materials. Silicone is available through several vendors: Biodur (Germany), VisDocta (Italy), Corcoran (USA), Silicone Inc. (USA), ShiEtsu Silicones (Japan), Plasmat (China). There are several safety issues that must be recognized before a plastination lab is constructed and during the operation of the lab. Documentation of the chemicals used must be at hand at all times. Recognize hazardous materials for safe keeping and also for disposal. Constantly monitor the exposure of the personnel to the acetone and other chemicals. Make sure the laboratory has proper ventilation and exhaust. The electrical outlets and light fixtures should be changed to give protection when levels of acetone are increased. Adequate fire protection and fire-safe storage should be addressed.

Results: The material, equipment and space allocated for the plastination laboratory should be tied to the desired size of the laboratory. There are many sources of information available to the novice to help with technical aspects of building a laboratory. One of the best sources available is the International Society for Plastination and their experienced plastinators.

Conclusion: Plastination has been available over 30 years. There are hundreds of laboratories of plastination around the world. A plastination laboratory is unique. It is different than a regular science laboratory because of the high amount of acetone that is used. Following safety guidelines is key to successfully establishing a laboratory of plastination.

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PLASTINATION MUSEUM: ENGAGING THE NEXT GENERATION OF HEALTHCARE PROFESSIONALS AND THE PUBLIC

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Purpose: The main purpose of the Plastination Museum is to provide valuable educational resources for the University of Toledo students in the medical and related anatomical disciplines. The museum is located in the College of Medicine, Health Science Campus, at the University of Toledo. The museum provides a dynamic study and teaching space. The museum was named after Dr. Liberato DiDio, former chairman of the Department of Anatomy, and Dr. Peter Goldblatt, former chairman of the Department of Pathology. The establishment of the museum and its use will be discussed.

Methods: The "construction" of the Plastination Museum started 20 years ago when several plastinated specimens were created as a source of the didactic material to advance the teaching mission of the department of anatomy. Funding for the project was through monies received by the plastination laboratory's specimen preparation services to other institutions. The original project budget rationale involved the following: transfer of the plastination lab to a new location to free space for the museum, new wall painting, acoustic ceiling, and floor and new wood/glass cabinets installed. The museum was constructed in three months and now houses approximately 300 specimens comprising the anatomical and pathological collections of the College of Medicine. Each cabinet was divided according to function (digestion, breathing, circulation, filtration, control, support, development and comparative). Each cabinet has an android tablet containing explanations of each specimen providing a self-guided tour.

Results: The space allocated to the museum, even though small, has been used appropriately by medical students and other healthcare students and professionals. Thousands of high schools students from the vicinity around Toledo and south of Michigan had tours arranged through the Student-to-Student Program. The student-to-Student program is an educational outreach program organized by 1st and 2nd year medical students that gives presentations and tours to more than 1500 undergraduate students from the community per year. In addition to students the museum is also open to the public upon request.

Conclusion: The Plastination Museum was created with a limited budget but has been proven to be an excellent method for housing the anatomical and pathological collections of the college of Medicine in a single residence. The museum has proved to be an enormous asset to educate students and the public on normal anatomy and diseases.

USE OF MOLECULAR SIEVES TO RECOVER HIGHER YIELD OF PURE RECYCLED ACETONE

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Purpose: This work introduces molecular sieves as a cost-effective method of transforming conventionally distilled acetone (95 - 97%) into acetone pure enough (99. 5 to 100%) to complete the dehydration of specimens for plastination.

Methods: Used acetone (<95%) from freeze substitution and room temperature dehydration was recycled using conventional recyclers (BR Instruments and Omega Recyclers) yielding 97% purity. In order to remove the remaining water and increase the purity of recycled acetone to ~100%, molecular sieves were used. Twenty-two point five Kg (fifty pounds) of 3Å pore molecular sieves (http://www.interraglobal.com/) were used to distil 189 L (50 gallons) of acetone (1:1 ratio). A cylinder containing the molecular sieves was immediately transferred to the plastic 189 L (50 gallon) drum of acetone containing the 97% distilled acetone. Care was taken to ensure that the transfer to the container was made as fast as possible to avoid the sieve absorbing air humidity.

Results: Acetone distilled using traditional methods with BR Instruments and Omega recyclers yielded acetone with approximately 97% purity. Both small-scale and large-scale treatments with molecular sieves yielded acetone purity of 99.5-99.9%. After 48 hours of treatment with molecular sieves, the purity of acetone remained constant.

Conclusions: The use of molecular sieves to produce pure acetone will complement the dehydration of acetone using conventional distillation methods and has proved to be very efficient. Waste acetone is virtually eliminated, saving laboratories hundreds or even thousands of dollars in purchasing new acetone, recycling and disposal fees, in addition to being an eco-friendly process. The process is safe but when treating large volumes of acetone good ventilation and safe (spark proof) areas are desirable because of the acetone vapor that is produced in larger quantities.

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NEAR FIELD COMMUNICATION (NFC) DEVICES AND PLASTINATION: AN INTEGRATED TUTORIAL SYSTEM TOOL FOR SELF-DIRECTED LEARNING

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Purpose: The purpose of integrating Near Field Communication ("NFC") with plastination is to provide students with a self-directed learning tool that offers intelligible flexibility for the study of anatomy. The objective of this learning tool is to offer students an interactive learning environment outside of the usual academic setting. This self-directed learning tool allows students to point at different parts of the plastinated anatomical specimen, which are tagged with smart chips, directing students to a web-page that presents a description of the specific anatomical muscle, nerve, or artery to which the wand is directed.

Methods: An application was designed to integrate the NFC reader, NFC tags, Android tablet device and plastinates. The NFC is a set of standards for radio communication between tablets, smartphones and similar devices that allows communication with each other by proximity or touch. We used a vWand (Sistelnetworks) in order to provide NFC connectivity for the Android tablet using Bluetooth connection. This wand allowed flexibility and uniformity within the system. Twenty-five structures were identified in a silicone- plastinated lower limb. Each anatomical description was entered in HTML format and stored as a webpage in the server. An NFC tag was attached to each structure and the URL web address of each structure was written into the tag using a VWand Pro Android app. When the tag was read by the vWand, an application launched the web browser containing a link to the webpage with the anatomical description of the structure.

Results: The prototype consisted of 24 NFC tags implanted in a plastinated lower limb. Each tag when opened corresponded to a URL containing the description of the structure.

Conclusions: The NFC device is a platform for self-directed learning that integrates plastinates with digital technology providing flexibility for the study of anatomy and pathology outside the usual academic settings. In addition, it provides an interactive environment, structure and guidance to the student and a powerful educational tool to promote meaningful learning through the integration of words, sounds and visuals.

EFFECTS OF DIFFERENT FIXATIVES ON PLANTS: OUTCOMES FOR FURTHER PLASTINATION.

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Purpose: Preserving the natural color and texture are the main issues in plastination, and fixation is the first step for this purpose. Although there is little information about plastination of plants in the present literature, it is an important issue for plastination. The purpose of this study is to compare the efficiencies of different fixative solutions on plants to maintain their natural color and texture.

Methods: We studied five different fixatives: Kaiserling, Klotz, Jore's, 5% formalin and 5%+30% acetone mix on red and white miniature rose flowers (*Rosaceae* spp.) with their stems and leaves, orchid (*Orchidaceae* spp.) leaves and onion bulbs. Five sets of these plants were put in jars and filled with the fixatives listed above. Fixation was carried out at +4°C. Photographs were taken and crosschecked at 16^{th}, 24^{th} and 64^{th} hours of fixation.

Results: At the end of the fixation process, we found that Kaiserling and Jore's solutions are better than the others fixatives. They protect the colors of the plants and their brightness. 5% formalin also protects colors but it made the plant surface a little dull. Klotz and 5%+30% acetone mix decolorizes the plants. Klotz adds some yellowish color. Fixed plants with 5%+30% acetone mix were paler and colors had faded.

Conclusion: When it comes to plastination, perfection depends on a perfect fixation. The main function of tissue fixation is to prevent putrefaction and autolysis. Especially for plastination, it has to preserve the natural texture and color too. Plastination of plants is still a challenging issue and is not taking place in the literature sufficiently. We think that these data can be helpful for the development of a plastination process for plants. For preserving and displaying particularly endemic or endangered plant species for education, museums or exhibitions, plastination is the one realistic solution.

PREPARING BONES FOR PLASTINATION USING DERMESTID BEETLES: EFFECT OF ENVIRONMENTAL TEMPERATURE IN THE GROWTH OF A DERMESTARIUM.

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Purpose: Plastination of bone structures is challenging. It requires bone preparation prior to plastination. Many techniques to clear the bone from other debris are commonly used such as dissection and macerations (chemical and heat). One of the major concerns in preparing bones for plastination is the remaining fat. Osteological preparations should have holes drilled through their cortex into the medulla to enhance defatting. If fat is retained it will result in greasy specimens years later. Dermestid beetles are well known, readily available, and used for forensic investigations and preparation of skeletons, mainly for zoology museums, and less frequently in human anatomy. In order to investigate a fast, accurate and effective method of preparation of bones for plastination, Dermestid beetles were evaluated with regard to the ideal temperature for the optimal functioning of the Dermestid colonies (dermestarium).

Methods: The **dermestarium** was prepared with plastic boxes containing cotton on the bottom, covered with fine nylon screen, controlled temperature and low light environment. Prior to being introduced into the dermestarium, bones were clear of excess soft tissue, immersed in 70% alcohol and dried at 40° C in an oven for 72 hours. The cleaning of the bones by the Dermestid colony was monitored daily. The process was interrupted when the Dermestids reached the ligaments. The bones were removed from the colony, and at this point were ready for plastination. In order to identify the optimal temperature for the operation of the colony, 35 dermestaria were distributed in 5 groups (7 Dermestid colonies per group) and subjected to specific temperatures: DM1 (17 °C), DM2 (20 °C), DM3 (25°C), DM4 (30°C) and DM5 (35°C). Each dermestarium was made of 70 Dermestids (20 adults and 50 larvae). Each colony received 150 g of a substrate of a decapitated Wistar rat, gutted, skinned and dried. The dermestaria were monitored for 15 days. The weight of the digested material from each dermestarium was recorded and compared.

Results: The digested weight (g) ± standard errors were the following: DM1 (0 g), DM2 (0 g), DM3 (109±11), DM4 (131±2) and DM5 (120±5). In the DM1 and DM2 colonies the larvae and adult Dermestids died resulting in inactivity of the colony. The DM3 (25°C), DM4 (30°C) and DM5 (35°C) grew as expected but there were no statistical differences in the weight of digested carcass (one-way ANOVA $p > 0.05$).

Conclusion: The study showed that temperatures in the range of 25-35° C have the greatest impact on the growth rate of the Dermestids. *Supported by the grant of CNPq, FAPES.*

WATERLOGGED ARCHAEOLOGICAL IVORY CONSERVATION: ELEPHANT TUSKS FROM BAJO DE LA CAMAPANA PHOENICIAN SHIPWRECK SITE, AT MUSEO NACIONAL DE ARQUEOLOGÍA SUBACUÁTICA

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Purpose: The underwater archaeological project at the Bajo de la Campana site (San Javier, Murcia, Spain) was developed under the agreement signed between the Ministry of Culture of Spain and the Institute of Nautical Archaeology, Texas A&M University (TAMU), between 2007 and 2011. From this Phoenician shipwreck were recovered different types of materials, among of them 53 elephant tusk, some of them with inscriptions. The research goal for the conservation of waterlogged ivory, currently being developed, is to determine a conservation treatment that allows us to remove the excess water and provide mechanical strength with dimensional stability. We have started the research work with the analytical study of waterlogged archaeological ivory to determine its chemical composition, the hierarchical organization of its structural elements, the physical and mechanical properties and the impact on it of the underwater environment. The practical stage includes experimentation, characterization and evaluation of the different conservation methods, among which is plastination. Plastination, and a conservation procedure using polymers, developed by TAMU, are two of the treatments that stand out for their results.

Methods: Two waterlogged archaeological ivory samples from Bajo de la Campana were used for the plastination assays. A 3D-CT scan study, control pictures and baseline weight were obtained from the samples before and after plastination in order determine the degree of change caused by this treatment process. After 5 days of dehydration with acetone at -25ºC samples were impregnated during 24h at room temperature, sample 1 with S15+S3 mixture (Biodur®) and sample 2 with PR10+CR20 mixture (Corcoran®). Curing of sample 1 with cross-linker S6 took one week in the gas-curing chamber, and curing of sample 2 with hardener CT32 was finished in one day.

Results: Both silicone techniques were found to have produced a successful treatment. The procedures assessments were satisfactory; we have been able to remove water from samples with a remarkable dimensional stability, only 10% (sample 1) and 12% (sample 2) of weight lost after two months of plastination. Sample 1 was more natural looking with better color and texture than sample 2. Following treatment, no discernible changes were observed in the physical dimensions of either of the silicone-plastinated ivory samples. Both samples have acquired the necessary mechanical strength to make possible their study or display. The results from before and after plastination 3D-CT scans are under processing.

Conclusion Plastination technique, traditionally linked to medicine or veterinary, could be applied on archaeological heritage conservation and will allow us to preserve the valuable information that these goods provide as historical documents.

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UPPER LIMB PLASTINATED SECTIONS IN TOPOGRAPHY STUDIES

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Purpose: Further development of surgery requires more detailed study of structure and topography of upper limb neurovascular fascicles. The classical topographical anatomy method of studying frozen sections was suggested by Nikolay Pirogov. However, transparent plastinated sections are unchallengeable in terms of studying details of small anatomical structures.

Methods: After morphometry of the upper limbs of 15 bodies (men and women, aged 48-70) they were placed in sagittal and frontal planes according to bone landmarks. Shoulder and forearm areas were marked out into 10 sections, and elbow joint areas into 3 areas. After being kept in a freezer at -25° C for 3 days the limbs were cut by a high-speed band saw into 10-15 mm sections according to the marks. The sections were then numbered and plastinated according to the E12 method. The end plastinates were examined by the naked eye and with a binocular loupe at low magnification using an adapted model of polar coordinates.

Results: It was found that preparatory marking out of the limb helps to get similar series of transparent dissections for further studying and classification of anatomic structures and connections. The transparency of the plastinates allows thorough and detailed study of both large and small vessels and nerves in transmitted as well as backscattered/reflective light. A preparatory injection of a colored silicone into the arterial vessels makes the end dissections extremely revealing. A polar coordinates model provided exact data on the location of all the neurovascular structures of the shoulder, forearm and elbow joint.

Conclusion: The study of transparent plastinated sections adds new data to the topography of muscles, vessels, nerves and fasciae in their natural location and state because they are not shifted as happens when classical methods of dissection are used. This new technique of using a polar coordinates model also makes mathematical and statistical analysis and data processing possible. Plastinated sections have an unlimited storage life and can be used for practical training of traumatologists, microsurgeons and radiologists.

COMPUTERIZED 3D ANATOMICAL MODELING USING CONE BEAM COMPUTED TOMOGRAPHY (CBCT) SCANS OF PLASTINATED HEARTS

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Purpose: Computerized modeling of anatomical structures is an important aspect of computer-aided instruction in medical and allied medical education. Plastinated anatomical material provides an additional data collection approach since virtually any anatomical or pathological structure routinely obtained in a gross anatomy laboratory can be imaged. The purpose of this study was to establish a computer modeling approach utilizing plastinated anatomical material, specifically human hearts, combined with CBCT imaging.

Methods: Four human hearts were collected following gross anatomical dissection and subjected to routine plastination procedures including dehydration (-25° C), defatting, forced impregnation, and curing at room temperature. Specimens were subjected to CBCT and DICOM slice images were subjected to 3D modeling utilizing ER3D software (espressoray3d.com, Honolulu, HI). A GPU-aided marching cubes algorithm was used to convert VOI (volume of interest) voxels into triangulated surface geometry complete with smoothed surface normals. Surfaces were shaded using a standard OpenGL-based Phong lighting model. The ER3D file format was utilized to store the medical imaging data alongside the surface mesh information in one file configuration. Surface models were exported for viewing on the iPad utilizing Verto Studio 3D application (vertstudio.com, San Diego, CA). Qualitative comparisons were conducted between plastinated hearts and their corresponding computer models based on a list of morphological cardiac features commonly identified in the gross anatomy dissection laboratory. A pair match 2x2 contingency analysis was utilized to test the hypothesis that correspondence does not occur ($p<.01$) between plastinations and computer models utilizing 25 external and 17 internal cardiac structures.

Results: Qualitative observations confirmed that the heart displayed the expected surface morphological features typically observable through routine anatomical dissection. A correspondence of 98% achieved when comparing external features observable on the plastinated hearts with the corresponding computer models indicated a highly significant statistical relationship between plastinated and computer models.

Conclusion: Results indicate that computerized models can be successfully generated from plastinated material that provides accurate representations for use in anatomical education. These models can be ported for visualization on various personal electronic devices including iPhones and iPads.

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NEW MULTIDIMENSIONAL STAIN FOR PLASTINATION

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Purpose: A new non-toxic, water-soluble stain was developed from a natural pigment. The reddish stain is not flammable and no additives are needed. The stain can be diluted with water. It may be applied to the specimen during any aqueous state pre-dehydration, as well as in any siliconized state post-impregnation.

Methods: The stain is shipped as a concentrated aqueous solution and then diluted with water, 1 part of stain + 9 parts of water. Fresh, fixed or impregnated tissues may be stained. Depending on the plan for the specimen, the entire specimen may be covered with the stain or stain applied only to select portions or areas of the specimen. Stain intensity may be decreased by diluting with more water. Once the stain is applied, the excess stain should be blotted. More information is available at: http://anato.cl/index.php.

Results: The stained specimen will remain this color whether stored in water or formalin for cadaveric demonstration or if flushed with water to remove fixative prior to dehydration. If stained specimens are stored wet for over a year, they may need to have some stain reapplied. The stain intensity during dehydration is not altered. Neither impregnation, nor curing, changes the staining intensity or characteristics of the specimen. Stain may be applied at any time during its preparation.

Conclusion: This new stain is useful for staining totally any type of specimen, or any portion thereof. Color intensity may be reduced prior to application by dilution with water. The stain may be applied during any step of the plastination process; but works best if applied prior to dehydration. The color of the stained specimen is not altered by acetone and is stable during impregnation and curing. This stain is a good alternative to other home-made or commercial stains.

USING CASTING AND CONSECUTIVE SHEET PLASTINATION, THE UNIQUE STRUCTURE OF THE VASCULAR PROCESSES IN THE GIRAFFE KIDNEY WAS ELUCIDATED.

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Purpose: The giraffe has an extremely high blood pressure, which makes it anatomically and physiologically a very interesting animal. In regards of this, the vascularization of the kidneys is of special interest. Through a co-operation with the local zoo, we got the opportunity to study the structure of the kidneys using a combination of cast and sheet plastination.

Methods: The fresh kidneys were cast by injection of red epoxy-resin in the renal artery and blue epoxy-resin in the renal vein. The procedure was done according to the "Heidelberg Plastination Folder" by Gunther von Hagens using E20 from Biodur®. Afterwards the kidney was fixed in 4% formaldehyde before being sliced into 3 mm thick sections. The sections were then dehydrated in acetone and impregnated with P40. Impregnated slices were cured by UV-light.

Results: The anatomical division of the organ into cortical and a medullary parts was very distinct using the combination of casting and sheet plastination. The branching of the arteries at the medulla-cortex transition zone and the glomeruli in the cortical part of the organ were conspicuous and were examined at higher magnification. Furthermore, this combined technique was also suitable to study the encapsulation of the vascular processes, which we have previously shown, was prominent in S10 plastinated kidneys.

Conclusion: The combination of casting and sheet-plastination enhances the potential to study the relations between the vascular system and the surrounding parenchyma in the giraffe kidney. Compared to the combination of casting and S10 plastination, it opens up the possibility to examine the structures at higher magnification; hence the P40 plastinated slices are suitable for microscopy or scanning.

This study further supports the description of the giraffe renal arterial system by Maluf (Anat Rec 267:94-111, 2002) but the technique is suitable for studying the kidneys from any species.

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A NOVEL INSTRUCTIVE TOOL FOR TRAINING OF ELECTROPHYSIOLOGISTS

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Purpose: Teaching of anatomy is usually realized using photographs, diagrams or CT and/or MR images. Spatial relationships could be best assessed employing heart specimens. Unfortunately, the use of fresh fixed hearts is problematic. Human plastinated hearts provide a unique tool to improve knowledge of relevant anatomy and topography for the electrophysiologists.

Methods: Standard techniques of plastination (S 10, room temperature process, E12) of the hearts from cadavers that retain its original shape and yet enable specific preparation according to clinical requirements were used to prepare special demonstration specimens. The fixed hearts were exposed to impregnation with silicone or epoxy resin, as well as in combination with corrosion techniques. Demonstration pacing leads, catheters and lights were implanted either during dissection or after plastination.

Results: The specimens were tested in educational courses and in training of cardiology fellows. Several modifications of clinical plastinated specimens were used: 1) hearts for demonstration of different structures in the chambers, as well as the valves and a variety of the heart's blood vessels; 2) slices of the heart injected with colored silicone according to the typical fluoroscopic projections during electrophysiological procedures, to the long and short axes during transesophageal and intracardiac echocardiography views as well as CT and MRI projections; 3) hearts with pacing leads and ablation catheters in different positions. All subjects provided high scores for the use of these specimens.

Conclusions: Clinically oriented plastination of human hearts provides a variety of opportunities for the education of fellows. Is conceivable that better knowledge of anatomy will contribute to an improvement of quality of care in electrophysiology.

NIKOLAY PIROGOV– THE FOUNDER OF FROZEN BODY DISSECTION METHOD

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Purpose: One of the most remarkable works by Nikolay Pirogov, a great Russian surgeon and anatomist, was his "Topographical Anatomy of Frozen Body Dissections" (*Anatomia topographica sectionibus per corpus humanum congelatum triplici directione ductis illustrata, 1859)* which became the basis for plastination techniques E12 and P40.

Methods: Nikolay Pirogov had the idea to use frozen sections of the human body to study the topography of different organs, cavities and other anatomical structures when he saw a butcher cutting frozen pig bodies at the local market, Sennoy (which means "hay") market, in St. Petersburg in 1849. At his Institute of Anatomy, Nikolay Pirogov did more than 1000 dissections of frozen human bodies in sagittal, frontal and horizontal planes 7-15 mm thick, using an ordinary saw. Then the artists used glass to copy the sections onto the sheets of paper where equal square boxes were drawn.

Results: Pirogov's method, unlike traditional dissection, does not ruin the organs' connections and provides natural 3D anatomical structures. From 1849 to 1859 Nikolay Pirogov was busy writing and editing his atlas, which was published in 4 volumes: "Topographical Anatomy of Frozen Body Dissections", with 970 dissection pictures and 224 tables with detailed comments. The atlas also presents a lot of research information on different pathologies, injuries and other physiological states, as well as aging changes and sex differences. In fact, besides becoming a breakthrough anatomy course and reference book, the atlas established new ways for topographical anatomy development.

Conclusions: For more than 150 years, Pirogov's dissection atlas has been an unsurpassed masterpiece and it is still a valuable manual for surgeons and anatomists. His brilliant technique started a new age in human body studies and has been used successfully at the initial stages of plastination processes E12 and P40.

S10 PLASTINATION OF *OESTRUS OVIS* AS A TEACHING TOOL. RESULTS AND LIMITATIONS

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Purpose: Plastination is a well-known process used nowadays in anatomy and surgery teaching, but to date it has not been commonly used for parasite preservation. In fact, only two works have been found in this field, one focused on the human nematode *Ascaris lumbricoides* and another on 11 species of animal cestoda, nematoda and arthropoda. The aim of this study was to optimize the silicone technique for plastination of larvae of the parasitic sheep diptera *Oestrus ovis* for teaching purposes.

Methods: Ten larvae of *O. ovis* containing a mixture of second or immature stages, and third or mature stages were used for the plastination assays. The standard method of S10 silicone technique was used.

Results: After plastination of the larvae was finished several problems appeared. Only one of the parasites was successfully plastinated, while the others showed serious problems such as breakages of the cuticle and body collapse. Furthermore, specimens lost much weight. These problems could be due to incomplete dehydration or impregnation since the cuticle thickness and the powerful muscle fibers of the parasite might have limited complete acetone or silicone tissue embedding. Histological cross-sections of the larvae before and after plastination might be a useful tool to determine how the problem occurred, especially in macroscopic defective areas, by comparing the abnormal structure of the plastinated parasites with other non-plastinated in both types of larvae (mature and immature larvae).

Conclusion: Although silicone plastinated larvae such as *Oestrus ovis* might be quite useful for teaching or research purposes, particular adaptations in the standard methodology, such as small cuts in the belly of the larvae, could help to standardize the technique for insect parasite species.

TOPOGRAPHIC ANATOMY STUDY OF UTERINE TUBE AND OVARIAN CAT BURSA BY MEANS OF ULTRATHIN SLICE PLASTINATION

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Objective: In the cat female the topographical anatomy of the uterine tube with respect to the ovary is difficult to understand because the ovarian bursa is closed; the oviduct follows a coiled trajectory and traditional dissection is not very effective at this site. In this study epoxy ultrathin transverse slices were used to gain a deeper knowledge of the topographical relationship between the uterine tube, the ovary and ovarian bursa.

Methods: Two cat body blocks of the ovarian region were prepared to obtain transverse ultrathin plastinated sections (300 µm). The blocks were prepared following these steps: fixation, dehydration, clearing, forced impregnation (Epoxy E12, E6, E600, Biodur®) and curing. Ultrathin slides were then obtained using a diamond saw and cast using the E12-E1 sandwich method (Biodur®) before polymerization for 3 days at 45° C. Each slide was scanned (Epson V 700) both sides at a 2500 dpi resolution. Some details of greater interest were photographed with a magnifying lens (Carl Zeiss Stemi 2000-C).

Results: In the most cranial slices, the ovarian topography was identified in relation to the abdominal wall and the ovarian suspensory ligament. In a caudal sequence a detailed spatial relationship was established between the oviduct and the ovary, highlighting the location of the infundibulum and fimbria in relation with to medial ovarian aspect. The ovarian bursa, the sinuous oviduct trajectory both in the ampulla and isthmus, and the mesosalpinx were analyzed in all the sections.

Conclusions: Plastinated ultrathin serial sections of the cat ovarian region contributed to substantially improving the comprehension of the topographical relationships between the uterine tube and the ovary, as well as giving essential information about the ovarian bursa peritoneal attachments.

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PLASTINATION OF THE CRANIOCERVICAL JUNCTION BY DIFFERENT PROCESSES AND METHODS

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Purpose: To obtain the best plastination preservation method(s) of the transverse and alar ligaments at the craniocervical junction (CVJ) in order to enable the characteristics of the ligaments to be studied, nine dissected specimens were plastinated using different methods.

Methods: Specimens of the CVJ were obtained by *en bloc* removal of part of the base of the skull surrounding the foramen magnum together with the C1 (atlas) to C3 cervical vertebrae and their soft tissues. The surrounding muscular tissue was excised. Where possible the spinal cord was left in *situ* for orientation.

Two specimens were prepared using the S10 technique on 3mm horizontally sectioned specimens. Three specimens were prepared using the E12 technique after cutting them in 3mm sections in the three anatomical planes. Two further specimens were decalcified first in 5% nitric acid in 10% formalin, and tested after 3-5 days for hardness or complete decalcification. Two specimens were cleared using KOH before plastination by the E12 technique. Sectioning of the specimens was done with the specimens at -20°C.

Results: Sectioning of the specimens with the band saw was difficult because the specimens came apart in some cases. The S10 specimens became dark and the different tissues were not easily discernible. The E12 specimens were clear and the ligaments were identifiable, even under high power dissection microscopy. The remaining specimens were still being cleared before being plastinated and the efficacy of this process will be elaborated on at the presentation.

Conclusion: The E12 method of preservation is able to differentiate tissues of the CVJ the best, so far. The method of clearing before plastination was incomplete at the time of submission and its results will be presented at the Conference. Sectioning of tissues should be done with the specimen embedded in a block of frozen formalin solution at -20°C to obtain whole specimens which do not become fragmented.

POLYESTER PLASTINATION: P40 TECHNIQUE

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Purpose: Polyester (P35) is the classic technique for plastination of brain slices and has routinely been used for three decades. Its differentiation of white and gray matter is un-paralleled. Modifications to the polyester process were made 20 years ago (P40) and 5 years ago (P50), but neither of these improved slice quality. However, ease of production of slices improved with P40 & P50 (Biodur™). Also, any region of the body may be sliced and the new resins used for slice production.

Methods: P40-Specimen preparation: the brain is fixed with formalin only; addition of common additives will cause inferior results. The well-fixed brain is sliced on a "deli slicer" at your desired thickness (2-4 cm) and placed between grids (metal or plastic) and tied as a package with twine to allow ease of transfer from one solution bath to the next. Before dehydration, formalin is rinsed from slices in flowing tap water overnight. For body slices, the body is frozen (ultra cold) fresh and sliced on a band saw (2-3mm). As the slices are produced, sawdust must be scraped off and the clean slice placed between grids (metal or plastic) and tied as a package with twine and submerged in acetone. Dehydration is carried out in cold acetone. Depending on slice thickness, two or three changes of pure acetone every two to three days is usually sufficient. To enhance body slice clarity, defatting in room temperature acetone or methylene chloride after dehydration is recommended. Impregnation - the exchange of the dehydrant for the resin, is carried out in a vacuum kettle by decreasing pressure (increasing vacuum) at a rather fast pace (one or two days). By lowering the pressure, acetone vaporizes and leaves the tissue, assuring a tissue void which will allow the resin to enter the cells. Impregnation may be done at room temperature of in the refrigerator. Understanding vapor pressure (vp) principles will assure complete impregnation of the slices with polyester. At 5°C acetone's vp= 85mm Hg (110 Torr) while at +25°C vp= 210mm Hg (300 Torr). Therefore, at room temperature impregnation (acetone removal) will commence at a higher pressure (210mm) than in the refrigerator. Impregnation may be done with only the P40 resin, or a hardener (A4) may be added to aid curing. Finally, once the acetone has been removed from the specimen, impregnation is complete and the impregnated slices are ready for casting (placing between two glass plates) and curing. The impregnated slices are placed between two glass plates (2-3 mm) with a gasket around the perimeter to seal the flat chamber and contain the resin and slice. The constructed flat chamber containing the impregnated slice is filled with P40, sealed and exposed to UVA light to harden the polyester filled slices. Curing P40 is an exothermic reaction and the heat must be controlled using a fan/ventilator to prevent damage to the slice. After curing, the flat chamber is dismantled and the sticky edges of the slice are trimmed with a saw. To enhance body slice clarity, defatting with methylene chloride or room temperature acetone is recommended.

Results: Slices produced by the polyester (P40) technique are great teaching aids which show neuroanatomical detail, are student friendly and are useful for study with MR and CT images.

Conclusion: Plastination has proven to be an excellent method for preservation of biological specimens for 35 years. The P35 Biodur™ polyester plastination process remains the gold standard for plastination of brain slices. The P40 modification is a user friendly process for brain slices as well as other thin sliced specimens of the body.

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SILICONE PLASTINATION: COLD TEMPERATURE TECHNIQUE

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Purpose: The classic technique for silicone plastination has stood the test of time. A few modifications have been made in the past 25 years but these have not made a huge impact on plastination. The Biodur™/cold temperature process remains the gold standard. This process will be discussed with reference to today's needs.

Methods: Specimen preparation - remains the initial and very important step in silicone plastination and any other plastination or preservation technique. A specimen needs to be designed with an intended purpose with thoughts as to: why am I preparing this specimen? How will it be used? And what needs to be highlighted for this use? Hollow organs must be dilated to some degree and care taken not to over-dilate the organ. Dehydration - must be complete and carried out in cold acetone over a period of four to six weeks. It is beneficial to position specimens anatomically correct when dehydration is begun. Impregnation – the exchange of the dehydrant/intermediary solvent for the polymer-mix, must be done under decreasing pressure (increasing vacuum) at a slow pace (three to six weeks). By lowering the pressure, acetone leaves the tissue assuring a tissue void for the silicone-mix to enter and occupy. Since impregnation is dependent on vaporizing the solvent/acetone and the removal of such, it is important to know the vapor pressure (vp) of the solvent/acetone at the temperature at which the process is carried out. For instance at -20°C vp = 21mm Hg, at -15°C vp =28mm Hg, at 0°C vp =65mm Hg and at +25°C vp= 210mm Hg. Knowing the vp of acetone for your selected temperature during impregnation will help assure that you extract the solvent from the specimen by lowering the pressure enough. Finally, once the acetone/solvent has been removed from the specimen, impregnation is finished, and the silicone-filled specimens are brought to ambient pressure and temperature and excess polymer is allowed to drain from the specimens. After the excess polymer-mix is removed from the specimen, the specimen filled with silicone-mix is treated to a gaseous cross-linker/hardener. Once the silicone has cured/hardened, the specimen is ready to be used.

Results: Specimens produced by the cold temperature silicone technique are superior, unique, durable, student-friendly and form an archive of normal or abnormal anatomy.

Conclusion: Plastination has proven to be an excellent method for preservation of biological specimens for 35 years. The Biodur™/cold temperature plastination process remains the gold standard for plastination of biological tissue.

WOODPECKER (PICOIDES NUTTALLII) AND MAPANA (BOTHROPS ATROX) PLASTINATION USING SILICONE S10

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Purpose: The woodpecker and mapana are animal species endemic of the tropics. The former belongs to a population of native birds originally from the tropical and subtropical forests, sometimes with migratory characteristics; and the latter is widely distributed in regions of Central and South America where it is considered a public health problem for the high number of deaths related to its bite. The purpose of this work is the preservation of these two species using the technique of silicone S10 plastination according to von Hagens' protocols, while presenting particular morphological characteristics (feathers and scales respectively) that determine important elements in the stages of dehydration and impregnation.

Methods: The woodpecker specimen was found abandoned in a garden with evisceration of intestinal contents and signs of hemorrhage; the mapana was donated by a snake tamer, delivered in a container with 30 % ethyl alcohol. In both cases the specimens were washed with tap water and then immersed in baths of 100%isopropyl alcohol at room temperature. The alcohol concentration was determined with a calibrated alcoholmeter every two weeks; isopropyl alcohol was changed when its concentration was beneath 100% and until we did not find variation of the concentration in two consecutive measurements. The specimens were then immersed in methylene chloride for three days and then immersed in a mixture of curable polymer (silicone S10) with catalyst polymer (catalyst S3) in a ratio of 1 part of S3 per 100 parts of S10 for 24 hours. The next day the process of forced impregnation began, bubbles were observed and according to the protocol of von Hagens, we began gradually to decrease the vacuum pressure down to 3 mm Hg at which no bubbles were observed. The specimens were removed, the remnants of the mixture were drained, and they were then placed in a closed chamber with vaporizing gas curing polymer (S6). In the first week the specimens were dried with absorbent paper, they were then left in a closed gas curing chamber for six weeks. In both cases a natural position of the animal was preserved in their natural environment.

Results: The plastination technique was applied to the woodpecker and mapana according to the protocol of von Hagens; this was conducted smoothly, and the specimens that were obtained retained their external morphological characteristics and are displayed in the Permanent Exhibition Area of the Morphology Department of the Fundacion Universitaria Autonoma de las Americas in the city of Pereira, Colombia. Furthermore, the snake is now also useful as instructional material for medical students in the field of Clinical Toxicology.

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RECOVERY WITH PLASTINATION TECHNIQUE OF FORMALIN FIXED ANATOMICAL SPECIMENS FOR TEACHING IN HIGHER EDUCATION MORPHOLOGY OR MUSEUM EXHIBITION

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Purpose: The morphology courses taught in Colombia frequently use specimens and bodies that have been conserved for more than 10 years (this due to the lack of availability of cadavers and human organs and the traditional preserving techniques using formalin). The high cost of simulators and alternative techniques for fixing and preserving bodies impedes their implementation in higher academic education. Our main purpose was to recover old human specimens, fixed with traditional techniques, with silicone plastination for use in teaching in the anatomy lab.

Methods: In the pursuit of resolving this problem, 24 specimens (due for incineration) were fixed with formaldehyde, immersed in regular water for a week and, a week later, in saline solution 0.9 %; afterwards the plastination technique was performed as follows: specimens were dehydrated with isopropyl alcohol for 12 weeks, cleared with methylene chloride, impregnated with silicone Biodur S10® (surplus silicone was removed with absorbent paper) and curing gas Biodur S3®- all using the protocol from the University of Murcia.

Results: All specimens were recovered demonstrating a significant improvement in coloration, appearance and maintenance of morphological characteristics. Nowadays, the specimens are being used in the academic practices of Medical and Dentistry students.

Conclusion: Plastination is very useful for recovering specimens fixed for long periods of time with formalin, obtaining optimums results. Specimens obtained are similar in color and appearance to other specimens with less fixation time using traditional techniques, and they are suitable for use in the teaching lab or exhibition.

THE KLINGLER PREPARATION TECHNIQUE AND PLASTINATION: ORIENTING STUDENTS TO THREE-DIMENSIONAL NEUROANATOMY

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Purpose: This project will discuss the Klingler preparation technique applied to plastination, as well as assess its potential benefits for orienting students to three-dimensional neuroanatomy.

Methods: Four brains were fixed, dissected using the Klingler method, then subsequently plastinated.

Results: The Klingler method was utilized to display the fiber tracts of the corpus callosum, brain stem and cerebellum. This technique revealed the numerous bilateral white matter tracts as well the inferior and middle cerebellar peduncles.

Conclusions: Since its inception, plastination has served as an adjunct in teaching anatomy. If used properly, plastinated specimens can augment students' understanding of neural architecture. Brains dissected following the preparation method by Klingler can be plastinated and utilized for visualization of fiber paths. This technique can be used to highlight complex structures and isolate neuroanatomical structures that students often have trouble visualizing in three dimensions, such as the corpus callosum.

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USING PLASTINATION TO PRESERVE KOREAN MARTYRS' CORPSES

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Purpose: Most Catholic martyrs' corpses in Korean shrines are kept without preservative treatments, thus bodies are being damaged, oxidized, and becoming moldy and decomposed as time passes. It is also not feasible to store them in an airtight system because the installation and maintenance of such systems is too costly. Our goal is to preserve Korean martyrs' whole corpses, not as muscular or organ specimens, using plastination, which doesn't cause damage to the tissue, and makes it possible to preserve as semi-permanent, odorless, and tangible specimens.

Methods: Forty corpses referred to the institution from 2008 to 2010 were studied. They were fixed with 10% formaldehyde for 2 months, and washed for 2 days. Then, they were dehydrated with acetone for 20 days in order to remove residual moisture and fat tissue. They were then vacuum impregnated using silicone in room temperature and at 4^{o}C, for 15 days each. In room temperature, excess silicone was eliminated for 7 days, and then the plastination was cured.

Results: About 3 months were required to complete the plastinated specimen of the martyr's corpses. Till now, the specimens are safely preserved and no traces of oxidization, mold, or discharge of silicone have been found. Bone surfaces are more hardened because of the silicone.

Conclusion: Our results support that plastination can be an outstanding way of preservation, reducing expenditure for airtight systems.

CLINICAL PLASTINATION: INSIGHT INTO EMBRYOLOGICAL DEVELOPMENT, SURGICAL AND SPATIAL ANATOMY OF THE AORTIC ROOT AND RELATED STRUCTURES

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Purpose: Clinical plastination is of particular interest in the field of cardiac surgery as it provides a variety of opportunities for widening of a clinical manner of thinking using plastinated heart specimens.

Methods: For creating demonstration specimens of aortic root and related structures we used standard plastination techniques of hearts from cadavers while retaining their original shape. Different types of modern procedures (aortic root remodeling, re-implantation and its modifications) were performed. Innovative approaches have been implemented to enhance the quality of surgical anatomy for educational process.

Results: Several modifications of anatomical dissections were developed: 1) modified types of surgical dissections to expose the aortic root and valve, coronary arteries and conduction system; 2) hearts with pathological changes of the aortic root and congenital malformations were plastinated; 3) slices of the heart were injected with colored silicone according to the long and short axis ultrasound views as well as MRI projections; 4) mechanical and biological valves were implanted. The distinctive feature is that the hearts are very pictorial and can be easily demonstrated. The cross-sectional and plastinated specimens of the natural hearts allow us to demonstrate all the details of spatial anatomy of the aortic root and related structures.

Conclusions: In addition to the traditional anatomical methods, the clinical plastination technique should be available in clinical centers as it improves the effectiveness of education in ultrasound, radiographic and surgical anatomy, procedures and techniques. It is necessary to combine routinely-used diagnostic and surgical projections with heart slices and plastinated specimens as it gives a better understanding even to the specialists in terms of clinical necessities.

SILICONE-BASED COLORATION TECHNIQUE DEVELOPED TO HIGHLIGHT PLASTINATED SPECIMENS

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Purpose: To develop a coloration technique that allows the application of pigment to a fully plastinated specimen that can withstand the rigors of handling through transportation and teaching.

Methods: Once fully plastinated using the Biodur® S10/S15 technique, a silicone-based mixture of methyl ethyl ketone (MEK), silicone and various Biodur® dye pastes were applied. Once the solutions of silicone were made, ranging from 0 to 1.0g, aesthetic and durability tests were performed to discover the most desirable mixture. Durability testing was developed to mimic the usual handling of plastinated specimens through transportation as well as hands-on teaching of anatomy. These tests include frictional forces made with a gloved hand, scratching areas with a blunt pointer and scratching various areas with the back end of a scalpel blade. The final and possibly the most critical testing included discovering the most aesthetically pleasing amount of dye paste by holding both the MEK and silicone constant and adding incremental additions of the dye paste.

Results: Throughout the initial testing of varying silicone levels various conclusions were made of both the aesthetics of the silicone composition as well as the durability. The silicone aesthetics testing, as well as the durability tests, resulted in choosing a solution under 0.4g. The last experiment, although a more subjective conclusion, revealed the best visuals results when adding 40µl of Biodur®AC51 for muscles, 80µl of Biodur®AC50 for arteries and 120µl of Biodur® AC40 for veins.

Conclusion: This silicone-based coloration technique allows a plastinated specimen to don further life-like visual characteristics to better serve the duty for anatomy and medical education.

DEVELOPMENT AND INSTALLATION OF A PLASTINATION LABORATORY USING LOW COST EQUIPMENT AND MATERIALS

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Purpose: The aim of this work is to report our experience at creating and assembling low cost plastination laboratories, seeking to improve the use of economic resources, that may be scarce in some institutions, and proving that it is possible to get high quality specimens with local materials.

Methods: First, vacuum chambers for small, medium and large specimens were developed following the guidelines established by Gunther von Hagens in his early work on plastination. We also researched local procurement of polymers such as polydimethylsiloxane (silicone), dibutylin dilaurate (catalyst) and tetraethyl orthosilicate (hardener). Vacuum pumps from refrigeration systems were adapted for =utilization in the forced impregnation step.

Results: Mounting a fully functional room-temperature plastination laboratory was achieved; it allows developing the technique and obtaining high durability specimens that are widely accepted by students and professionals.

Conclusion: Plastination laboratories can be mounted for small, medium and large specimens, with local materials, at low cost and with perfect correlation with the elements used in the original techniques, ensuring the development of a plastination technique available to any institution.

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CONTRIBUTIONS TO THE DEVELOPMENT OF PLASTINATION TECHNIQUE AT ROOM TEMPERATURE WITH SILICONE

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Purpose: The aim of this work is to present a room-temperature plastination technique developed in our laboratories and the results obtained there from. In this technique, we highlight the use of silicones, catalysts and generic hardeners, and some variations of the traditional technique, which resulted in a low-cost technique and also a high speed of implementation.

Methods: Room-temperature plastination was carried out. Dehydration was performed in 1 month, first three weeks at cold temperature (-20°C) and the fourth week at room temperature, for defatting. After that, forced impregnation took place, where different specimens were exposed to Biodur silicone, North Carolina silicone and generic silicone (polydimethylsiloxane) obtained in our countries, with the generic catalyst, dibutylin dilaurate. The average process for each specimen lasted 3 or 4 days, 8 hours of daily work (active forced impregnation), stopping the forced impregnation overnight (passive forced impregnation). After reaching 5 mmHg without bubbling and ending the vacuum process, specimens were drained and positioned. Finally, curing was performed by exposing the specimens to tetraethyl orthosilicate vapor, also obtained in our countries. The different morphological characteristics of the specimens determined forced impregnation time variations, as well as curing. After polymerization was complete, specimens were stored in plastic bags, facilitating internal curing.

Results: Several plastinated specimens were obtained (human and animals). Three kinds of resin were used: Biodur, North Carolina and a local production resin. Completely dry, rigid specimens were obtained, which retained the original color and anatomical shape. Some specimens had also been previously injected with natural latex, and it remained intact in the final pieces.

Conclusion: Based on our technique, demonstrated in this work, we believe specimens of excellent quality and durability can be obtained, reducing costs and increasing the speed of production of plastinated specimens.

USE OF PLASTINATED MATERIAL IN DETRIMENT OF TRADITIONAL MODELS: VERIFICATION OF PREDILECTION OF HUMAN ANATOMY STUDENTS

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Purpose: The use of anatomical specimens is of fundamental importance for the study and learning of anatomy. Various types of anatomical parts are employed for this purpose, each with advantages and disadvantages. The objective of this field study was observational and cross-checked the preferences of undergraduate students in dentistry, nursing and physiotherapy, who attended the course of human anatomy that semester, totaling 338 students, in relation to the type of part to be studied.

Methods: We used the heart laboratory study at the Anatomy Faculty of the Integrated Faculty Tiradentes - FITS, Brazil, with each group comprising synthetic specimens (group 1), glycerin (group 2), preserved in formaldehyde (group 3), plastinated (group 4) and plastinated stained (group 5). The specimens were prepared in the stands at random and each student chose at their discretion, the part that they found more attractive and would rather study, stating the order of preference and the reason for the choice.

Results: We observed that most preferred group 5 (64.2 %), followed by group 4 (21.6%), group 1 (10.9%), group 2 (2.4 %) and group 3 (0.9%). The positive and negative reasons for their choice were listed and assigned 1 point for each positive item and -1 to negative: they are natural, anatomical accuracy, no unpleasant odor, similar to living organ staining, non-irritating to the nose and eyes, able to manipulate without gloves, leaving no residue on the hands and benches, availability of specimens in the institution. The results were: Group 5 received 6 points, followed by 1 to 4 groups each with 4 points; group 2 received note -2 three points.

Conclusion: We conclude that plastinated specimens, mostly colored, represent major anatomic fidelity by being natural specimens and are very attractive to students, encouraging them and improving their learning, requiring however, that they should be more common in colleges of Brazil where the number is very limited or non-existent, and should replace the formalin and glycerin specimens that are unhealthy and unattractive for anatomical study.

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THE FIRST DALIAN PLASTINATION WORKSHOP: A NEW APPROACH TO UNDERSTANDING THE ART OF PLASTINATION

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Purpose: The workshop aimed at introducing participants to the basic concepts of plastination and its applications.

Methods: The first Dalian plastination workshop was held at the Dalian Hoffen Plastination labs, China, August 12th-17th, 2013. There were 7 participants in the workshop, representing South Korea, China and Egypt in addition to the USA. The first couple of days were dedicated to low temperature silicone plastination, and the last couple of days were for sheet plastination using the P45 method, a modification of the P40 technique using a warm water bath to cure sections instead of UV light. Participants had several opportunities for hands-on experience starting from dissection, sectioning, positioning, and even doing the final trimming of the polyester sections.

The most interesting part for me was a critique of several faulty preparations aimed to alert participants to avoid common mistakes during the plastination process.

The workshop included an evaluation and feedback questionnaire to improve future Workshops (a workshop will be held again in August 2014), and was concluded by a visit to the 'Mysteries of Life Museum' in Dalian where a wide range of human and animal plastinated specimens are exhibited.

Results: Participants had ample opportunities for dissecting and preparing specimens for plastination. Participants expressed obvious satisfaction with the workshop approach especially with the demonstration of faulty specimens.

Conclusion: The workshop was a great success. The section on the critique of faulty specimens was very useful, informative, and represented an innovative approach to understanding plastination. Thanks to Dr. Sui and to his staff for their thorough and meticulous preparation and for their remarkable hospitality.

RESTORING AND REPAIRING PLASTINATED SPECIMENS TO PROLONG USEFULNESS AND ENHANCE EDUCATIONAL VALUE

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Purpose: The extensive and regular use of plastinated specimens in anatomy classes exposes these specimens to a significant degree of deterioration rendering them almost useless. At this stage they no longer serve the purpose they have been prepared for. We employed a basic technique to restore plastinated specimens where muscles and neurovascular structures are reconnected and re-painted to restore the original appearance and promote usability and significance in anatomy education.

Methods: Human plastinated specimens, including whole bodies (male and female), torsos, upper and lower limbs and pelves have been extensively used in anatomy teaching for almost a decade in the Department of Physical Therapy at Mt. Saint Mary College, Los Angeles, California. The specimens were prepared at the University of Michigan Plastination laboratory. A large number of muscles had suffered detachment. Multiple nerves and vessels were disconnected, and several segments were discolored. A simple silicone glue was used to re-attach structures and water-based paint was used to re-color vessels and nerves. The restoration process took around 48 hours to complete.

Results: The specimens' appearance improved remarkably following the restoration process. Muscles and neurovascular structures were reconnected to recompose their normal anatomical shape.

Conclusion: The restoration and repair process is essential in maintaining the usefulness and sustainability of plastinated specimens. Periodic restoration will prolong the lifespan of plastinated specimens for a much longer time and therefore fully serve the educational purpose for which they were initially prepared.

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THE GROSS ANATOMY LAB IN USAGE OF DICOM DATA AND CORRELATION OF SHEET PLASTINATION

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Purpose: The use of datasets from computerized tomography (CT) and their application in Anatomy classes is of special relevance at the Institute for Anatomy and Cell Biology of the University of Heidelberg. Since winter term 2012/13 datasets from a multi-line CT are used to support a classical dissection course.

Historically the dissection course was complemented by optional classes of “Virtual Anatomy” in which students study topographical Anatomy, using standardized CT-datasets. These datasets illuminate the regular Anatomy and selected pathological conditions. The additional usage of plastinated body sheets allows a direct comparison between imaging and Anatomy.

Methods: Now the Institute of Anatomy and Cell Biology can generate a complete CT dataset from each body donor. This procedure not only enables detection of important anatomical changes or variations before embalming and dissection, it also enables the students to directly correlate imaging data with the conditions found during the dissecting classes. In this context it proved to be helpful to enhance the visualization of blood vessels by injection of contrast agents prior to embalming. Moreover, plastinated body sheets were also used to improve topographical knowledge and interpretation of CT data.

Results: Thus, the students can toggle between different visualization methods and thereby improve their knowledge of topographical Anatomy as well as their skills in interpreting CT data. As an additional way to visualize anatomical data in a different modality, the Institute uses an “Anatomage Table” (Anatomage Inc., San Jose, Ca, USA) which allows the visualization of CT scans, as well as other anatomical images, with a body donor virtually lying on a table.

Conclusion: Thus Heidelberg University applies a multi-modal and comprehensive method to guarantee that medical students receive a profound anatomical training, which by its own rights already points to forthcoming routine clinical procedures.

NEW DEHYDRATION METHOD IN PLASTINATION PROCESS

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Purpose: Dehydration of specimens is an important step of plastination, a process of which exchanges the specimen fluid (water and fat) with an organic solvent. The dehydrating agent must be miscible with water. Cold acetone usually is the best solvent for dehydration. This process leads to huge amounts of waste acetone contaminated by water and fat, which produces the old acetone as a hazardous waste. Acetone is a colorless and highly flammable manufactured liquid. It is used as a solvent, in the plastics industry, and as a cleaning agent etc. Breathing acetone fumes can cause nose, throat, lung, and eye irritation. Also exposure to high levels of acetone can cause death, coma, unconsciousness, seizures, and respiratory distress. The purpose of this study is to establish a new method for the dehydration step in plastination to decrease the disadvantages associated with acetone.

Methods: Each group of specimens was transferred to 99% acetone baths at -25˚C. 10 % (W) solid calcium chloride as the water absorbent was added to experimental container (E). Acetone purity was measured using acetonometer every two days. After a week, the acetone inside the control container (C) was replaced with pure acetone and the aqueous phase in the bottom of container E was removed and 10 % (W) solid calcium chloride was added to the container. This process was repeated until complete dehydration was achieved, i.e., when the acetone percentage remained constant for 2 containers.

Results: The acetone used for group E was one third of group C. There was no significant difference between the E and C groups of plastinated specimens with regard to points of strength, flexibility and color.

Conclusions: Our new method was found to be much more economical and safer than the conventional dehydration method. Properties of the specimens dehydrated by the new method were the same as the conventional method.

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PRINCIPLES OF EPOXY PLASTINATION TECHNIQUE (E12)

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Purpose: The E12 plastination process is a well-established preservation technique used for demonstration in teaching and also in research.

Methods: Material and slicing: for E12 plastination we usually use fresh tissue which is frozen at –80°C for one week. In the next step slices with an average thickness between 3 and 5mm were cut. The slices were stored at -25°C overnight. Dehydration and degreasing: the acetone used for dehydration is cooled at –25°C. Each slice will be placed between soft plastic grids in order to allow better circulation of the dehydration fluid. The acetone was changed once after 3 days at a concentration of 96%, by using technical quality acetone. The final concentration of the dehydration bath was 99%. When dehydration was finished the freezer was disconnected. Next day, the acetone was changed with room temperature methylene-chloride (DCM) for degreasing. Degreasing was finished after 7 days. Impregnation: impregnation was performed at +5°C using the following epoxy (E12) mixture: E12/E1/AE10 (95:26:10 pbw). The slices were submerged in the E12 mixture and placed in a vacuum chamber. Pressure was continuously reduced over the next two days down to 2 mm Hg.

The slices are cast between two sheets of tempered glass with a 4 mm flexible gasket used as a spacer. The slices are placed between glass plates, sealed, and the flat chambers were filled with casting mixture. They were then placed for one hour in a vacuum chamber at 3 mmHg to remove small air bubbles present in the resin. Large bubbles were removed afterwards manually. After bubble removal, the flat chambers were placed horizontally, inclined at 15°, and left for one day. The polymer became more viscous and sticky and after one more day the flat chambers containing the slices were placed in an oven at 45°C for 4 days.

Results: The transparency and color of the slices were perfect and shrinkage was not evident. The finished E12 slices were semi-transparent, easy to orientate and offered a lot of anatomical details down to the submacroscopic level.

Conclusion: The E12 technique was and still is the method of choice for producing transparent body slices. Transparent body or organ slices are used for teaching and research purposes, because they allow the study of the topography of all body structures in a non-collapsed and non-dislocated state. In addition, the specimens are useful in advanced training programs (CT and MRI).

THREE-DIMENSIONAL RECONSTRUCTION OF ANATOMICAL STRUCTURES BY USING PLASTINATED CROSS-SECTIONS

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Purpose: Computerized reconstruction of anatomical structures is becoming very useful for developing anatomical teaching modules and animations. Although databases exist consisting of serial sections derived from frozen cadaveric material, plastination represents an alternative method for developing anatomical data useful for computerized reconstruction. The purpose of this study was to describe a method for developing a computerized model of different anatomical specimens by using plastinated slices.

Methods: Different anatomical specimens (ankle, lumbar spine, skull, and shoulder joint) were used for this study. A tissue block containing the desired region was removed from the cadaver, then dehydrated, degreased and finally impregnated with a resin mixture E12/ E6/ E600. Using a band saw the E12 block was cut into 1 mm slices. Once scanned, these images of the plastinated slices are loaded into WinSURF and traced from the monitor. After all contours are traced, the reconstruction is rendered and visualized.

Results: The generated 3D models display a morphology corresponding qualitatively to the actual cadaver specimen. The quality of the reconstructed images appeared distinct, especially the spatial positions and complicated relationships of contiguous structures. Soft tissue features were easily seen when displayed with the bones positioned in the background. All reconstructed structures can be displayed in groups or as a whole and interactively rotated in 3D space.

Conclusion: Plastination provides a useful alternative for generating anatomical databases. The reconstructed model can be used for residency education, testing an unusual surgery, and for the development of new surgical approaches.

ADVANTAGES OF PLASTINATED SPECIMENS FOR TEACHING PATHOLOGY

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Purpose: Plastinated specimens have been an integral part of general anatomy courses at medical schools in Russia for more than a decade. However, we are still to see extensive use of plastinates in teaching pathological anatomy.

Methods: The International Morphological Centre in Saint Petersburg, Russia, has produced more than 300 plastinated specimens to be used in pathological anatomy courses. Pathological material sampling was carried out in morbid anatomy departments of St. Petersburg hospitals in compliance with the requirements of a pathological department's curriculum, covering all essential pathological bulk specimens. The specimen selection process included taking photographs of the specimen and tissue and organ fragment sampling for histological study. The selected specimen was dissected again and marked, then it was fixed in formaldehyde solutions with increasing concentration for 2 to 8 weeks. When fixation was completed and histological study results had been obtained, each specimen was used for producing both a three-dimensional silicone plastinate and transparent plastinated slices. The room temperature silicone impregnation technique was applied to produce three-dimensional plastinates, and the conventional flat chamber E12 method was used to make transparent plastinated slices.

Results: It has been found that the most efficient way to demonstrate pathological changes in organs is to present three-dimensional plastinates along with transparent plastinated slices. Some pathological states, e.g. recent myocardial infarction or chronic venous congestion, cannot be clearly seen in silicon plastinates after formaldehyde fixation, and thus transparent plastinated slices are the only way to demonstrate such phenomena. Silicone plastination should be applied to produce this type of specimen only after Kaiserling fixation, which preserves the natural color of organs and tissues. Transparent plastinated slices can efficiently be used when studied in transmitted light of a binocular loupe with low magnifying power.

Conclusion: Plastinated specimens have proved to be a highly efficient teaching resource in pathological anatomy courses, and they undoubtedly have a number of advantages when compared to conventional specimens, since the students demonstrated better understanding of pathological processes. Integrating plastinated specimens in a pathological anatomy curriculum gives more variety to teaching and empowers research techniques.

PROS AND CONS OF ROOM TEMPERATURE PLASTINATION TECHNIQUE

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Purpose: The last decade has seen new room temperature plastination which is different from the classical cold method developed by Gunther von Hagens. Along with general plastination techniques the new method uses a different impregnation polymer compound and a different procedure during specimen hardening.

Methods: A series of experiments was undertaken to plastinate anatomical specimens using Biodur-S10® and room temperature technique, IMC modification. At the same time, fixation, dehydration and degreasing were done according to the classical technique. Comparative criteria included polymer price, electricity costs, extra equipment, duration of impregnation and hardening, end-plastinates physical properties and external appearance, as well as workability and personnel safety.

Results: One of the advantages of room temperature plastination is low viscosity of the polymer compound which facilitates impregnation and reduces its duration and also simplifies monitoring. Another advantage is that the polymer compound is nonreactive, which makes extra refrigerators and hardening chambers unnecessary, and, besides, results in lower electricity bills. On the other hand, there are some drawbacks too, namely – high cost of low-molecular silicone, complications when trying to get high elasticity specimens, a limited time frame for the hardening stage and lower transparency of the hardened specimens.

Conclusion: The choice between cold and room temperature plastination depends on laboratory equipment and accessories as well as the objectives. We maintain that room temperature plastination can be recommended for medium-size laboratories that want to save on equipment cost and electricity, and for plastination of parenchymatous organs and brain. The major goal of this technique is to obtain results quickly. However, the classical method has more advantages at the hardening stage, uses more common polymers and is better to produce whole plastinated bodies and high elasticity hollow organs.

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ANATOMIC, ULTRASONOGRAPHIC, COMPUTED TOMOGRAPHY AND MAGNETIC RESONANCE STUDY OF THE MEDIAL ASPECT OF THE CANINE ELBOW JOINT

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Purpose: Anatomical, ultrasonographic (US), computed tomographic (CT) and magnetic resonance imaging (MRI) studies of the canine elbow joint have been reported separately. The purpose of this study was to assess the canine elbow joint by means of US (high frequency transducer of 18 MHz), CT and MRI and correlate the images with plastinated anatomical sections obtained on the same planes used in the imaging protocols.

Methods: Anatomical study: 10 forelimbs obtained from 5 adult German Shepherd cross-breed dog cadavers were frozen at -70° C to obtain transparent sections (2mm thick) on the same planes as the imaging studies; anatomical sections were preserved using the E12 plastination technique. Ultrasonographic study: 10 elbow joints from 5 adult German Shepherd cross-breed dogs were evaluated using an 18 MHz linear array transducer. CT study: 6 elbow joints from 3 adult German Shepherd cross-breed dogs were evaluated, and reformatted images were obtained on the same planes as the ultrasonographic study. Magnetic resonance study: 6 elbows joints from 3 adult German Shepherd cross-breed dogs were evaluated using T1 and T2 weighted protocols. Correlations between imaging techniques results and anatomical sections were made.

Results: The US study assessed, on the medial aspect of the joint, the insertion of the tendons of brachialis and biceps brachii muscles, the medial collateral ligament and the medial coronoid process. CT evaluated the cortical and subchondral bone of the medial coronoid process, the trochlear notch of the ulna, the radial incisures, the anconeal process and the humeral condyles. MRI assessed soft tissue structures such as cartilage, the flexor muscles and their tendons of origin, collateral ligaments, and the insertion of the tendons of brachialis and biceps brachii muscles. There was a good correlation between the images from diagnostic imaging techniques and the transparent anatomical sections.

Conclusion: Our results agree with those obtained in previous studies where the canine elbow joint was evaluated by one imaging technique at a time. This work, however, combines anatomical plastination and three diagnostic imaging techniques at once. By means of a high frequency transducer a better ultrasonographic resolution of soft tissue structures was observed, especially the insertion of the tendons of biceps brachii and brachialis muscles on the ulna. US and MRI techniques were found to be suitable for soft tissue structures, whilst CT was more appropriate for assessing bone structures. Correlation of plastinated anatomical sections and images of three different diagnostic imaging techniques leads to a comprehensive understanding of the canine elbow joint.

SYNERGISTIC EFFECTS OF SHEET PLASTINATES AND ANATOMICAL PHOTOGRAPHY

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Purpose: Sheet plastinates provide specific insights into anatomy. In addition the details and functional aspects recognizable in a real anatomical plastinate are far more authentic and fascinating than pictures in books or on the screen. This is particularly important if the anatomy is also to be presented in nature museums, secondary schools, etc. On the other hand the use of pictures has obvious advantages. The goal of this study was to find ways in which real sheet plastinates and pictures thereof can be combined with synergistic effects.

Methods: Sheet plastinates of various animal species were prepared using the patented Tissue Tracing Technique (TTT), Selective Impregnation (SI) and regular flat chamber sheet plastination. Overview and high-resolution detail pictures were taken from finished sheet plastinates. The pictures were edited and labelled if necessary. Prints were produced in various sizes, on different materials and presented in combination with real sheet plastinates, acrylic-embedded prints and screen presentations.

Results: Enlarged overview prints and labelled detail views of plastinates can highlight specific aspects and provide a better understanding of the anatomy than plastinates alone. A combination of a real sheet plastinate with high resolution detail images of the same specimen allows the user to track back any visible detail and given information to the real specimen. In an exhibition setting, the use of acrylic embedded prints or high quality picture prints seems most convenient. Interactive screen presentations that allow the user to highlight different fields of interest can be used in e.g. biology classes, but also in nature museums and other exhibitions.

Conclusions: Combining the authenticity and fascination of a real sheet plastinate with labelled detail views and enlarged pictures produces a synergistic effect in two ways:

Obviously structures in a real specimen can be identified more easily and functional aspects better understood with the help of a labelled photograph besides the real specimen.

The other ways round people tend to verify the information provided in the pictures immediately by looking at the real specimen. When they succeed in tracking back the given information to what they can find and learn with their own eyes directly from nature, this can create a lot of trust and spark interest in science. Real specimens that are not exactly the same as the one in the picture can be used as long as structures can be clearly correlated, but the synergistic effect is much higher if the specimen shown in the pictures and presented in reality is identical.

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DEFINITION OF THE "TO-BE-NAMED LIGAMENT" AND VERTEBRODURAL LIGAMENT AND THEIR POSSIBLE EFFECTS ON THE CIRCULATION OF CSF

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Purpose: The purpose of this study was to examine the presence of a connection between the dura mater and the posterior wall of the spinal canal at the level of C1-C2 and to examine its course and composition.

Methods: Gross dissection was performed on the suboccipital region in 10 cadavers. Ten head-neck specimens were sliced, having been treated with the P45 plastination method. The P45 sheet plastination is a relatively new-patented technology in china. It is a special polyester resin corrosion method designed to preserve biological sectional specimens *in situ* and the P45 plastination sheet provides good light transmission, allowing the internal structure of the sheet to be shown clearly and intact.

Results: Within all 10 specimens a dense fibrous band was clearly identified in the nuchal ligament. It arose from the tissue of the posterior border of the nuchal ligament and then projected anterosuperiorly to enter the atlantoaxial interspace. It was termed as the "to-be-named ligament" (TBNL). In all specimens the existence of a fibrous connection was confirmed between the dura mater and the posterior wall of the spinal canal at the level of C1-C2. It was identified as vertebrodural ligament (VDL). The VDL was subdivided into three parts. Five variations of the VDL were identified according to the anatomical differences of each part of the VDL. The TBNL and VDL firmly link the posterior aspect of cervical dura mater to the rear of C1-C2 and the nuchal region.

Conclusion: According to these findings, the authors speculate that the movements of the head and neck are likely to affect the shape of the cervical dural sleeve via the TBNL and VDL in some manner. Based on the continuity of the connective tissues concerned this speculation seems to be reasonable. It is hypothesized that the muscle-VDL-dural sleeve complex, in the suboccipital region, may work as a pump to provide an important force required to actively move the CSF in the spinal canal.

SHEET PLASTINATION WITH BRAZILIAN COMMERCIAL CLEAR POLYESTER CASTING RESIN AND PROPANOL AS INTERMEDIARY SOLVENT

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Purpose: In South America, local polymers are not available for plastination and must be imported, making plastination costly. A local source for inexpensive polymer would help make this technique financially viable. In Brazil, acetone – the recommended intermediary solvent, may only be purchased and used by a licensed organization. This license is difficult to obtain. Hence, to use acetone for an intermediary solvent is nearly impossible. This study evaluated a Brazilian commercial clear polyester casting resin for sheet plastination and propanol as an intermediary solvent.

Methods: Two canine heads (fixed and frozen) were sliced @3 mm on a band saw. Slices were divided into two groups and dehydrated in cold acetone or in propanol at room temperature. Acetone was changed 4 times every 3 days. Propanol baths started at 50% and changed weekly into 60%, 70%, 80%, 90% and 100% propanol. After dehydration, the slices were impregnated under vacuum, at room temperature. The Brazilian polyester casting resin was diluted with 1% styrene monomer to make the resin less viscous. Rapid bubbling was maintained for two to three hours. After impregnation was complete, the slices were placed between two acetate sheets with enough resin to cover both surfaces of the specimen. For hardening, the specimens were exposed to the sunlight (UV light) for 12 hours. After hardening the resin, the acetate sheets were removed and the resin sheets containing the specimen had their edges trimmed with a band saw. The slices were evaluated with respect to their overall appearance, transparency and usefulness.

Results: Both solvents dehydrated the slices. During impregnation, solvent extraction (bubble formation) in both groups was similar. Bubble production corresponded to intermediate solvent evaporation and extraction; and hence, the penetration of the resin into the tissue. Bubble production occurred at different pressures. Bubbles formation in acetone-dehydrated specimens started at 200 mm Hg (due to acetone's high vapor pressure), while propanol-dehydrated specimens (due to propanol's low vapor pressure) started at 27 mm Hg. However, this difference did not affect impregnation rate, which was completed in 2-3 hours. The general appearance of the slices was similar and all were useful for anatomical study, but the propanol-dehydrated slices were more transparent, providing better viewing through the resin.

Conclusion: Brazilian polyester casting resin was effective for sheet plastination. Propanol was an adequate intermediary solvent. It is concluded that propanol and Brazilian resin are a means to expand sheet plastination in South America, since it is 5 times less expensive than imported sheet plastination resins and propanol is much easier to purchase than acetone.

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BODY DONATION FOR BODYWORLDS AND ANATOMICAL SCIENCES

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Purpose: The program was started in 1983 at the University of Heidelberg, and transferred to the newly-established Institute for Plastination in 1993. A total of 14,499 donors have registered, of whom 13,067 are living. So far 1,432 bodies have been received.

Methods: Potential donors are provided with a brochure and questionnaire giving full details of the program. There is no financial incentive; within Germany the IfP covers the costs of transport of the deceased. Donors sign a 'Declaration of Intent' to donate: this is not a binding contract and can be revoked at any time. Regular meetings of body donors are held, and there is an 'Independent Federal Association of Body Donors' in Germany.

Results: Breakdown of donors according to age and sex: of the living donors, 7357 (56%) are female and 5710 (43%) are male; 604 (42%) of the deceased were female and 828 (57%) were male. The majority of the donors (69%) are over 51 years of age, 18% are between 41-50 years, 13% are aged 40 years or below. Just under a third of donors (31%) are also organ donors, and 35% have also agreed to tissue donation. Attitudes to anonymity were fairly evenly split, with 56% requesting that their body or body parts remain anonymous, and 44% not.

Conclusion: Motivation for donation is varied, with the most common reasons being altruistic. 88% of donors agreed with the statement "I would like to donate my body to a good cause"; an almost equal number (81%) agreed that "I would like to contribute to medical research".